# Maritime Tsunami Hazard Assessment for Neah Bay, Washington

Technical Report

May 2024

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Submitted to the
Washington State Emergency Management Division and
Washington Geological Survey
for
Tsunami Maritime Response and Mitigation Strategy

# Contents

# 1. Introduction

This Tsunami Hazard Assessment (THA) tests tsunamis from two earthquake sources: the Cascadia subduction zone (CSZ) and the Alaska-Aleutian subduction zone (AASZ) for Neah Bay, Washington and the Makah Reservation. The modeled tsunami results from this study are useful for estimating potential current speeds, inundation depths, minimum water depths, and wave arrival times for a maximum considered local and distant source tsunami scenario at multiple sea-level tide stages (mean high water [MHW] and mean low water [MLW]). The data from this modeling study is used in the Tsunami Maritime Response and Mitigation Strategy for Neah Bay and the Makah Tribal Marina to aid in planning and preparing the maritime community for a tsunami. This maritime guidance document is a collaboration between Washington Emergency Management Division, the Washington Department of Natural Resources' Washington Geological Survey, and the Makah Tribe.

The tsunami modeling for this project consists of one distinct fgmax region covering all of Neah Bay, Makah Bay, and Cape Flattery at 1/9$^{th}$ arc-second resolution (Figure 1). An fgmax region is a fixed grid (fg) that saves the maximum (max) values of model variables attained over the duration of the simulation. These variables include water depth (h) and water speed (s) derived from the velocity components (s = √ u2 + v2), as well as other quantities of interest derived from the depth (h) and horizontal momenta (hu and hv; the quantities modeled in the shallow water equations). This large fgmax region records and save each model variable in a single job run. However, each tsunami source and assigned tidal stage require a separate job run; model results from each job run are stored in individual multivariable netCDF files. Thus, two earthquake sources (CSZ and AASZ), two sea level scenarios (MHW and MLW), and one model resolution (1/9$^{th}$ arc-second) need a total of four job runs, yielding four unique netCDF files. See Appendix B for further discussion of the data format. All digital elevation models (DEMs) and project data utilize World Geodetic System 1984 (WGS84, ESPG:4326) as the standard coordinate system for this study.

The tsunami modeling for this study is done using GeoClaw, version 5.9.0 (Clawpack Development Team, 2023). GeoClaw open-source software is available at http://www.clawpack.org/geoclaw. The exact version of the code used in the simulations reported here is also available by request from the Washington Geological Survey (WGS) at the Washington State Department of Natural Resources (WADNR). GeoClaw simulates tsunami generation, propagation, and inundation. This model, which solves the nonlinear shallow water equations and uses Adaptive Mesh Refinement (AMR) to focus fine computational grids around the defined fgmax regions, has undergone extensive verification and validation (Berger and others, 2011; LeVeque and others, 2011). GeoClaw has been accepted as a validated model by the U.S. National Tsunami Hazard Mitigation Program (NTHMP) after conducting multiple benchmark tests as part of an NTHMP benchmarking workshop (González and others, 2011). The following THA generally follows the format of reports developed by the University of Washington Tsunami Modeling Group (UWTMG; http://depts.washington.edu/ptha/projects/index.html). Some of the text in this report describes modeling methods developed by the UWTMG and is also used in those earlier reports.


Figure 1. Outline of the 1/9th arc-second resolution fgmax region covering the study domain for the Port of Neah Bay and Makah maritime strategy.

# 2. Earthquake sources

This study tests two earthquake sources: 1) a local Cascadia subduction zone (CSZ) megathrust event with moment magnitude $M_w$ 9.0 (Cascadia Extended L1), and 2) a distant Alaska-Aleutian subduction zone (AASZ) event off the coast of Alaska with moment magnitude $M_w$ 9.24 (AKpmel20).

## 2.1 Cascadia subduction zone earthquake

This study assesses a hypothetical tsunami generated by a megathrust event of the Cascadia subduction zone (CSZ). The CSZ spans from Northern California to British Columbia and has been seismically quiet since the year 1700 (Jacoby and others, 1997; Satake and others, 2003; Yamaguchi and others, 1997; Atwater and others, 2005). However, geologic evidence of submerged coastal areas and tsunami deposits (Atwater and Hemphill-Haley, 1997; Atwater and others, 2004), in addition to offshore sedimentary evidence (Goldfinger and others, 2012; Goldfinger and others, 2017), reveals that Cascadia has had at least 23 approximate magnitude 9 earthquakes in the last 10,000 years. In addition, global positioning data show that Cascadia is currently building seismic stress, portending a future great earthquake (Burgette and others, 2009; Yousefi and others, 2020). The USGS estimates that there is a 10-14% chance of a magnitude 9 earthquake, and a 30% chance of a magnitude 8 on the CSZ within the next 50 years (Petersen and others, 2002).

The CSZ fault model used for this study is a derivative of the L1 scenario (Witter and others, 2011; 2013, coined the CSZ Extended L1 scenario. It's predecessor, the $M_w$ 9.0 L1 scenario, is one of 15 scenarios based on an analysis of offshore data spanning 10,000 years for a THA of Bandon, Oregon (Witter and others, 2011). The L1 scenario's earthquake rupture terminates at around 48°N along the northern edge of the Juan de Fuca Plate (southern end of Vancouver Island, British Columbia). Due to Bandon's proximity to the southern part of the CSZ, a full-margin earthquake rupture propagating into the more northern Explorer Plate, which could be significant to Washington's Salish Sea (Dolcimascolo and others, 2021), was not considered. The $M_w$9.0 Extended L1 scenario, developed by the NOAA Center for Tsunami Research at the Pacific Marine Environmental Laboratory (PMEL), solves this problem by extending the earthquake rupture up to the northern end of Vancouver Island, accommodating the Explorer Plate possibility (Gica and Arcas, 2015). The rupture geometry of this fault model still includes a surface-rupturing splay fault structure that amplifies tsunami waves, like the L1 scenario. The tsunami generated from this scenario consists of very large waves along the Pacific coast at the entrance to the Strait of Juan de Fuca, where Neah Bay and the Makah Reservation is located. Figure 2 displays the crustal and seafloor deformation produced by the Extended L1 model; modeled coseismic subsidence is tremendous within this project's study area, yielding approximately 10-13 feet of change (Figure 3). Washington State has adopted the Extended L1 scenario (and the original L1) as the "maximum considered" CSZ tsunami scenario. The L-category source models have an estimated mean recurrence interval of ~3,333 years (Witter and others, 2013). This is a close and conservative approximation to design requirements for critical facilities in the international building code for seismic hazards that build to the engineering standard of a 2,500-year event (International Code Council, 2015).

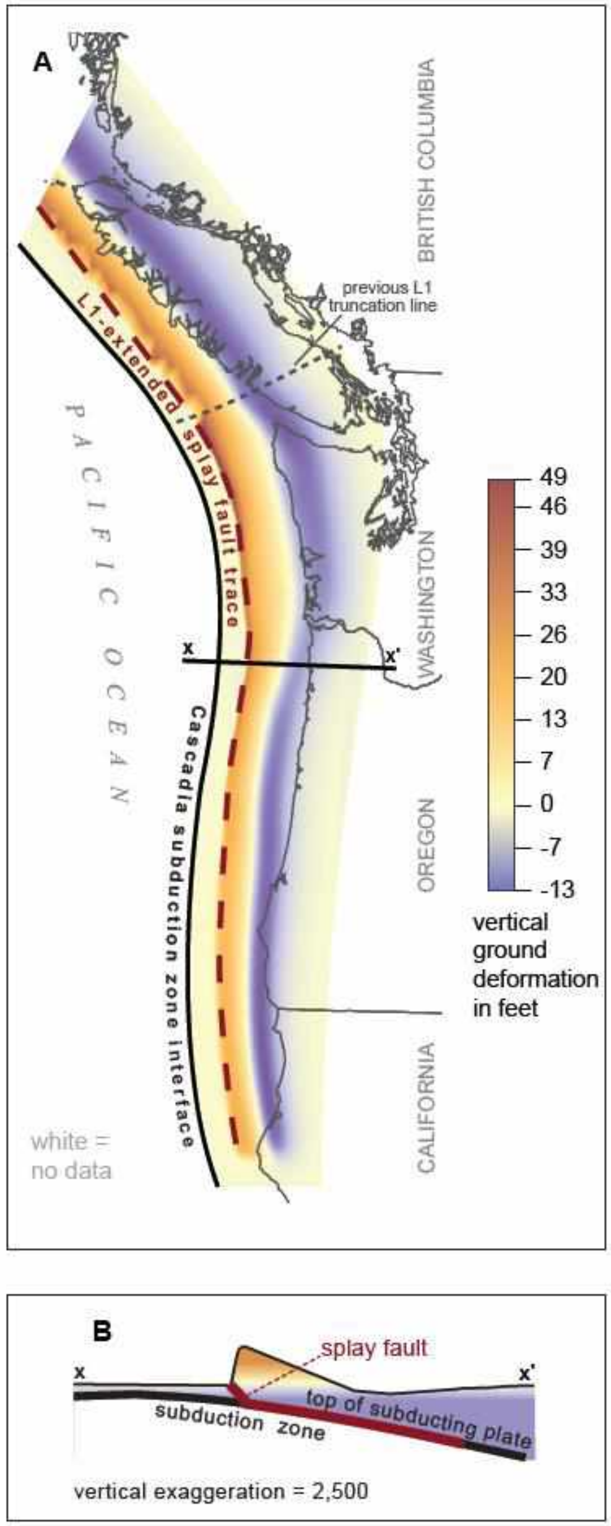


Figure 2. Vertical ground deformation for the Extended L1 scenario modified by the NOAA Center for Tsunami Research at PMEL (Gica and Arcas, 2015). This earthquake scenario has a maximum uplift 15.08 meters (~49 feet) offshore and a maximum subsidence -3.98 meters (~-13 feet) near the shore. B. Splay fault model diagram corresponding to the X–X' line in subfigure A.

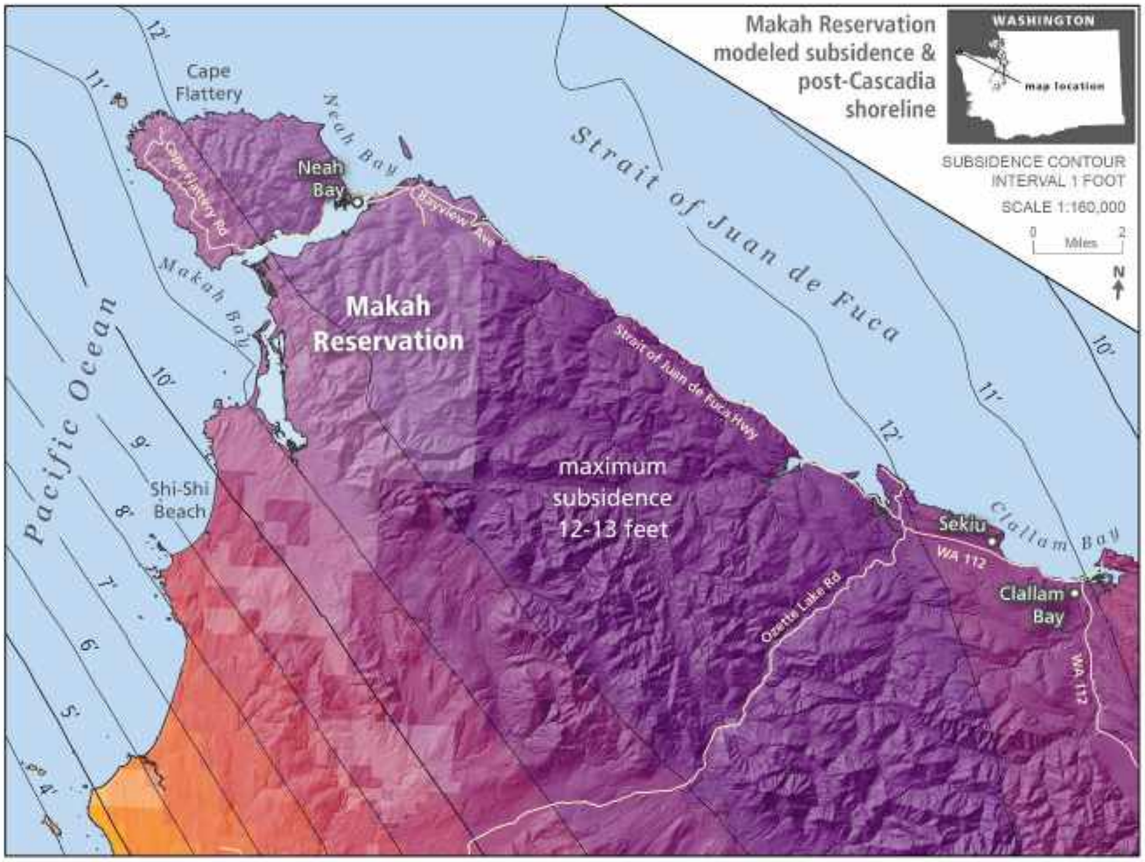


Figure 3. Map of modeled coseismic subsidence from the Extended L1 earthquake scenario in northwest Washington on the Olympic Peninsula (area of study). Subsidence contours are equal to 1-foot. Maximum modeled subsidence within Makah Bay, Cape Flattery, and Neah Bay is as much as 10-13 feet.

## 2.2 Alaska-Aleutian subduction zone earthquake

The very seismically active Alaska-Aleutian subduction zone (AASZ) has had 82 observed tsunamis since the year 1788 (Wesson and others, 2007), including the tsunami generated by the 1964 $M_w$ 9.2 Great Alaskan earthquake. The tsunami generated by this earthquake devastated not only the Alaskan coastline (Plafker and Kachadoorian, 1966), but also caused damage and fatalities along coastal areas of British Columbia, Washington, Oregon, and California (Lander and others, 1993).

The NOAA Center for Tsunami Research developed the AASZ earthquake scenario used in this study (Figure 4, referred to as AKpmel20; Chamberlin and others, 2009). This scenario is a hypothetical earthquake with a similar magnitude as the 1964 Alaska Earthquake ($M_w$ 9.2). It has uniform slip of 20 m specified over a set of 20 “unit source" subfaults (Table 1) that correspond to the NOAA SIFT propagation database (Gica and others, 2008; http://sift.pmel.noaa.gov/ComMIT/compressed/info_sz.dat). A series of tsunami simulations with different combinations of unit sources led to the selection of this specific set of unit sources that produce the maximum tsunami impact to Washington’s waterways. Because organizations such as the United States Geological Survey (USGS) and Pacific Northwest Seismic Network (PNSN) typically report magnitudes with only one decimal place, this scenario is considered the "maximal $M_w$ 9.2" event for impact to Washington (assuming a crustal shear modulus, or rigidity, of 40 GPa).

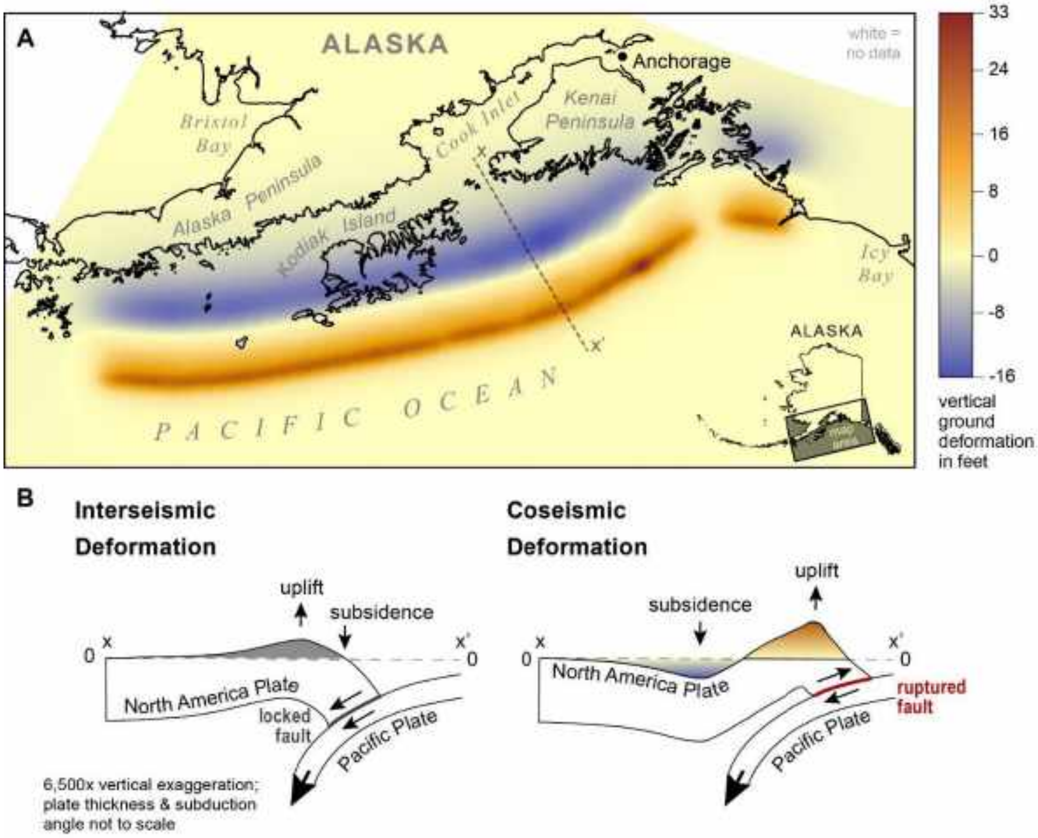


Figure 4: A. Surface deformation of the AKpmel20 source developed by the NOAA Center for Tsunami Research (Chamberlin and others, 2009). This earthquake scenario has a maximum uplift 9.7 meters (~33 feet) and maximum subsidence -4.9 meters (~-16 feet). B. Schematic representations of both interseismic (gradual) and coseismic (sudden) deformation.

Table 1: Subfault parameters for the Alaska earthquake source (AKpmel20) source used in this study (Chamberlain and others, 2009). All subfaults have a length = 100 km, width = 50 km, dip = 15°, rake = 90°, and slip = 20 m. The subfaults come from the NOAA Unit Source database and Sift propagation database metadata file (Gica and others, 2008). With crustal rigidity (shear modulus) set to $\mu$ = 40 GPa, this gives a Mw 9.24 event (LeVeque and others, 2019).

| Unit Source | Longitude | Latitude | Depth (km) | Strike (degrees) |
|---|---|---|---|---|
| acsza29 | -157.7390 | 55.1330 | 17.94 | 247.0000 |
| acsza29 | -158.1203 | 55.4908 | 30.88 | 246.2137 |
| acsza30 | -156.3960 | 55.5090 | 17.94 | 240.0000 |
| acsza30 | -156.8479 | 55.8534 | 30.88 | 240.4869 |
| acsza31 | -155.1050 | 55.9700 | 17.94 | 236.0000 |
| acsza31 | -155.5685 | 56.3016 | 30.88 | 235.6690 |
| acsza32 | -153.7920 | 56.4730 | 17.94 | 236.0000 |
| acsza32 | -154.2120 | 56.8210 | 30.88 | 235.4756 |
| acsza33 | -152.4630 | 56.9750 | 17.94 | 236.0000 |

| | | | | |
|---|---|---|---|---|
| acsza33 | -152.8909 | 57.3227 | 30.88 | 235.4119 |
| acsza34 | -151.0629 | 57.5124 | 17.94 | 236.0000 |
| acsza34 | -151.5802 | 57.8213 | 30.88 | 234.6891 |
| acsza35 | -149.7403 | 58.0441 | 17.94 | 230.0000 |
| acsza35 | -150.3575 | 58.3252 | 30.88 | 230.1971 |
| acsza36 | -148.6751 | 58.6565 | 17.94 | 218.0000 |
| acsza36 | -149.4588 | 58.8129 | 30.88 | 217.3327 |
| acsza37 | -147.7495 | 59.2720 | 17.94 | 213.7100 |
| acsza37 | -148.3921 | 59.5820 | 30.88 | 214.2669 |
| acsza38 | -145.3445 | 60.1351 | 17.94 | 260.0800 |
| acsza38 | -145.4638 | 60.5429 | 30.88 | 259.0313 |

## 3. Topography and bathymetry

Digital Elevation Models (DEMs) are needed by the GeoClaw modeling software to effectively track the movement of tsunami waves from the source to the study area. The footprints of the DEMs used in this study were developed/hosted by the NOAA National Centers for Environmental Information (NCEI) and are listed in Table 2. All DEMs used in this study are vertically referenced to mean high water (MHW), so that the “0” elevation reference point for model outputs is MHW. For the mean low water (MLW) simulations, the MHW DEM was also used, but sea level was set to -1.682 m (-5.518 ft) below zero. All DEMs used in this study are projected in the World Geodetic System 1984 (WGS84, ESPG:4326) coordinate system. Note that published DEMs may have errors, or the landscape may have changed since the DEM was initially developed.

Table 2. DEMs used in this tsunami modeling study.

| Name | Resolution | Source |
|---|---|---|
| ETOPO1<br>Global Relief Model | 1 arc-minute | Amante and Eakins, 2009 |
| Strait of Juan de Fuca (SJdF) | 2 arc-second | NOAA NGDC, 2015 |
| CUDEM<br>(ncei19_n48x50_w0124x75_2020 ) | 1/9 arc-second for the study area | CIRES, 2020 |

## 3.1 Study DEMs

The highest resolution model outputs for this study are run on a DEM covering the Cape Flattery, Makah Bay, and Neah Bay with 1/9 arc-second grid points (1/9 arc-second both in longitude and latitude). For this study, some small unpublished edits by the Washington Geological Survey were made to the GC 1/9" DEM tile prior to the job run (CIRES, 2020) to correct minor errors. See Appendix A for a description of the modifications made. We also use another DEM covering the Strait of Juan de Fuca (NOAA NGDC, 2015), which was coarsened to 2" using a pre-processing script that subsampled every sixth point in each direction (SJdF 2"). This coarsened DEM supplies topography and bathymetry coverage ajacent to Neah Bay at the entrance to the Salish Sea. Lastly, the simulations also use ETOPO1 1-minute topography (Amante and Eakins, 2009) to cover the entire modeling domain for both the CSZ and AASZ runs, which both initiate in the Pacific Ocean. Figure 5 displays the extent of all DEMs used in this assessment, with the exception of the 1-minute ETOPO1 DEM used in the Pacific.

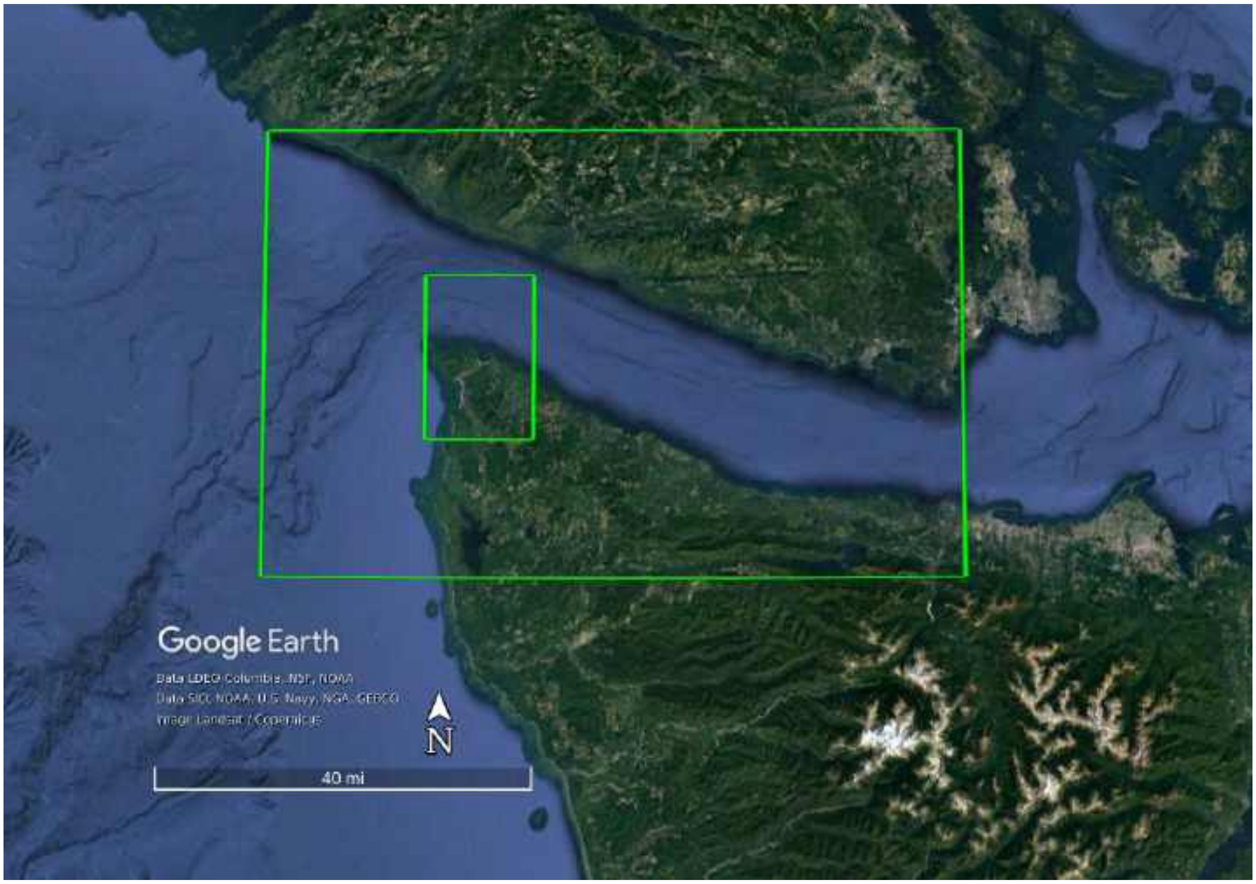


Figure 5. DEMs used in this study. Larger box is the extent of the 2” SJdF DEM. Smaller box is the extent of the 1/9” CUDEM (refer to Table 2). All simulations also used the ETOPO1 1-minute resolution DEM (not shown; Amante and Eakins, 2009) for coverage of the Pacific Ocean.

## 4. Study area

This study defines one 1/9th arc-second (Makah) fgmax region (refer to Figure 1). This fgmax region uses a fixed set of points (independent of adaptive mesh refinement [AMR]) on which the maximum of each quantity of interest is monitored over the course of the simulation. The quantities monitored are the flow depth, flow speed, and momentum flux. These fgmax points also monitor the time of the maximum values and the first wave arrival at each grid point. Furthermore, all fgmax points lie on a grid with spacing based on their respective resolution and align with the DEM grids. Table 3 gives an overview of the number of points included in the Makah fgmax region and Figure 6 provides visuals of this fgmax region.

Table 3: The total number of fgmax points in the Makah fgmax region that is used in this tsunami hazard assessment. This fgmax region only contains grid points for which the topography elevation is less than 15 m above MHW in the specified region boundaries. The column labeled “Count" gives the number of fgmax points in the region. See Section 6 for sample results of the maximum values monitored in each job run.

| Fgmax region | Count | Resolution |
|---|---|---|
| Makah | 7,623,365 | 1/9” |

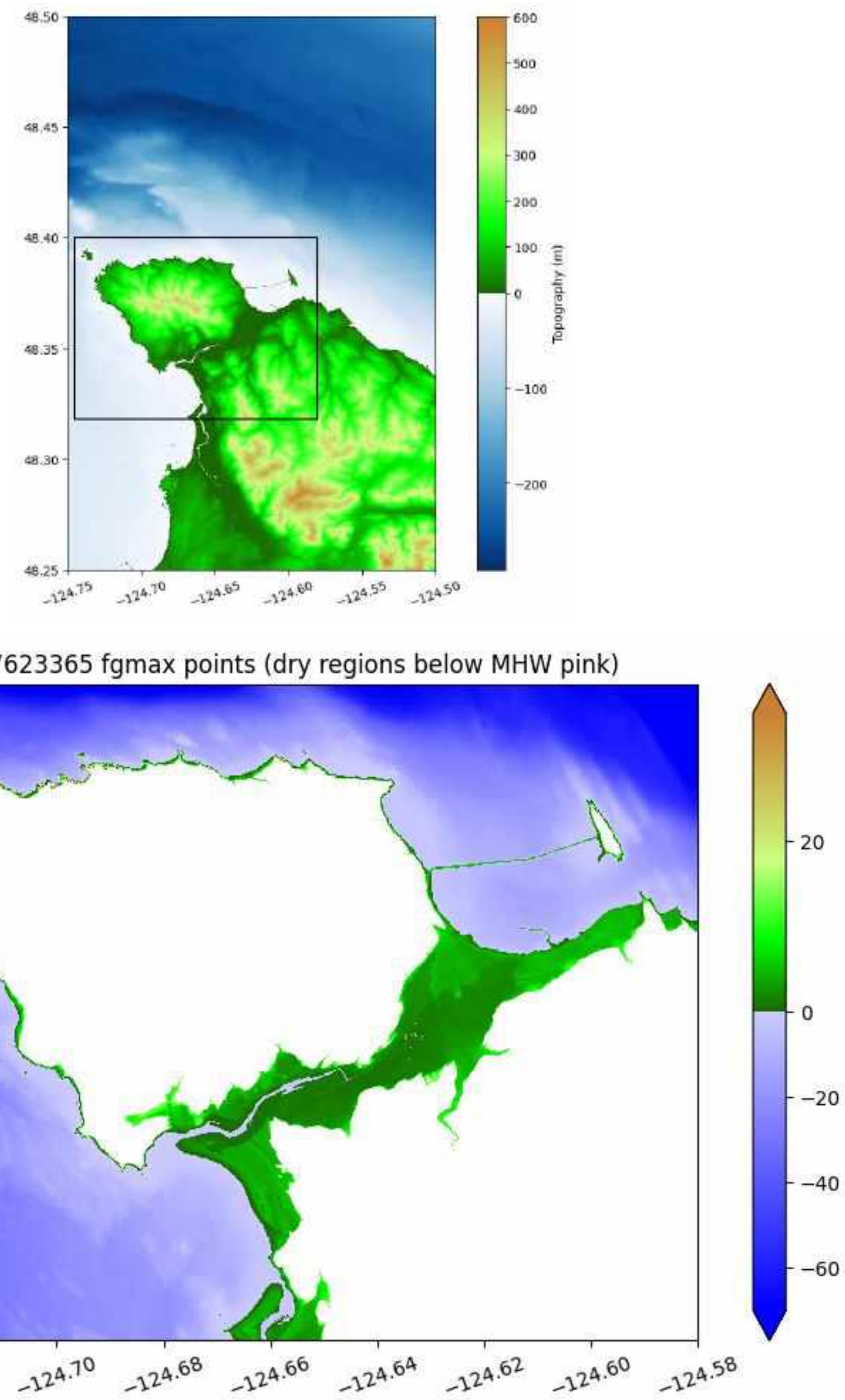


Figure 6: Specified area used to select fgmax points for the Makah fgmax region (top). 7,623,365 points selected in the fgmax region (bottom).

### 4.1 Fgmax selection improvements and limitations

The fgmax region selected for this project was specified in a pre-processing script that only selects grid points that return topography elevations below a specified limit, Zmax. For the current project, Zmax is set to 15 meters. This pre-processing script is available upon request by the WGS. Additionally, if only onshore inundation and nearshore currents need to be modeled, there is also the capability to set a maximum depth threshold (e.g. -60 or -40 meters). This would then only select fgmax points within the polygon or rectangle boundary where the bathymetry elevation is both above the specified value and less than Zmax. Note that this project includes all water points in each fgmax polygon to model currents farther from shore and did not include a maximum depth threshold. To run the code with many fgmax points efficiently, the UWTMG also improved the way the GeoClaw code internally handled the fgmax points. This resulted in a substantial computational speedup, while still monitoring values in the same manner as in previous versions of GeoClaw. Refer to LeVeque and others (2019) for a more complete summary of all improvements developed when selecting fgmax points and increasing computation efficiency.

### 4.2 Dry land below Mean High Water

Few locations in each fgmax region represent dry land with elevations below MHW, though protected from inundation under normal conditions. The standard GeoClaw software would initialize these points with water up to the level of MHW at the start of the simulation. Inadvertently, GeoClaw would flood these locations even if no tsunami arrived, which can be a misleading result. Moreover, for locations where the tsunami does reach land below MHW, there would be very different wave dynamics if the tsunami moved over an initially flooded artificial lake rather than moving over dry land. In these scenarios, the maximum depths recorded would be very different, with the former being incorrect. For example, water entering an artificial lake will spread out rapidly and eventually raise the level everywhere by a small amount. On the other hand, the same quantity of water overtopping a dike or levee and moving across dry land will quickly decelerate due to high bottom friction, giving higher maximum depth near the dike and little or no flooding farther inland. To deal with this problem, the UWTMG first developed a capability used in their project that modeled Whatcom County (Adams and others, 2019) and then improved upon it in the Island and Skagit County project (LeVeque and others, 2019) that forces these areas dry prior to tsunami wave arrival. Documentation of this “force dry” capability has been built into the GeoClaw code since v5.7.0 and is used in this current project. The locations that were subject to this problem were effectively forced dry and were saved as a variable in the input netCDF file needed to run the tsunami simulation (Appendix B). This file is available upon request from the WGS.

## 5. Model uncertainties and limitations

The inputs to the GeoClaw model include the earthquake sources, the DEMs used, and the Fgmax areas (discussed in sections 2-4). In addition, other geophysical parameters are designated. Some physical processes are not included in these simulations, which use the two-dimensional shallow water equations. See below for the discussion of these parameters and their potential effect on the modeling results.

## 5.1 Tide stage and sea level rise

The simulations for this study were run at both Mean High Water (MHW) and Mean Low Water (MLW) tidal datums. The MHW datum is conservative for tsunami inundation depths as the deeper tidal stage amplifies flooding over land. The MLW datum is often conservative for tsunami currents, in that current speeds tend to increase at lower water levels in shallow areas. The MLW datum is also conservative for minimum water depths to infer maximum drawdown values. Running simulations at both MHW and MLW tidal stages capture the range of variability of expected conditions along the Guemes Channel waterfront during a tsunami event. The DEMs used near the study location are referenced to the MHW datum (= 0), with the exception of the Strait of Juan de Fuca and ETOPO1 DEMs which are referenced to NAVD88. This is not a concern because those datasets cover parts of the model at coarse resolution. The simulations at MLW used the same DEMs (referenced to MHW), but sea level was set in GeoClaw at -1.5883 m (~ -5 feet) to approximate MLW. The MLW level was obtained from data collected by the NOAA tide gauge #9443090 located in Neah Bay, WA (NOAA, 2011). While consideration of future sea level rise is important for planning, this study does not account for potential sea level rise projections.

## 5.2 The built environment

The topographic DEMs used in this study are “bare earth” and are created by stripping the land surface of built structures, buildings, and vegetation. The presence of structures and vegetation can alter tsunami flow patterns and generally impede inland flow. To some extent, the lack of structures in the model makes the model results more conservative, because structures can reduce inland penetration of the tsunami wave. Actual tsunami flows are likely to interact with structures that may impede flow and cause water to pile up in some areas. Bare earth DEMs may lead to simulations with higher flow velocities because there is nothing to slow the flows. Actual tsunami flows may be slowed by structures, or conversely may speed up in areas where the flow is channelized, such as between buildings. Structures also contribute to debris that interacts with tsunami flows. In some cases, structures may be necessary to best model an area, and for this study the engineered breakwater was included in the DEM, though modified, at the Makah Marina. See Appendix A for details.

## 5.3 Bottom friction

Each simulation uses the value 0.025 for Manning’s Roughness Coefficient. This is a standard value used in tsunami modeling and corresponds to a gravelly earth surface material. Using 0.025 is conservative in some sense, because the presence of trees, structures, and vegetation would justify the use of a larger value, which might tend to reduce the inland flow. On the other hand, larger friction values can lead to deeper flow in some areas, since the water may pile up more as it advances more slowly across the topography.

## 5.4 Tsunami modification of bathymetry and topography

Scour, erosion, and deposition all happen in a tsunami. These topographic and bathymetric changes will inherently alter flow patterns of the tsunami wave. The erosion of natural berms or ridges along the coastline (or manufactured levies, dikes, or breakwaters) by the tsunami could increase more extensive flooding. On the other hand, the movement of material in a tsunami also requires an expenditure of tsunami energy, which could reduce the inland extent of inundation. These complex changes to the land are largely uncertain in a tsunami, and GeoClaw does not account for erosional or bathymetric/topographic change during simulations. Because there is no active modification to the topography and bathymetry in these results, the modeling dynamics of flow presented here may not entirely predict future tsunami behavior in the study area.

## 6. Fgmax results

This section contains figures of modeling results from each job run (4 total). The Washington Geological Survey at the Washington State Department of Natural Resources developed these model results into high-quality graphics for the final maritime guidance publication and products. The fgmax plots that follow show simplistic visual representations of the maximum onshore flow depths, maximum speeds, and minimum water depths recorded over the full simulation time for each source (10 hours for the CSZ scenario and 14 hours for the AASZ scenario) at mean high water (MHW) and mean low water (MLW) tidal stages. To query the specific values of each grid cell within the simulated fgmax region, the data files (in netCDF format) are available from the Washington Geological Survey upon request (refer to Appendix B).

The deepest onshore inundation depths (flooding over dry land) in the fgmax area are generated from the CSZ Extended L1 event at MHW. At this tide stage, average flow depths range from 2-5 meters (6-16) feet in Neah Bay proper, and 8-10 meters (28-33 feet) near the Tribal Headquarters along Resort Drive. Figure 7 shows onshore flow depths for the Cascadia Extended L1 source at both MHW and MLW tidal stages. On the contrary, the AASZ scenario produces minimal inundation depths to the Neah Bay region of study area, though still produces inundation in the low-lying areas adjacent to Makah Bay, especially from the simulation run using the MHW tidal stage. For example, modeling from this scenario shows the tsunami propagating ~3 river miles up the Wa’atch River valley, with onshore flooding depths increasing up to 2+ meters (~1-7 feet) depending on topography (Figure 8).

Maximum speeds are shown in meters/second for the CSZ scenario in Figure 9, and for the AASZ scenario in Figure 10 at MHW and MLW tidal stages. Modeled results suggest that the maximum current speeds for a given location can form at either MHW or MLW tidal stages. When combining the results from both tide stages, the CSZ scenario generates currents that exceed 4.5 meters/second in many areas throughout the study area, including the entrance into Neah Bay and at the mouth of the Wa’atch River. The modeled current speeds are slightly less within the Makah Tribal Marina itself, though pockets of speeds greater than 3 meters/second are still prevalent. In the AASZ, there are two main locations where modeled current speeds reach 4.5 meters/second. These include the mouth of the Wa’atch River and the water just north of Hobuck Bridge. Within the Makah Tribal Marina, the AASZ scenario produces current speeds that are generally less than 1.5 meters/second, though acute pockets of faster speeds within the 2-4 meter/second range appear in the areas adjacent to the marina breakwater and fish gap entrance.

Minimum water depth values are important for understanding the potential drawdown of water preceding or between tsunami wave crests. In marinas, this can result in vessels becoming stranded and possibly tipped prior to wave crest arrival. The low tide simulations resulted in greater drawdowns for both the CSZ (Figure 11) and AASZ (Figure 12) scenario. The modeled CSZ scenario produces slightly lesser reaches of 3-feet or less water depths from shore than the AASZ scenario, comparatively in the study area. This is likely a result of local subsidence in the CSZ scenario slightly diminishing the overall impact of the tsunami trough as the local sea-level starts to recover and flow back into the subsided areas immediately following the earthquake deformation. The Δh gauge plots (Appendix D) capture this impact that subsidence has on overall water depths relative to the post-earthquake conditions over time for each event.

## 6.1 Maximum onshore flow depths

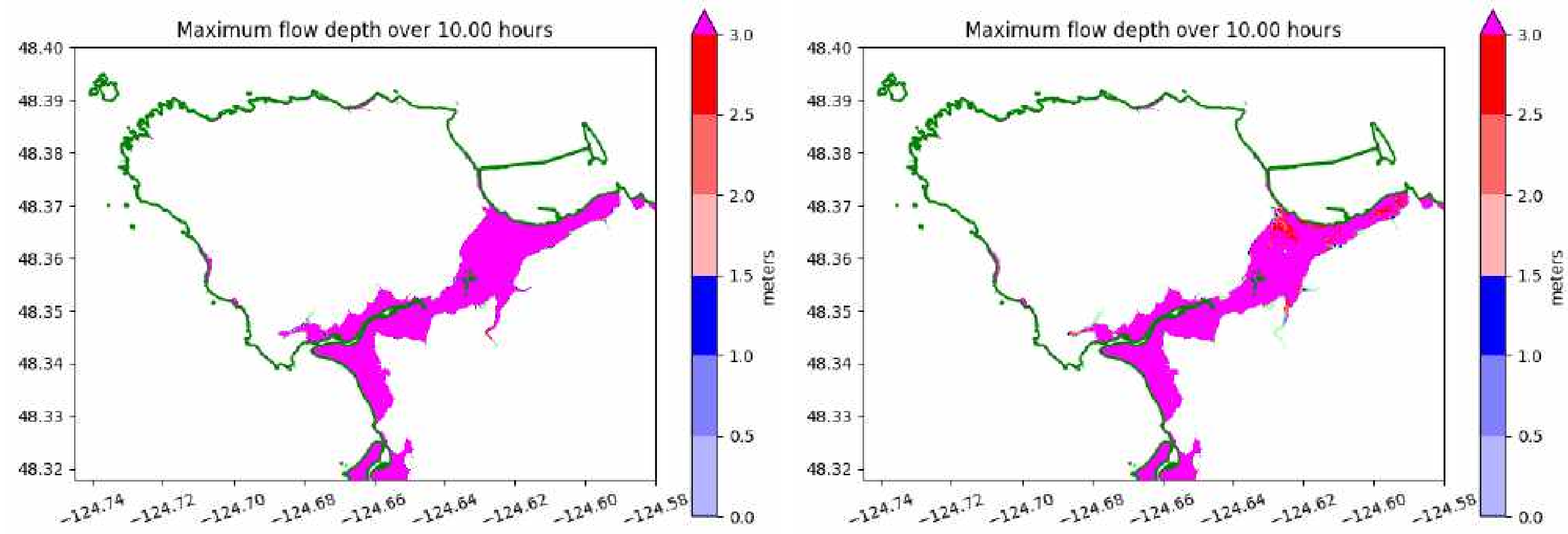


Figure 7: Cascadia subduction zone scenario, maximum onshore depths attained over 10 hours for MHW simulation (left), and MLW simulation (right). Model resolution: 1/9$^{th}$ arc-second.

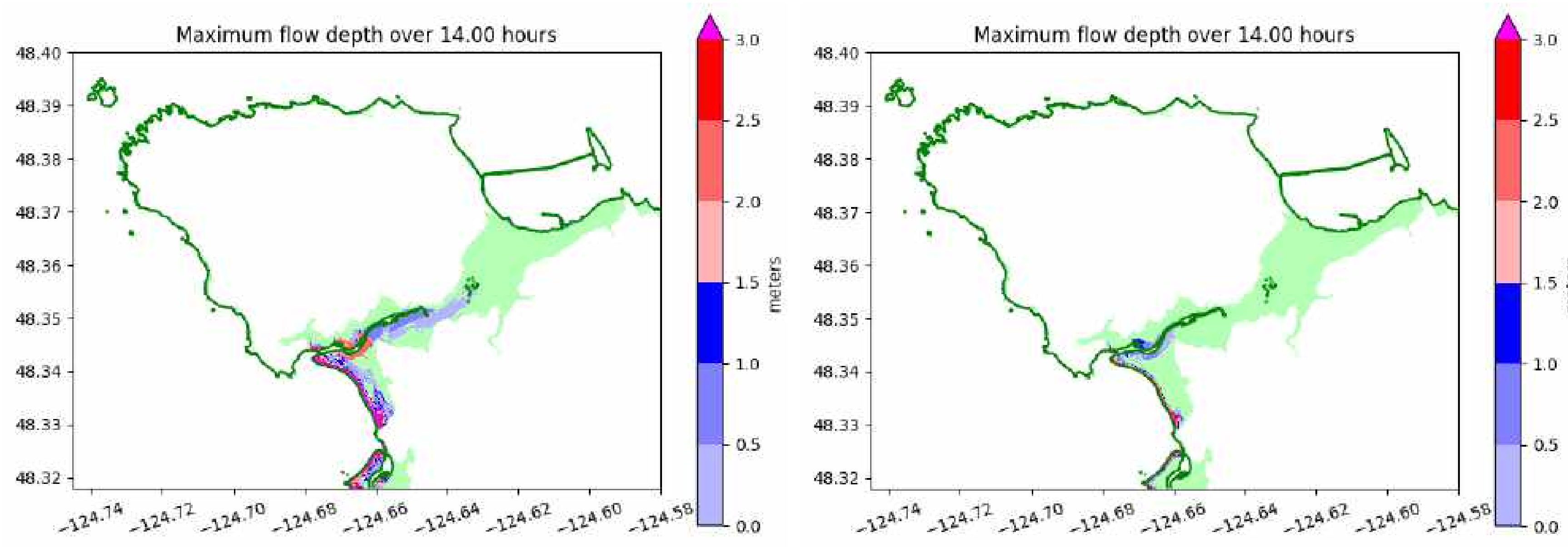


Figure 8: Alaska-Aleutian subduction zone scenario, maximum onshore depths attained over 14 hours for MHW simulation (left), and MLW simulation (right). Model resolution: 1/9th arc-second.

## 6.2 Maximum speeds

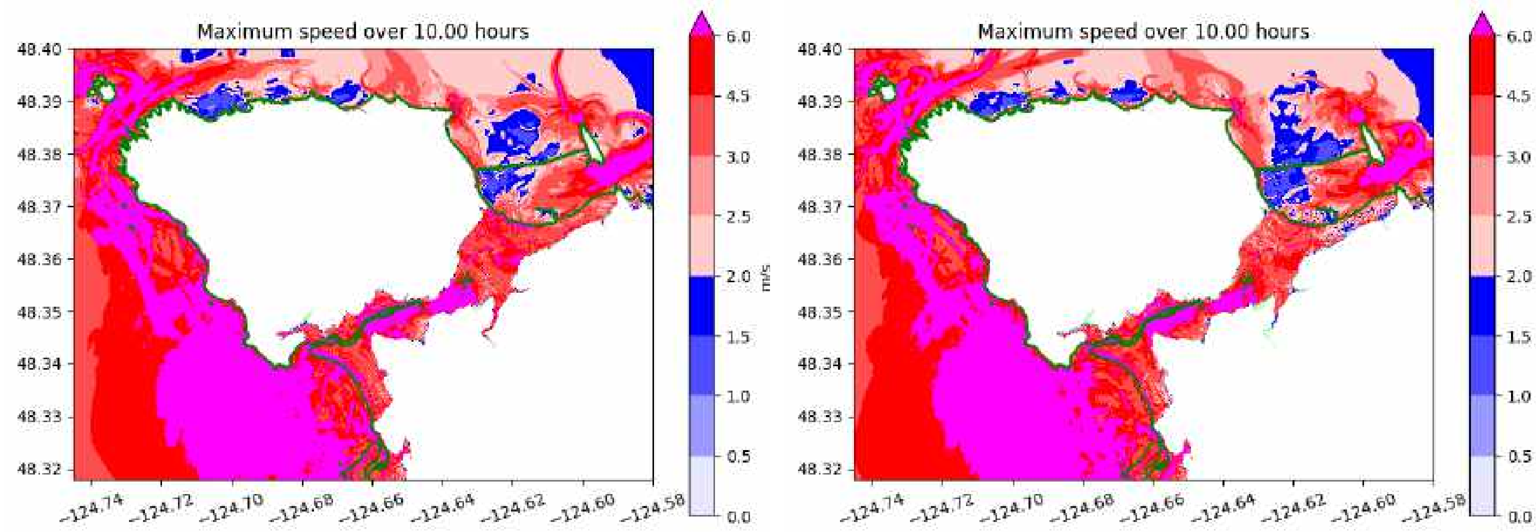


Figure 9: Cascadia subduction zone scenario, maximum speeds attained over 10 hours for MHW simulation (left), and MLW simulation (right). Model resolution: 1/9th arc-second.

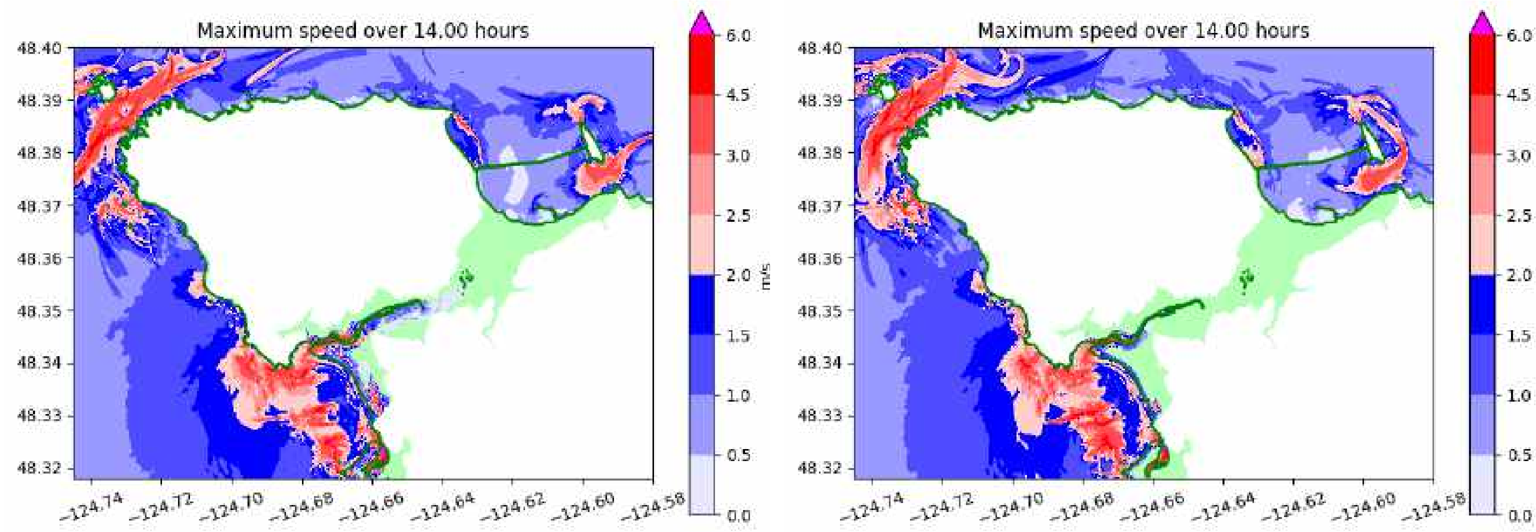


Figure 10: Alaska-Aleutian subduction zone scenario, maximum speeds attained over 14 hours for MHW simulation (left), and MLW simulation (right). Model resolution: 1/9th arc-second.

## 6.3 Minimum water depths

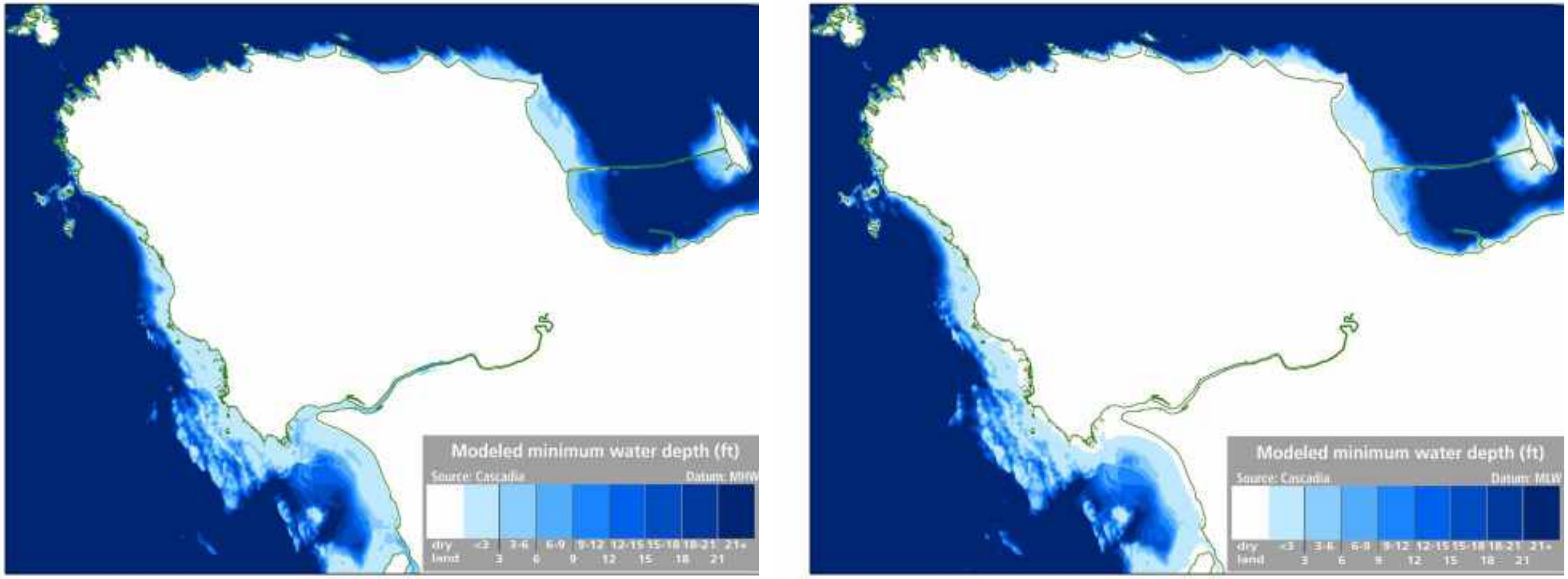


Figure 11: Cascadia subduction zone scenario, minimum water depths attained over 10 hours for MHW simulation (left), and MLW simulation (right). Lightest blue represents water depths of three feet or less. Darkest blue represents water depths greater than 21 feet. Model resolution: 1/9th arc-second.

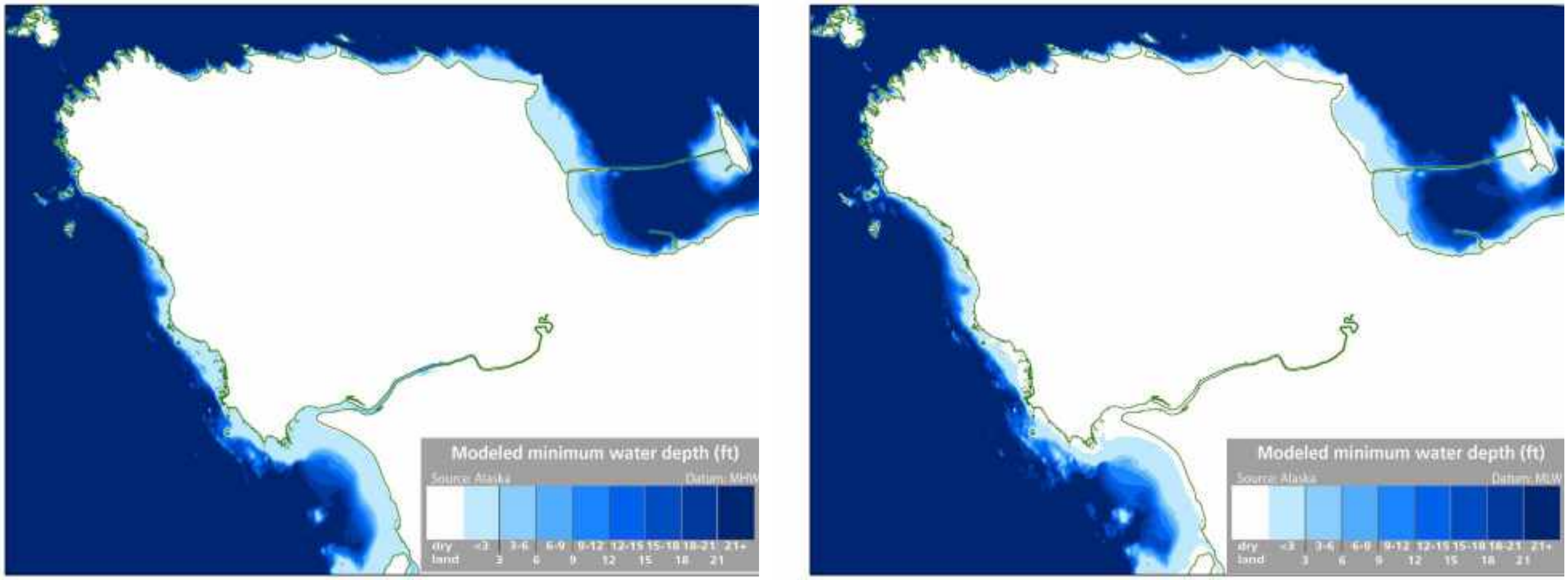


Figure 12: Alaska-Aleutian subduction zone scenario, minimum water depths attained over 10 hours for MHW simulation (left), and MLW simulation (right). Lightest blue represents water depths of three feet or less. Darkest blue represents water depths greater than 21 feet. Model resolution: 1/9th arc-second.

# 7. Gauge output results

## 7.1 Synthetic gauge locations

Figure 13 shows the locations of the 72 simulated gauges used to capture time series of the flow depth/surface elevation, and current velocity at specified locations for each simulation. All 72 gauges are used in both the CSZ and AASZ scenario job runs and modeled at the highest resolution (1/9 arc-second). Figure 14 captures the specific gauges within Neah Bay proper, while Figure 15 displays all gauges within the Makah Tribal Marina in a zoomed viewed. Lastly, Figure 16 shows a zoomed view of the tide gauges near the Makah Tribal Headquarter facilities on the Makah Bay side of the study area. Most gauges are located offshore, being placed in water; though some are also located onshore at key locations specified by Makah Emergency Management and the Port of Neah Bay leadership. Table 4 summarizes the geographic location for each gauge.

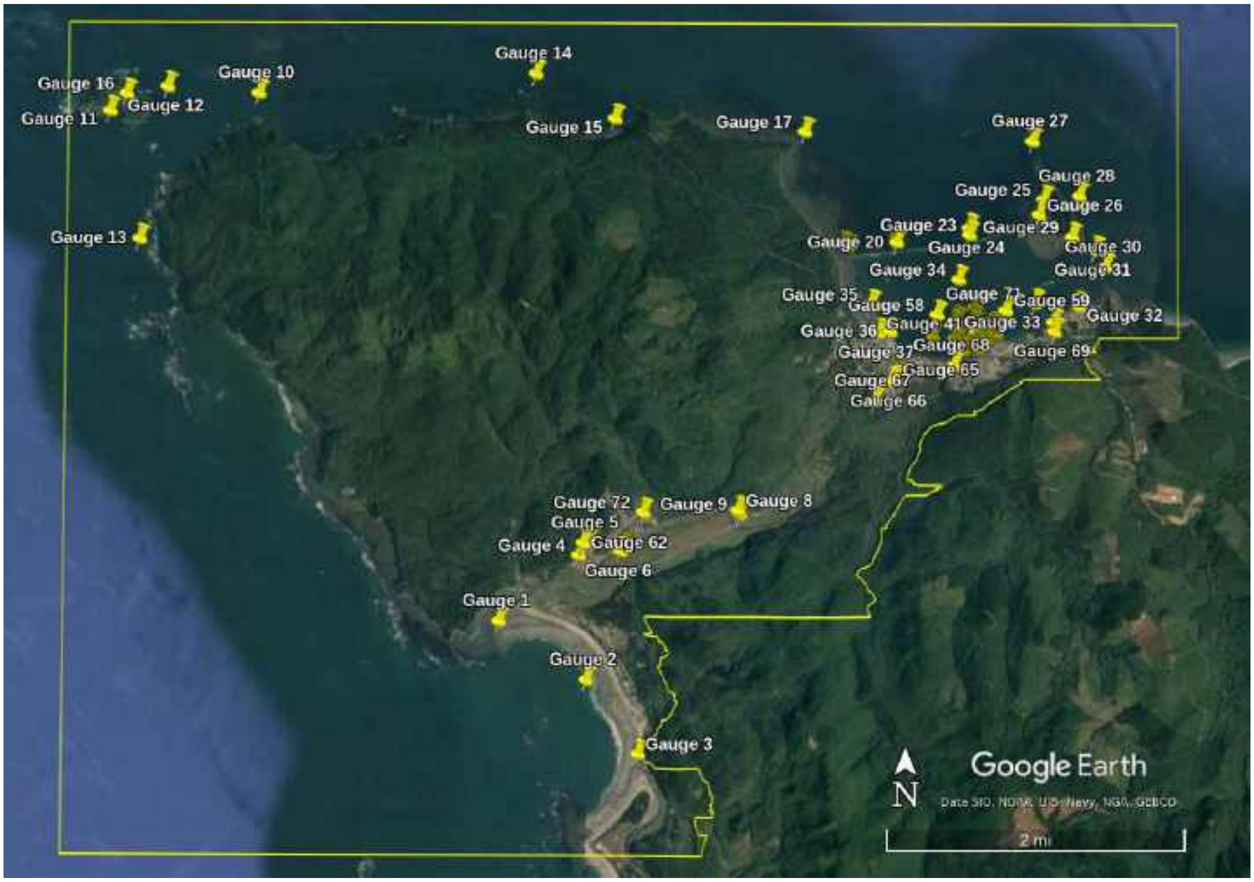


Figure 13. All 72 synthetic gauge locations in this study.

Figure 14. Spatial view of the tide gauges placed in Neah Bay proper.


Figure 15. A zoomed view of the selected tide gauges within the Makah Tribal Marina.


Figure 16. A zoomed view of the selected tide gauges near the Makah Tribal Headquarter facilities.

Table 4. Locations of all synthetic tide gauges in this study. These gauges are also shown in map view in Figures 13-17. Each gauge records the results for both the Cascadia subduction zone and Alaska-Aleutian subduction zone scenarios.

| Number | Latitude | Longitude | Description | Offshore vs Onshore |
|---|---|---|---|---|
| 1 | 48.3397 | -124.681 | Wa'atch River mouth | Offshore |
| 2 | 48.33395 | -124.668 | Makah Bay, center | Offshore |
| 3 | 48.32672 | -124.66 | Tsoo-Yess River mouth | Offshore |
| 4 | 48.34618 | -124.669 | Cape Flattery Rd, Resort Dr | Onshore |
| 5 | 48.34739 | -124.668 | Makah Tribal Headquarters | Onshore |
| 6 | 48.34658 | -124.663 | Wa'atch River, south of Hobuck Rd | Offshore |
| 7 | 48.347 | -124.663 | Wa'atch River, north of Hobuck Rd | Offshore |
| 8 | 48.35061 | -124.646 | Wa'atch River, north of Makah Psge | Offshore |
| 9 | 48.35028 | -124.645 | Wa'atch River, south of Makah Psge | Offshore |
| 10 | 48.39171 | -124.717 | Offshore Cape Flattery | Offshore |
| 11 | 48.38992 | -124.739 | West of Tatoosh Island | Offshore |
| 12 | 48.39235 | -124.731 | East of Tatoosh Island | Offshore |
| 13 | 48.37728 | -124.735 | West of Cape Flattery | Offshore |
| 14 | 48.39371 | -124.676 | Chibahdehl Rocks | Offshore |
| 15 | 48.38925 | -124.664 | Warmhouse Beach | Offshore |
| 16 | 48.39159 | -124.737 | Cape Flattery Lighthouse | Onshore |
| 17 | 48.38801 | -124.636 | Koitlah Point | Offshore |
| 18 | 48.37679 | -124.63 | North of Boom Rd Jetty entrance | Offshore |
| 19 | 48.37661 | -124.63 | South of Boom Rd Jetty entrance | Offshore |
| 20 | 48.37709 | -124.622 | Neah Bay Scenic Viewpoint, south | Offshore |
| 21 | 48.37769 | -124.622 | Neah Bay Scenic Viewpoint, north | Offshore |
| 22 | 48.37739 | -124.622 | Neah Bay Scenic Viewpoint | Onshore |
| 23 | 48.37787 | -124.612 | South of Jetty, center | Offshore |
| 24 | 48.37854 | -124.612 | North of Jetty center | Offshore |
| 25 | 48.38136 | -124.6 | North of Jetty, Waadah Island | Offshore |
| 26 | 48.37984 | -124.601 | South of Jetty, Waadah Island | Offshore |
| 27 | 48.38711 | -124.602 | Waadah Point | Offshore |
| 28 | 48.3817 | -124.595 | West of Waadah Island | Offshore |
| 29 | 48.37767 | -124.596 | South of Waadah Island | Offshore |
| 30 | 48.37469 | -124.591 | Baada Point | Offshore |
| 31 | 48.37636 | -124.593 | Neah Bay, entrance | Offshore |
| 32 | 48.3708 | -124.595 | Makah Tribal Police | Onshore |
| 33 | 48.36922 | -124.599 | US Coast Guard Station Neah Bay | Onshore |
| 34 | 48.37343 | -124.613 | Neah Bay, center | Offshore |
| 35 | 48.37097 | -124.626 | Neah Bay, west | Offshore |
| 36 | 48.3683 | -124.623 | Makah Tribal Council Senior Citizen Center | Onshore |
| 37 | 48.36816 | -124.625 | Makah Tribal Social Health Services | Onshore |

| | | | | |
|---|---|---|---|---|
| 38 | 48.36649 | -124.61 | Makah Tribal Marina | Onshore |
| 39 | 48.36643 | -124.612 | Makah Tribal Marina Boat Ramp | Offshore |
| 40 | 48.36663 | -124.612 | Makah Tribal Marina, south | Offshore |
| 41 | 48.36811 | -124.611 | Makah Tribal Marina, center | Offshore |
| 42 | 48.36776 | -124.613 | Makah Tribal Marina, west | Offshore |
| 43 | 48.36827 | -124.609 | Makah Tribal Marina, east | Offshore |
| 44 | 48.36901 | -124.611 | Makah Tribal Marina, north | Offshore |
| 45 | 48.36824 | -124.608 | Makah Tribal Marina Breakwater, west entrance | Offshore |
| 46 | 48.3693 | -124.613 | Makah Tribal Marina Breakwater, north entrance | Offshore |
| 47 | 48.36954 | -124.611 | Makah Tribal Marina north of breakwater, center | Offshore |
| 48 | 48.36886 | -124.608 | Makah Tribal Marina north of breakwater, northeast | Offshore |
| 49 | 48.36803 | -124.608 | Makah Tribal Marina east of breakwater, southeast | Offshore |
| 50 | 48.36743 | -124.609 | Makah Tribal Marina, southeast | Offshore |
| 51 | 48.36639 | -124.613 | Makah Tribal Marina, southwest | Offshore |
| 52 | 48.36689 | -124.61 | Makah Tribal Marina, south (2) | Offshore |
| 53 | 48.36913 | -124.611 | Makah Tribal Marina south of breakwater, center | Offshore |
| 54 | 48.36865 | -124.608 | Makah Tribal Marina west of breakwater, northeast | Offshore |
| 55 | 48.36808 | -124.609 | Makah Tribal Marina northwest of southeast Jetty | Offshore |
| 56 | 48.36808 | -124.608 | Makah Tribal Marina Breakwater west, entrance (2) | Offshore |
| 57 | 48.36946 | -124.613 | Makah Tribal Marina west of north Breakwater, entrance | Offshore |
| 58 | 48.36996 | -124.616 | Neah Bay northwest of Makah Tribal Marina | Offshore |
| 59 | 48.37041 | -124.606 | Neah Bay northeast of Makah Tribal Marina | Offshore |
| 60 | 48.37068 | -124.611 | Neah Bay north of Makah Tribal Marina | Offshore |
| 61 | 48.36907 | -124.614 | Makah Tribal Marina, northwest | Offshore |
| 62 | 48.34738 | -124.669 | Makah Tribal Council | Onshore |
| 63 | 48.36758 | -124.614 | Makah Dock Ice Machine | Offshore |
| 64 | 48.36389 | -124.622 | Neah Bay Elementary School | Onshore |
| 65 | 48.36355 | -124.623 | Neah Bay Middle School | Onshore |
| 66 | 48.36337 | -124.623 | Neah Bay High School | Onshore |
| 67 | 48.36144 | -124.625 | Neah Bay water treatment | Onshore |
| 68 | 48.36494 | -124.614 | Makah Tribal Fire Department | Onshore |
| 69 | 48.36831 | -124.599 | Makah Cultural & Research Center Museum | Offshore |
| 70 | 48.36777 | -124.617 | Neah Bay Fuel Station | Offshore |
| 71 | 48.37108 | -124.602 | Coast Guard Station dock | Offshore |
| 72 | 48.35041 | -124.66 | Waste Water Treatment Center | Offshore |

## 7.2 Synthetic gauge plots

The individual gauge plots show time series outputs of the flow depth (h), fluctuations in the water depth (Δh; incorporating local subsidence impacts), surface elevation (eta; the variation in the waveform amplitude relative to the pre-earthquake water surface elevation [0; regional MHW]), and speed for both the CSZ and AASZ scenarios at MHW and MLW from each individual simulated tide gauge (Appendix D). All gauges were simulated at the highest level of refinement (or resolution; 1/9 arc-second). The "TopoBathy" subplots beneath the surface elevation plots indicate the elevation of each tide gauge relative to the modeled tidal datum (including any coseismic land level changes). Negative "TopoBathy" numbers record the offshore water depth at the location of which the simulated tide gauge is placed. The speed is shown as a time series of speed vs time (√ (u2 + v2)), in addition to the individual E—W (u) and N—S (v) velocity components. The u—v plane located in the lower right plot for each event also allows one to see how the E—W component, u, of the speed compares to the N—S component, v, which can help discern the dominant direction of the tsunami current if one exists. On the other hand, the speed vs time plots simply show one-dimensional current speeds over the course of the simulation. Note that the vertical and horizontal axes on the gauge plots vary by location, parameter, and duration. The vertical scale is set by the maximum values in each plot to better show each individual result.

## Acknowledgments

We acknowledge the Port of Neah Bay and the US Army Corp of Engineers (USACE) for supplying us with updated topography and bathymetry data used to modify the 1/9 arc-second DEM. Additionally, we thank NOAA National Centers of Environmental Information for providing this 1/9 arc-second DEM and Guy McWethy (Washington Geological Survey) for his work in modifying it to reflect the updated data. We also acknowledge the NOAA Center for Tsunami Research (NCTR) at the Pacific Marine Environmental Laboratory in Seattle for providing the earthquake deformation files for the Cascadia subduction zone Extended L1 and Alaska-Aleutian subduction zone (AASZ) earthquake fault models, as well as the unit source parameters in Table 1 for the AASZ scenario. This work is supported by the Washington Geological Survey. The Tsunami Maritime Response and Mitigation Strategy study is funded by NOAA Award #NA22NWS4670021. This does not constitute an endorsement by NOAA.


## Data availability

The computer code and input data used in this study has been archived and is available on request from the Washington Geological Survey. The DEMs used in this study are available from the National Centers for Environmental Information (NCEI) at www.ncei.noaa.gov (modified DEM of Neah Bay is available from the Washington Geological Survey). NCEI provides these referenced to the MHW and NAVD88 vertical datums. NAVD88 can be converted to MHW with NOAA's VDatum tool: https://vdatum.noaa.gov/vdatumweb/.

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# Appendix A. Modifications to the Neah Bay 1/9 arc-second DEM

Modifications were made to the 1/9 arc-second DEM covering Neah Bay by the Washington Geological Survey, Washington State Department of Natural Resources for the purposes of this study. After reviewing recent lidar flown by the United States Amry Corp of Engineers (USACE) that was shared by the Port of Neah Bay, it became apparent that the wave attenuator structures (breakwaters and jetties) within Neah Bay and the Makah Tribal Marina were not properly resolved in the originally developed DEM provided by the NOAA Centers for Environmental Information (NCEI). Specifically, the initial elevations of the Jetty adjacent to Waadah Island and Marina breakwater were within the range of ~1-3 meters (~6-10 feet) above Mean High Water. Yet the local lidar suggested that the jetty elevation ranges from ~3-5 meters (~11 to 15 feet) along its length, while the breakwater protecting the marina has a consistent elevation of ~4.5 meters (~15 feet). Thus, these structures were raised prior to modeling to best match the current structural conditions within Neah Bay. The updated DEM used in this tsunami hazard assessment now more accurately reflects the engineered structures within Neah Bay (Figure A1). To obtain a version of the modified DEM used in this study, please contact the Washington Geological Survey.

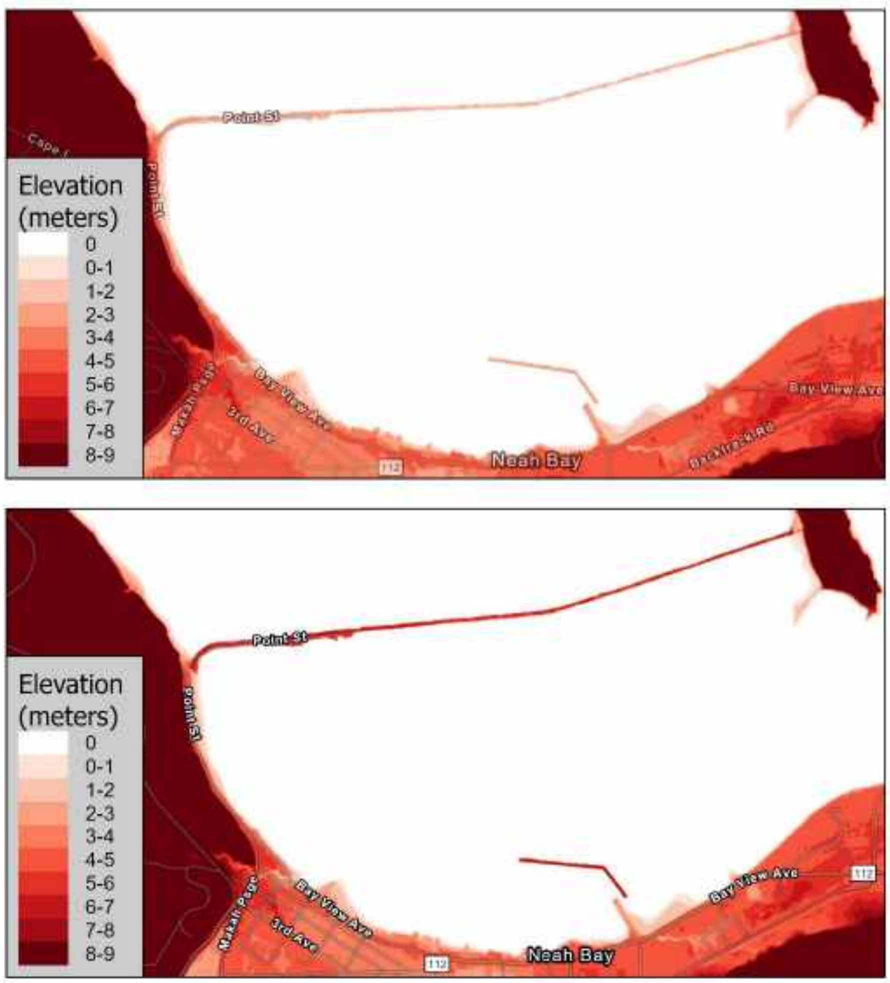



Figure A1: Initial DEM 1/9th arc-second DEM Tile provided by NOAA NCEI, ncei19_n48x50_w0124x75_2020, referenced to the Mean High Water tidal vertical datum (top) compared to the modified DEM with raised breakwater and jetty elevations used in this study (bottom).

# Appendix B. GeoClaw output and version information

Output was delivered as netCDF for each source (Cascadia subduction zone and Alaska-Aleutian subduction zone), at high tide (MHW) and low tide (MLW).

The netCDF files contain multiple field variables. A pre-processing script generates a few variables before the initiation of the GeoClaw run based on the fgmax region as part of the input. Following the GeoClaw run, the fgmax output generates other variables. Note that all variables are stored on two-dimensional uniform grids as defined by the lon and lat arrays. Only the points on this grid where fgmax point == 1 are used as fgmax points and only at these points is fgmax output available.

Values created as part of the GeoClaw input:

- lon: longitude, x (degrees),
- lat: latitude, y (degrees),
- Z: topography value Z from the DEM, relative to MHW (m),
- fgmax point: 1 if this point is used as an fgmax point, 0 otherwise,
- force_dry_init: 1 if this point is initialized as usual, 0 if this point is forced to be dry, regardless of initial topography value.

Values created based on the GeoClaw output:

- dz: Co-seismic surface deformation interpolated to each point (m),
- B: post-seismic topography value B from GeoClaw at gauge location (m),
- h: maximum depth of water over simulation (m),
- s: maximum speed over simulation (m/s),
- hss: maximum momentum $hs^2$ over simulation ($m^3/s^2$),
- hmin: minimum depth of water over simulation (m),
- arrival time: apparent arrival time (rising wave > 0.05 m) of tsunami (s),

In addition, the netCDF files contain the following metadata values:

- tfinal: final time of GeoClaw simulation (seconds),
- history: record of times data was added to file,
- outdir: location of output directory where data was found,
- run_finished: date and time run finished,

The fgmax points align exactly with the 1/9" DEM points. The finest level computational finite volume grid also aligns so that cell centers are exactly at the fgmax points, and Z in the netCDF file is the value from the DEM at this point. However, by integrating a piecewise bilinear function that interpolates the 1/9" DEM obtains the topography value B used in a grid cell in GeoClaw, which is not exactly equal to Z initially. Moreover, B is the value after any co-seismic deformation associated with the event.

## B.1 GeoClaw Version 5.9.0

The modeling for this project used GeoClaw Version 5.9.0. GeoClaw is open source, part of the Clawpack software, and available at http://www.clawpack.org. Refer to the official version 5.9.0 release notes to view changes and modifications from previous GeoClaw versions.

## B.2 GeoClaw source terms for propagation on the sphere

After completion of tsunami modeling for this project, the Washington Geological Survey was made aware of missing source terms in the mass equation within the GeoClaw code, and that the spherical coordinate form of the shallow water equations was not fully implemented in the Alaska tsunami simulations*. Normally, GeoClaw solves the shallow water wave equations on a rectangular grid in longitude-latitude space and deals with varying finite volume grid cell sizes, which decrease when moving away from the equator and toward the poles. However, the missing terms lead to waves decaying more than they should when propagating towards the poles, and less than they should when propagating toward the equator. The University of Washington Tsunami Modeling Group (UWTMG) completed an initial comparative test with and without these source terms using the same distant Alaska-Aleutian subduction zone (AASZ) earthquake source model as described in Section 2.2 for Cape Flattery, Washington (Figure B1). They confirmed the previous statement and found as much as a ~20% decrease in offshore wave heights compared to if these source terms are included (Figure B1).

*Additional terms were also missing in the momentum equations, “but these are quadratic in the fluid velocities and hence negligible for most realistic tsunami propagation problems, in which the depth-averaged fluid velocities are typically very small in the deep ocean where long-distance propagation takes place” (LeVeque, 2023).

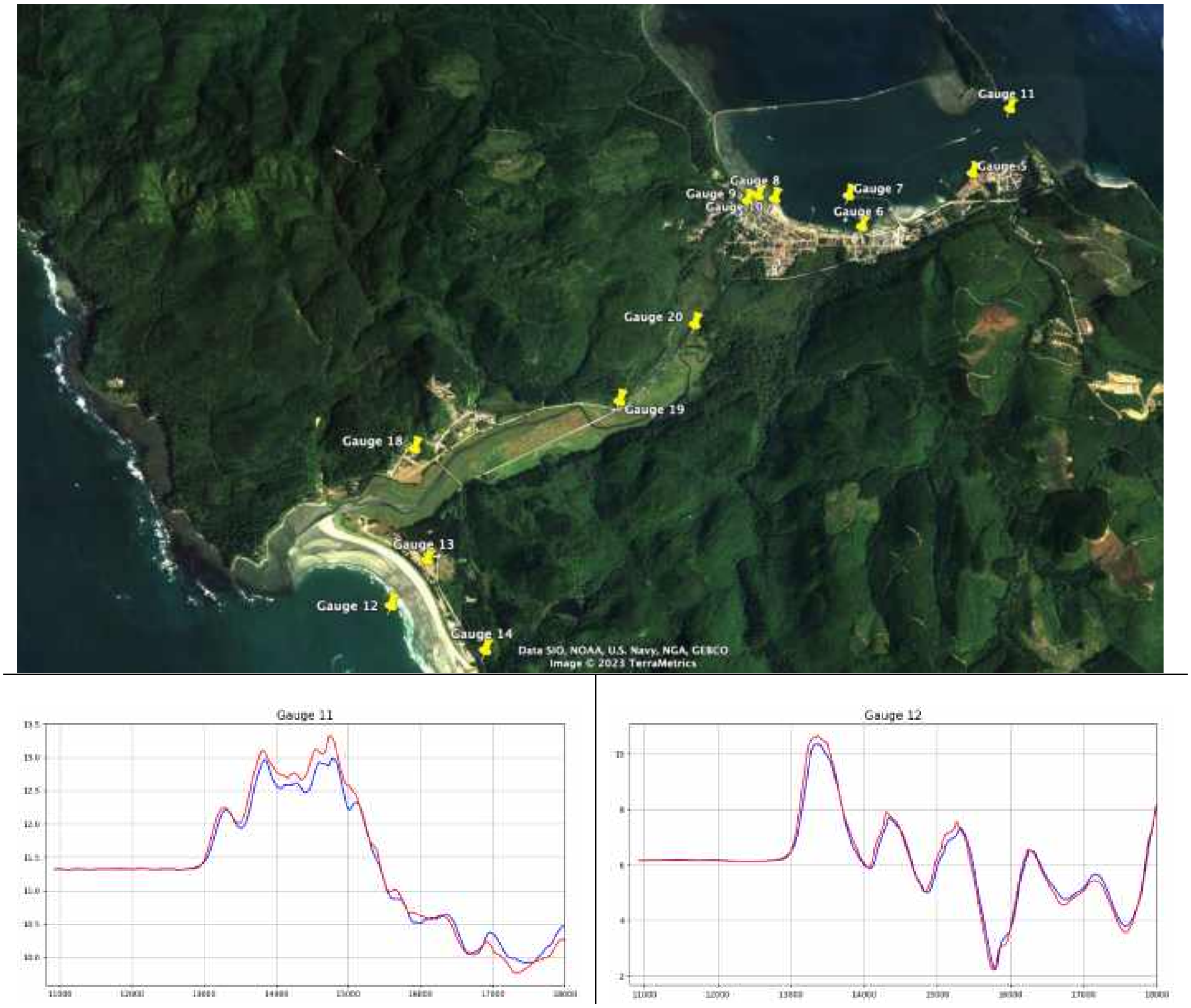
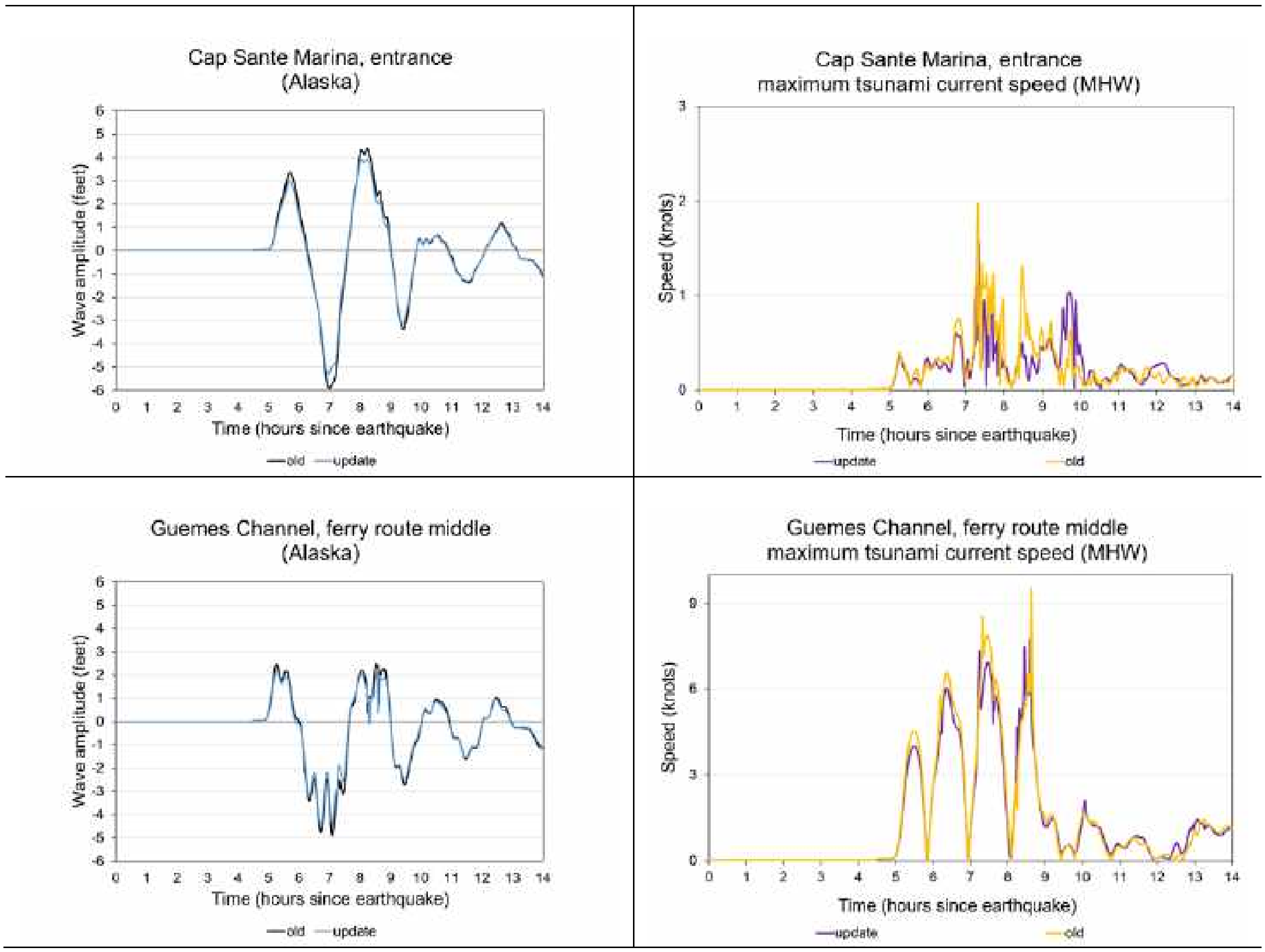



Figure B1: Comparative test case from a distant Alaska-Aleutian subduction zone scenario at the entrance to Neah Bay marina (Gauge 11) and offshore Buckroe (Hobuck) Beach in Makah Bay (gauge 12) with and without the corrected spherical source terms developed by the University of Washington Tsunami Modeling Group (UWTMG). Tide gauge marigrams plot water depth (meters) over time (seconds). Red lines represent the tsunami waveform from a previous job run simulated in 2020-2021 for the Cape Flattery Study area with the source terms omitted. Blue lines represent a recent (2023) rerun of the same study area with the source terms included. The waveform with the source terms included show slightly smaller amplitudes by 10-15% relative to the original simulation. The UWTMG modeling report, code, and data for this original modeling project can be viewed here: https://depts.washington.edu/ptha/WA_EMD_2020/ (Leveque and others, 2021).

In 2023, the Washington Geological Survey completed an additional comparative test with and without these spherical source terms for the Guemes Channel area within Washington's inner waterways for the distant AASZ source model at mean high water. Much like the UWTMG's findings, the GeoClaw code without the source terms (original job run) overestimates the waves traveling towards the equator and produced modeled wave heights and current speeds that are also ~10-15% greater than the results from the job run with these terms included (Figure B2). The UWTMG developed the following documentation, which includes additional information, notes, and testing on this topic: https://www.clawpack.org/sphere_source.html.



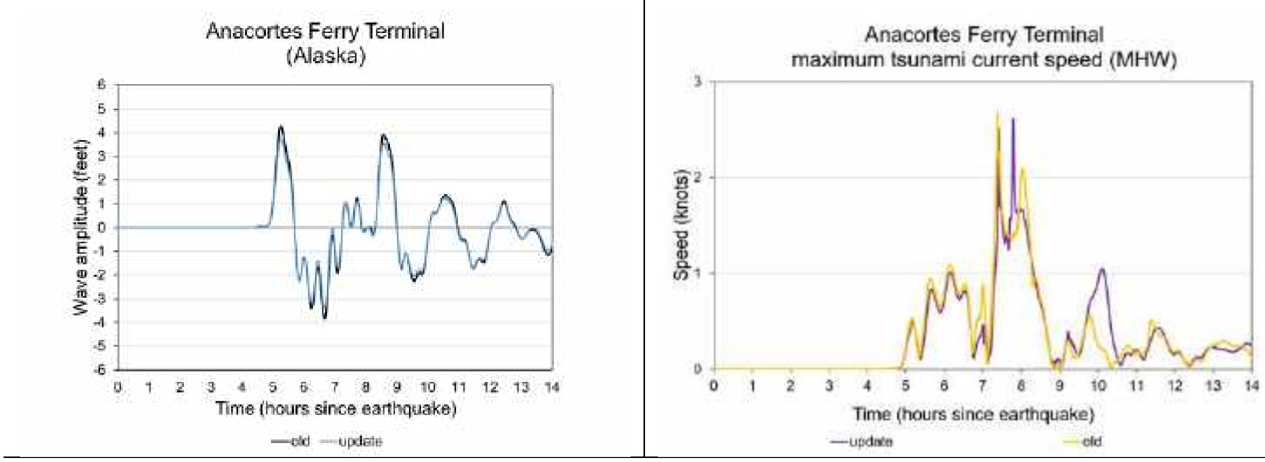



Figure B2: Comparative test case from a distant Alaska-Aleutian subduction zone scenario (simulated at Mean High Water) at select tide gauge locations within the Guemes Channel with and without the corrected spherical source terms. Left) Wave amplitude over time. Black lines represent the tsunami waveform without the source terms and blue lines represent the tsunami waveform with the corrected source terms. Right) Wave speed over time. Yellow lines represent the tsunami waveform without the source terms and purple lines represent the tsunami waveform with the corrected source terms. The waveform with the source terms included show slightly smaller wave amplitudes and slower current speeds by ~10-15% when compared to the original simulation. Cap Sante Marina, entrance represents tide gauge 56; Guemes Channel, ferry route middle represents tide gauge 124; Anacortes Ferry Terminal represents tide gauge 1 from the Port of Anacortes Maritime Strategy published in May of 2024: (https://mil.wa.gov/asset/66576dc5ec93a/Appendix%203_Anacortes_TMRMS_Technical%20Report.pdf).

It should be noted that the missing spherical source terms in the mass equation only relates to cases where waves propagate north-to-south or vice-versa for long distances. In other words, it's only when waves are traveling from one latitude to a very different latitude that these source terms become important in the shallow water wave equations, such as a tsunami that forms closer to the northern pole (like offshore of Alaska) and propagates far southward (such as to Washington). On the other hand, the lack of these terms makes little difference in modeled results for waves propagating east-west in mid-latitudes for long distances (such as a tsunami that propagates from Japan to Washington) or over short distances such as a local Cascadia subduction zone (CSZ) event.

Correcting this issue in the GeoClaw code by including these source terms cause the waves to decay faster as they travel south. This leads to relatively smaller modeled wave heights offshore Washington compared to if they were not included in the GeoClaw code. However, due to the large amount of uncertainty regarding the next AASZ earthquake event compared to the modeled scenario, and all other uncertainties, limitations, and assumptions listed in *Section 5*, this Tsunami Maritime Response and Mitigation Strategy opts to still use the original results corresponding to the distant AASZ tsunami scenario that omits these source terms for overall conservatism.

# Appendix C. Gauge report summaries

The following subheadings of this appendix include summary tables for all simulated tide gauges from each modeled earthquake source (Cascadia subduction zone and Alaska-Aleutian subduction zone [CSZ and AASZ, respectively]) and tidal level (Mean High Water [MHW] and Mean Low Water [MLW]). The variables within each table are defined as:

- B0: pre-seismic bathymetry/topography elevation (m)
- B: post-seismic bathymetry/topography elevation (m)
- dzi: co-seismic surface deformation (m)
- max h: maximum depth of water over simulation (m)
- min h: minimum depth of water over simulation (m)
- max zeta: maximum surface elevation (eta) offshore above MHW; or maximum depth (h) onshore (m)
- max Δh*: maximum change in water depth/height (h0-h; [max zeta-dzi]) over simulation (m)
- max eta post-earthquake: post-seismic maximum surface elevation (B + h) above MHW (m) over simulation (m)
- max s: maximum speed over simulation (m/s)
- max hs: maximum momentum over simulation ($m^2/s$)
- max hhs: maximum momentum flux $hs^2$ over simulation ($m^3/s^2$)
- tmax: time of maximum zeta over simulation (minutes)
- tmin: time of minimum zeta over simulation (minutes)
- tfirstPOS: time of first rising wave arrival (zeta > 0.1016 m) over simulation (minutes)
- tfirstNEG: time of first falling wave arrival (zeta < 0.1016 m) over simulation (minutes)
- tfirstDRAW**: time of first significant fall wave arrival (h0-h > 0.3048 m) over simulation (minutes)
- tfirstADVIS: time of first "advisory-level" wave arrival (h-h0 > 0.3048 m) over simulation (minutes). This threshold matches the Advisory Alert-level defined by the National Tsunami Hazard Mitigation Program (NTHMP)
- tfirstWARN: time of first "warning-level" wave arrival (h-h0 > 0.9144 m) over simulation (minutes). This threshold matches the Warning Alert-level defined by the NTHMP

* Note: max Δh is only included for the local source, CSZ runs. This is because we assume that zero land level changes would occur from a distant, AASZ scenario. Coseismic subsidence generated by the CSZ scenario leads to the land/seafloor and water surface levels to drop simultaneously within this study area. Following this drop, the water surface level would rebound back to the pre-earthquake conditions over the course of the simulated tsunami, but the land/seafloor would not. The rate at which the water surface level recovers is not captured in the tsunami simulation. Thus, determining offshore wave amplitude is challenging where land level changes exist because amplitude refers to the height above water surface level. This becomes a dynamic and uncertain variable where there are coseismic elevation changes. Rather, because flow depth (h) does not change during coseismic impacts, we instead report the change in water depth (max Δh) over the simulation to capture the maximum impact of the tsunami water height. This value represents both the tsunami wave amplitude and the amount of sea-level recovery following the earthquake in the zone of coseismic impact. This value may not represent the largest wave amplitude, which is generally the first wave in this study area. When no coseismic impacts occur, max Δh is the same as max zeta and/or max h (if the gauge is onshore).

**Note: tfirstDRAW timings reported as n/a suggest that either 1) the gauge was place onshore, or 2) the post-earthquake water depth never falls a foot or more (-0.3048 m) below the water depth (h0) at the time of the earthquake.

## Scenario: Cascadia subduction zone, MHW

| Gauge | B0 | B | dzi | max h | min h | max zeta | max Δh | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -2.17 | -5.74 | -3.56 | 14.97 | 2.15 | 9.23 | 12.79 | 9.23 | 6.5 | 47.21 | 187.98 | 36.33 | 276.32 | 3.3 | n/a | n/a | 4.6 | 7.5 |
| 2 | -5.44 | -9.03 | -3.59 | 18.9 | 0.18 | 9.87 | 13.47 | 9.87 | 6.58 | 47.27 | 180.57 | 35.14 | 49.82 | 2.4 | 43.9 | 44.1 | 4.3 | 6.6 |
| 3 | -2.17 | -5.75 | -3.58 | 16.02 | 1.64 | 10.27 | 13.85 | 10.27 | 7.85 | 33.6 | 169.64 | 34.03 | 277.07 | 2.9 | 107.7 | 167.4 | 4.7 | 7.5 |
| 4 | 3.47 | -0.18 | -3.65 | 10.46 | 0 | 10.46 | 14.11 | 10.28 | 6.01 | 37.31 | 151.55 | 36.06 | 0 | 19.9 | n/a | n/a | 20.5 | 21.9 |
| 5 | 2.98 | -0.68 | -3.66 | 11.24 | 0 | 11.24 | 14.9 | 10.55 | 4.27 | 43.96 | 187.39 | 35.89 | 0 | 21.6 | n/a | n/a | 21.7 | 22.2 |
| 6 | -1.74 | -5.42 | -3.68 | 14.36 | 1.74 | 8.93 | 12.61 | 8.93 | 5.82 | 83.19 | 484.02 | 35.72 | 0 | 12 | n/a | n/a | 13 | 17.2 |
| 7 | -1.72 | -5.4 | -3.68 | 14.07 | 1.72 | 8.67 | 12.35 | 8.67 | 6.92 | 87.04 | 543.64 | 35.73 | 0 | 12.2 | n/a | n/a | 13.4 | 18.9 |
| 8 | -1.35 | -5.13 | -3.78 | 13.45 | 1.35 | 8.32 | 12.1 | 8.32 | 5.64 | 70.45 | 397.28 | 38.29 | 1 | 10 | n/a | n/a | 19.5 | 23.6 |
| 9 | 0.81 | -2.97 | -3.78 | 11.03 | 0 | 11.03 | 14.81 | 8.06 | 5.68 | 58.02 | 324.9 | 37.9 | 0 | 24.4 | n/a | n/a | 25.3 | 26.9 |
| 10 | -32.9 | -36.58 | -3.67 | 41.8 | 32.43 | 5.23 | 8.9 | 5.23 | 6.94 | 277.93 | 1927.93 | 31.62 | 2.12 | 1.1 | 1 | 2.1 | 1.1 | 6 |
| 11 | -21.71 | -25.19 | -3.48 | 31.07 | 21.38 | 5.88 | 9.36 | 5.88 | 1.54 | 37.42 | 57.53 | 30.48 | 106.94 | 1 | 106.3 | 106.8 | 1.6 | 6.1 |
| 12 | -14.97 | -18.53 | -3.56 | 22.93 | 14.16 | 4.4 | 7.97 | 4.4 | 6.67 | 114.87 | 711.68 | 43.34 | 3.3 | 1 | 1 | 2 | 1.5 | 2.3 |
| 13 | -22.07 | -25.52 | -3.45 | 31.5 | 21.7 | 5.97 | 9.42 | 5.97 | 5.14 | 124.42 | 639.46 | 30.83 | 106.99 | 1 | 3.8 | 106.7 | 1.9 | 2 |
| 14 | -15.12 | -18.99 | -3.87 | 24.45 | 14.68 | 5.46 | 9.33 | 5.46 | 2.64 | 60.65 | 150.55 | 33.09 | 2.07 | 1 | 1.9 | 2 | 1 | 4 |
| 15 | -1.1 | -4.99 | -3.89 | 11.06 | 0.45 | 6.07 | 9.96 | 6.07 | 2.58 | 12.52 | 22.87 | 33.85 | 4.91 | 1.6 | 3.1 | 3.2 | 1.7 | 3.5 |
| 16 | 28.68 | 25.17 | -3.51 | 0 | 0 | 0 | 0 | 25.17 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 17 | -2.33 | -6.21 | -3.88 | 11.7 | 0.3 | 5.49 | 9.37 | 5.49 | 6.51 | 47.48 | 272.8 | 34.94 | 112.49 | 1.4 | 1.6 | 2.8 | 1.5 | 3.5 |
| 18 | -1.4 | -5.28 | -3.87 | 11.29 | 0 | 6.02 | 9.89 | 6.02 | 3.59 | 20.95 | 40.89 | 36.16 | 116.86 | 3.9 | 6.5 | 6.6 | 3.9 | 5.2 |
| 19 | -1.23 | -5.1 | -3.87 | 10.38 | 0.42 | 5.28 | 9.15 | 5.28 | 3.43 | 19.32 | 66.26 | 37.51 | 122.77 | 6.7 | 116.3 | 116.8 | 7.8 | 11.6 |
| 20 | -4.22 | -8.09 | -3.87 | 13.48 | 3.62 | 5.39 | 9.26 | 5.39 | 2.33 | 30.55 | 71.31 | 36.94 | 120.18 | 5.5 | 117 | 118.5 | 6.4 | 11.9 |
| 21 | -6.51 | -10.38 | -3.87 | 16.36 | 5.22 | 5.98 | 9.85 | 5.98 | 2.66 | 27.45 | 73.05 | 36.11 | 115.06 | 2.8 | 3.1 | 3.2 | 2.9 | 4.3 |
| 22 | 5.87 | 2 | -3.87 | 3.11 | 0 | 3.11 | 6.98 | 5.11 | 6.59 | 10.86 | 71.59 | 37.35 | 0 | 28.3 | n/a | n/a | 29 | 32.7 |
| 23 | -8.9 | -12.77 | -3.87 | 18.25 | 8.37 | 5.49 | 9.36 | 5.49 | 3.2 | 52.76 | 168.8 | 37.26 | 119.36 | 4.3 | 117.8 | 118.5 | 5.2 | 10.3 |
| 24 | -11.88 | -15.75 | -3.87 | 21.68 | 11.02 | 5.93 | 9.8 | 5.93 | 1.74 | 32.76 | 55.1 | 36 | 114.92 | 2.6 | 3.7 | 3.8 | 2.6 | 4 |
| 25 | -1.8 | -5.66 | -3.85 | 11.59 | 0.38 | 5.93 | 9.79 | 5.93 | 2.54 | 17.73 | 33.46 | 36.39 | 116.87 | 2.8 | 4.9 | 5.3 | 2.8 | 3.9 |
| 26 | -1.68 | -5.54 | -3.86 | 11.39 | 1.15 | 5.85 | 9.71 | 5.85 | 2.24 | 18.38 | 36.56 | 36.97 | 119.46 | 4 | 118.4 | 118.8 | 5.1 | 10.6 |
| 27 | -6.12 | -9.98 | -3.86 | 14.99 | 5.45 | 5.01 | 8.87 | 5.01 | 5.55 | 69.88 | 378.17 | 35.44 | 2.35 | 1.2 | 1.5 | 2.3 | 1.4 | 2.6 |
| 28 | -3.09 | -6.93 | -3.84 | 12.23 | 2.28 | 5.3 | 9.14 | 5.3 | 2.9 | 24.28 | 54.82 | 35.99 | 4.43 | 1.5 | 2.3 | 2.5 | 1.5 | 2.7 |
| 29 | -3.75 | -7.59 | -3.84 | 12.84 | 2.36 | 5.25 | 9.09 | 5.25 | 7.35 | 55.97 | 310.36 | 37.88 | 116.07 | 1.8 | 69 | 69.1 | 1.9 | 7.9 |
| 30 | -5.7 | -9.53 | -3.82 | 15.23 | 4.39 | 5.71 | 9.53 | 5.71 | 8.07 | 62.88 | 444.55 | 37.75 | 115.33 | 1.5 | 2.5 | 3.7 | 1.5 | 7.3 |
| 31 | -11.45 | -15.28 | -3.83 | 20.89 | 10.38 | 5.61 | 9.44 | 5.61 | 7.36 | 96.34 | 638.41 | 36.9 | 115.35 | 1.4 | 2.4 | 114.3 | 1.4 | 7.4 |
| 32 | 4.98 | 1.15 | -3.83 | 4.94 | 0 | 4.94 | 8.77 | 6.09 | 3.26 | 10.21 | 25.69 | 37.44 | 0 | 27.3 | n/a | n/a | 28.3 | 29.7 |
| 33 | 4.9 | 1.06 | -3.84 | 5.15 | 0 | 5.15 | 8.99 | 6.21 | 3.27 | 11.31 | 37 | 38.18 | 0 | 27.2 | n/a | n/a | 27.7 | 29.5 |
| 34 | -12.85 | -16.72 | -3.87 | 22.51 | 12.3 | 5.79 | 9.66 | 5.79 | 3.09 | 62.93 | 194.64 | 37.7 | 119.92 | 5 | 117.6 | 118.3 | 8.3 | 10.7 |
| 35 | -2.03 | -5.9 | -3.87 | 11.63 | 1.16 | 5.73 | 9.6 | 5.73 | 1.92 | 16.8 | 32.16 | 37.57 | 122.23 | 6.7 | 117.2 | 117.5 | 7.7 | 11.3 |

| Gauge | B0 | B | dzi | max h | min h | max zeta | max Δh | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 2.25 | -1.62 | -3.87 | 7.25 | 0 | 7.25 | 11.11 | 5.63 | 6.09 | 22.37 | 103.9 | 41.68 | 0 | 18.9 | n/a | n/a | 19.6 | 21.6 |
| 37 | 4.44 | 0.57 | -3.87 | 5.29 | 0 | 5.29 | 9.16 | 5.86 | 4.27 | 17.47 | 69.57 | 41.58 | 0 | 25.7 | n/a | n/a | 26 | 27.9 |
| 38 | 4.03 | 0.17 | -3.86 | 5.79 | 0 | 5.79 | 9.65 | 5.96 | 4.01 | 13.67 | 35.2 | 38.46 | 0 | 23.4 | n/a | n/a | 23.9 | 26.1 |
| 39 | -2.17 | -6.03 | -3.86 | 11.76 | 1.15 | 5.73 | 9.59 | 5.73 | 4.2 | 34.81 | 117.9 | 38.62 | 120.88 | 6 | 117.9 | 118.9 | 7.3 | 11.3 |
| 40 | -4.2 | -8.06 | -3.86 | 13.87 | 3.24 | 5.81 | 9.67 | 5.81 | 2.84 | 34.63 | 98.47 | 38.52 | 121.04 | 6 | 118.5 | 119.1 | 7.3 | 11.4 |
| 41 | -8.31 | -12.17 | -3.86 | 17.99 | 7.36 | 5.82 | 9.68 | 5.82 | 2.07 | 33.58 | 68.45 | 38.42 | 120.83 | 5.9 | 118.4 | 119 | 7.8 | 11.3 |
| 42 | -8.01 | -11.87 | -3.86 | 17.67 | 7.12 | 5.8 | 9.66 | 5.8 | 2.42 | 38.39 | 93.08 | 38.49 | 120.71 | 5.7 | 118 | 119 | 7.9 | 11.2 |
| 43 | -7.33 | -11.19 | -3.86 | 17.02 | 6.32 | 5.83 | 9.69 | 5.83 | 1.85 | 28.99 | 53.67 | 38.38 | 121.24 | 6.1 | 118.5 | 119 | 8 | 11.2 |
| 44 | -9.04 | -12.9 | -3.86 | 18.67 | 8.11 | 5.77 | 9.63 | 5.77 | 1.96 | 33.87 | 66.29 | 38.34 | 120.71 | 5.8 | 118.4 | 119 | 7.8 | 11.2 |
| 45 | -1.29 | -5.15 | -3.86 | 11.07 | 0.23 | 5.93 | 9.79 | 5.93 | 5.62 | 28.54 | 104.54 | 38.43 | 120.41 | 6.1 | 115.9 | 119.1 | 7.4 | 11.2 |
| 46 | -7.47 | -11.33 | -3.86 | 17.14 | 6.46 | 5.81 | 9.67 | 5.81 | 3.32 | 49.01 | 158.36 | 38.16 | 122.09 | 5.4 | 117.9 | 118.7 | 8.7 | 11.9 |
| 47 | -5.33 | -9.19 | -3.86 | 15.02 | 4.81 | 5.82 | 9.68 | 5.82 | 2.89 | 28.25 | 70.58 | 38 | 119.8 | 4.3 | 117.7 | 118.4 | 5.1 | 10.7 |
| 48 | -5 | -8.86 | -3.86 | 15.01 | 4.46 | 6.15 | 10.01 | 6.15 | 1.84 | 26.14 | 47.96 | 38.37 | 119.21 | 3.9 | 117.8 | 118.4 | 5 | 10.6 |
| 49 | -1.54 | -5.4 | -3.86 | 11.45 | 0.58 | 6.05 | 9.91 | 6.05 | 4.35 | 38.53 | 167.46 | 38.43 | 121.86 | 4.3 | 6.8 | 118.5 | 6.2 | 9.4 |
| 50 | -4.46 | -8.32 | -3.86 | 14.24 | 3.38 | 5.92 | 9.78 | 5.92 | 2.32 | 28.91 | 67.15 | 38.3 | 121.09 | 6.1 | 118.6 | 119 | 7.7 | 11.3 |
| 51 | -2.07 | -5.93 | -3.86 | 11.69 | 1.11 | 5.77 | 9.63 | 5.77 | 3.14 | 31.15 | 97.8 | 38.63 | 120.93 | 6.1 | 117.8 | 119 | 7.2 | 11.2 |
| 52 | -2.63 | -6.49 | -3.86 | 12.32 | 1.66 | 5.83 | 9.69 | 5.83 | 2.61 | 26.62 | 64.01 | 38.39 | 121.02 | 6.1 | 118.5 | 119 | 7.4 | 11.4 |
| 53 | -6.77 | -10.63 | -3.86 | 16.39 | 5.84 | 5.76 | 9.62 | 5.76 | 2.38 | 35.73 | 85.16 | 38.33 | 120.75 | 5.8 | 118.5 | 119 | 7.8 | 11.2 |
| 54 | -3.83 | -7.69 | -3.86 | 13.53 | 2.73 | 5.83 | 9.69 | 5.83 | 4.5 | 25.1 | 112.93 | 38.38 | 121.22 | 6.1 | 118.5 | 119 | 7.3 | 11.3 |
| 55 | -4.31 | -8.17 | -3.86 | 14.04 | 3.27 | 5.87 | 9.73 | 5.87 | 2.19 | 27.55 | 59.95 | 38.45 | 121.23 | 6.1 | 118.6 | 119 | 7.4 | 11.2 |
| 56 | -0.79 | -4.65 | -3.86 | 10.67 | 0 | 6.02 | 9.88 | 6.02 | 4.29 | 35.77 | 153.46 | 38.44 | 122.11 | 4.4 | 6.9 | 118.5 | 7.9 | 11.1 |
| 57 | -7.55 | -11.41 | -3.86 | 17.21 | 6.56 | 5.8 | 9.67 | 5.8 | 3.94 | 59.23 | 232.74 | 38.14 | 121.78 | 5.3 | 117.8 | 118.7 | 8.6 | 11.6 |
| 58 | -8.77 | -12.63 | -3.86 | 18.53 | 8.09 | 5.89 | 9.75 | 5.89 | 2.89 | 44.58 | 128.71 | 38.2 | 120.46 | 5.5 | 117.7 | 118.5 | 8.8 | 11.2 |
| 59 | -9.88 | -13.75 | -3.86 | 19.53 | 9.46 | 5.79 | 9.65 | 5.79 | 3.81 | 73.68 | 280.14 | 37.79 | 119.28 | 3.7 | 117.8 | 118.4 | 5.3 | 10.4 |
| 60 | -11.87 | -15.73 | -3.86 | 21.56 | 11.35 | 5.83 | 9.69 | 5.83 | 4.41 | 89.63 | 394.9 | 38 | 119.64 | 4.1 | 117.7 | 118.4 | 8.3 | 10.7 |
| 61 | -9.2 | -13.06 | -3.86 | 18.82 | 8.45 | 5.77 | 9.63 | 5.77 | 2.66 | 40.65 | 105.78 | 38.31 | 120.44 | 5.4 | 117.8 | 118.8 | 8.7 | 11.1 |
| 62 | 4.27 | 0.61 | -3.66 | 9.97 | 0 | 9.97 | 13.63 | 10.58 | 5 | 35.36 | 151.25 | 35.89 | 0 | 22.1 | n/a | n/a | 22.5 | 24.4 |
| 63 | -6.96 | -10.82 | -3.86 | 16.62 | 6.06 | 5.8 | 9.66 | 5.8 | 3.23 | 39.78 | 102.49 | 38.51 | 120.75 | 5.7 | 117.9 | 118.9 | 7.9 | 11.1 |
| 64 | 4.02 | 0.16 | -3.86 | 6.08 | 0 | 6.08 | 9.94 | 6.24 | 5.08 | 20.2 | 98.6 | 41.35 | 0 | 28.6 | n/a | n/a | 28.7 | 29.7 |
| 65 | 4.08 | 0.21 | -3.86 | 6.09 | 0 | 6.09 | 9.96 | 6.31 | 6.75 | 19.13 | 129.1 | 41.22 | 0 | 29.5 | n/a | n/a | 29.8 | 33.7 |
| 66 | 3.9 | 0.04 | -3.86 | 6.35 | 0 | 6.35 | 10.21 | 6.39 | 5.43 | 17.06 | 75.06 | 41.13 | 0 | 29.8 | n/a | n/a | 30 | 31.9 |
| 67 | 3.33 | -0.53 | -3.86 | 7.07 | 0 | 7.07 | 10.93 | 6.54 | 6.58 | 18.85 | 108.26 | 42.34 | 0 | 33.6 | n/a | n/a | 34.1 | 35.1 |
| 68 | 2.56 | -1.3 | -3.86 | 6.91 | 0 | 6.91 | 10.77 | 5.61 | 3.32 | 22.48 | 73.28 | 38.84 | 0 | 26.5 | n/a | n/a | 26.6 | 27.1 |
| 69 | 5.85 | 2.01 | -3.84 | 4.31 | 0 | 4.31 | 8.15 | 6.32 | 3.32 | 7.47 | 23.93 | 38.42 | 0 | 30.4 | n/a | n/a | 30.5 | 32.5 |
| 70 | -6.53 | -10.39 | -3.86 | 16.32 | 5.74 | 5.93 | 9.79 | 5.93 | 2.65 | 38.47 | 101.97 | 38.28 | 120.78 | 5.8 | 117.7 | 118.7 | 7.8 | 11.2 |
| 71 | -5.83 | -9.68 | -3.85 | 15.6 | 5.51 | 5.91 | 9.77 | 5.91 | 4.07 | 56.32 | 217 | 37.72 | 118.32 | 3 | 117.5 | 118.2 | 5.2 | 9.7 |
| 72 | 5.55 | 1.83 | -3.71 | 6.86 | 0 | 6.86 | 10.58 | 8.7 | 8.15 | 24.51 | 164.48 | 39.78 | 0 | 31.2 | n/a | n/a | 31.5 | 32.6 |

## Scenario: Cascadia subduction zone, MLW

| Gauge | B0 | B | dzi | max h | min h | max zeta | max Δh | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -2.17 | -5.74 | -3.56 | 13.17 | 0.49 | 7.43 | 11 | 7.43 | 5.8 | 45.8 | 179.57 | 36.77 | 1.98 | 3.8 | n/a | n/a | 4.8 | 8.1 |
| 2 | -5.44 | -9.03 | -3.59 | 17.23 | 0 | 8.2 | 11.79 | 8.2 | 7.66 | 40.28 | 154.67 | 36.26 | 50.47 | 2.4 | 44.9 | 45 | 4.2 | 6.8 |
| 3 | -2.17 | -5.75 | -3.58 | 14.26 | 0.49 | 8.51 | 12.09 | 8.51 | 7.36 | 23.52 | 136.97 | 34.21 | 0 | 3.6 | n/a | n/a | 5.3 | 7.9 |
| 4 | 3.47 | -0.18 | -3.65 | 8.91 | 0 | 8.91 | 12.56 | 8.73 | 6.79 | 35.72 | 185.91 | 36.39 | 0 | 24.8 | n/a | n/a | 25.6 | 27.3 |
| 5 | 2.98 | -0.68 | -3.66 | 9.6 | 0 | 9.6 | 13.26 | 8.91 | 5.34 | 39.73 | 209.08 | 36.76 | 0 | 26.5 | n/a | n/a | 26.6 | 26.8 |
| 6 | -1.75 | -5.43 | -3.68 | 13.06 | 0.07 | 7.64 | 11.32 | 7.63 | 5.64 | 72.55 | 409.01 | 36.06 | 1.73 | 20.9 | n/a | n/a | 20.9 | 21 |
| 7 | -1.73 | -5.41 | -3.68 | 12.76 | 0.04 | 7.36 | 11.04 | 7.35 | 7.71 | 76.22 | 538.96 | 36.25 | 1.72 | 21.1 | n/a | n/a | 21.1 | 21.3 |
| 8 | -1.41 | -5.19 | -3.78 | 11.31 | 0 | 6.18 | 9.96 | 6.12 | 4.39 | 44.31 | 194.44 | 39.13 | 0 | 29.9 | n/a | n/a | 29.9 | 30 |
| 9 | 0.81 | -2.97 | -3.78 | 8.91 | 0 | 8.91 | 12.69 | 5.94 | 5.89 | 33.09 | 142.22 | 39.25 | 0 | 30.7 | n/a | n/a | 31 | 32.3 |
| 10 | -32.9 | -36.58 | -3.67 | 39.91 | 30.77 | 3.33 | 7.01 | 3.33 | 4.88 | 193.1 | 942.6 | 31.97 | 2.14 | 1 | 1 | 2.1 | 1.1 | 6.1 |
| 11 | -21.71 | -25.19 | -3.48 | 29.44 | 19.63 | 4.25 | 7.73 | 4.25 | 3.35 | 80.02 | 268.02 | 30.66 | 108.1 | 1 | 106.8 | 107.8 | 1.6 | 6 |
| 12 | -14.97 | -18.53 | -3.56 | 21.61 | 12.51 | 3.08 | 6.64 | 3.08 | 7.58 | 138.51 | 1049.67 | 31.58 | 3.42 | 1 | 1.1 | 2.1 | 1.6 | 2.4 |
| 13 | -22.07 | -25.52 | -3.45 | 29.88 | 20.21 | 4.35 | 7.8 | 4.35 | 5.17 | 124.15 | 640.44 | 31.1 | 108.47 | 1 | 4 | n/a | 1.9 | 2 |
| 14 | -15.12 | -18.99 | -3.87 | 22.73 | 13.01 | 3.74 | 7.61 | 3.74 | 2.65 | 56.63 | 141.75 | 33.2 | 2.1 | 1 | 2 | 2 | 1 | 5.4 |
| 15 | -1.13 | -5.02 | -3.89 | 9.45 | 0 | 4.46 | 8.35 | 4.44 | 2.86 | 9.11 | 10.86 | 34.1 | 0 | 2 | n/a | n/a | 3.4 | 6.1 |
| 16 | 28.68 | 25.17 | -3.51 | 0 | 0 | 0 | 0 | 25.17 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 17 | -2.33 | -6.21 | -3.88 | 10.78 | 0 | 4.57 | 8.45 | 4.57 | 6.97 | 40.57 | 272.28 | 56.53 | 2.99 | 1.4 | 1.7 | 1.8 | 1.6 | 3.1 |
| 18 | -1.41 | -5.29 | -3.87 | 9.87 | 0 | 4.6 | 8.47 | 4.58 | 3.99 | 22.82 | 65.77 | 36.57 | 0 | 5.1 | n/a | n/a | 5.6 | 6 |
| 19 | -1.24 | -5.11 | -3.87 | 9.06 | 0 | 3.96 | 7.84 | 3.95 | 1.76 | 7.59 | 6.67 | 40.75 | 0 | 8.9 | n/a | n/a | 12 | 13.7 |
| 20 | -4.22 | -8.09 | -3.87 | 11.91 | 2.27 | 3.82 | 7.69 | 3.82 | 2.21 | 16.92 | 34.46 | 41.3 | 122.82 | 6 | 120.8 | n/a | 7.1 | 11.2 |
| 21 | -6.51 | -10.38 | -3.87 | 14.89 | 3.4 | 4.51 | 8.38 | 4.51 | 1.95 | 16.68 | 31.95 | 36.19 | 116.36 | 3 | 3.3 | 5.4 | 3.1 | 4.5 |
| 22 | 5.87 | 2 | -3.87 | 1.7 | 0 | 1.7 | 5.57 | 3.7 | 5.36 | 4.65 | 24.93 | 41.35 | 0 | 32.5 | n/a | n/a | 33.3 | 37.5 |
| 23 | -8.9 | -12.77 | -3.87 | 16.23 | 7.09 | 3.47 | 7.34 | 3.47 | 3.12 | 46.5 | 144.18 | 37.73 | 121.16 | 5.4 | 120.9 | n/a | 6.6 | 11.2 |
| 24 | -11.88 | -15.75 | -3.87 | 20.11 | 9.28 | 4.37 | 8.24 | 4.37 | 1.5 | 25.97 | 36.91 | 36.35 | 116.28 | 2.7 | 3.8 | 4 | 2.7 | 4.1 |
| 25 | -1.8 | -5.66 | -3.85 | 10.05 | 0.06 | 4.4 | 8.25 | 4.4 | 2.66 | 20.99 | 53.45 | 36.49 | 117.51 | 3.2 | n/a | n/a | 3.3 | 4.2 |
| 26 | -1.68 | -5.53 | -3.86 | 9.06 | 0 | 3.52 | 7.38 | 3.52 | 2.36 | 14.03 | 29.69 | 37.85 | 0 | 5.6 | n/a | n/a | 9.1 | 14.5 |
| 27 | -6.12 | -9.98 | -3.86 | 13.21 | 3.01 | 3.23 | 7.09 | 3.23 | 6.97 | 65.5 | 449.03 | 35.59 | 109.2 | 1.3 | 1.6 | 2.3 | 1.4 | 2.6 |
| 28 | -3.09 | -6.93 | -3.84 | 10.54 | 0.37 | 3.61 | 7.45 | 3.61 | 3.74 | 21.88 | 53.83 | 36.29 | 4.13 | 1.6 | 3.3 | 3.3 | 1.7 | 5 |
| 29 | -3.75 | -7.59 | -3.84 | 10.63 | 1.04 | 3.04 | 6.88 | 3.04 | 5.05 | 30.99 | 118.16 | 37.11 | 113.31 | 2 | 69.6 | 69.9 | 3.1 | 7.8 |
| 30 | -5.7 | -9.53 | -3.82 | 13.24 | 3.49 | 3.72 | 7.54 | 3.72 | 6.89 | 45.82 | 268.03 | 37.17 | 112.3 | 1.6 | 2.6 | 3.9 | 1.9 | 6.7 |
| 31 | -11.45 | -15.28 | -3.83 | 18.93 | 8.98 | 3.65 | 7.48 | 3.65 | 8.31 | 96.23 | 731.56 | 37.1 | 117.63 | 1.5 | 1.7 | 112.2 | 1.5 | 8 |
| 32 | 4.98 | 1.15 | -3.83 | 3.13 | 0 | 3.13 | 6.96 | 4.28 | 3.09 | 6.96 | 19.78 | 39.14 | 0 | 31.7 | n/a | n/a | 32.1 | 33.3 |
| 33 | 4.9 | 1.06 | -3.84 | 3.28 | 0 | 3.28 | 7.12 | 4.34 | 2.66 | 5.19 | 12.25 | 38.2 | 0 | 31.7 | n/a | n/a | 32.6 | 33.8 |
| 34 | -12.85 | -16.72 | -3.87 | 20.56 | 11.04 | 3.84 | 7.7 | 3.84 | 3 | 60.29 | 180.65 | 38.41 | 121.45 | 5.3 | 120.5 | n/a | 8.8 | 11.8 |
| 35 | -2.03 | -5.9 | -3.87 | 9.74 | 0.06 | 3.84 | 7.71 | 3.84 | 1.41 | 10.69 | 14.5 | 37.6 | 125.32 | 7.6 | 120.1 | n/a | 8.6 | 12.2 |

| Gauge | B0 | B | dzi | max h | min h | max zeta | max Δh | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 2.25 | -1.62 | -3.87 | 5.36 | 0 | 5.36 | 9.23 | 3.74 | 4.77 | 9.43 | 23.1 | 38.01 | 0 | 24.2 | n/a | n/a | 24.5 | 26.4 |
| 37 | 4.44 | 0.57 | -3.87 | 2.85 | 0 | 2.85 | 6.72 | 3.42 | 2.83 | 8.05 | 22.77 | 38.06 | 0 | 30.4 | n/a | n/a | 30.7 | 33.6 |
| 38 | 4.03 | 0.17 | -3.86 | 3.82 | 0 | 3.82 | 7.68 | 3.99 | 3.88 | 7.58 | 16.08 | 39.88 | 0 | 28.3 | n/a | n/a | 28.5 | 30.4 |
| 39 | -2.17 | -6.03 | -3.86 | 9.9 | 0.1 | 3.86 | 7.72 | 3.86 | 5.01 | 21.77 | 108.8 | 38.67 | 122.86 | 6.5 | 121.2 | 122 | 8.9 | 12 |
| 40 | -4.2 | -8.06 | -3.86 | 11.97 | 2.11 | 3.91 | 7.77 | 3.91 | 1.99 | 21.32 | 42.11 | 38.58 | 122.9 | 6.6 | 121.3 | 122.1 | 9 | 12 |
| 41 | -8.31 | -12.17 | -3.86 | 15.96 | 6.2 | 3.79 | 7.65 | 3.79 | 1.39 | 17.57 | 24.16 | 38.56 | 122.79 | 6.5 | 121.4 | 122 | 8.7 | 12.1 |
| 42 | -8.01 | -11.87 | -3.86 | 15.53 | 5.98 | 3.66 | 7.52 | 3.66 | 2.78 | 31.12 | 81.49 | 38.95 | 122.82 | 6.3 | 121.3 | 122.3 | 8.6 | 12 |
| 43 | -7.33 | -11.19 | -3.86 | 15.06 | 5.19 | 3.87 | 7.73 | 3.87 | 2.53 | 36.74 | 93 | 38.21 | 122.85 | 6.6 | 121.4 | 122 | 8.6 | 12 |
| 44 | -9.04 | -12.9 | -3.86 | 16.68 | 6.96 | 3.78 | 7.64 | 3.78 | 2.1 | 33.31 | 70.04 | 38.47 | 122.79 | 6.4 | 121.4 | 122.1 | 8.6 | 12.1 |
| 45 | -1.29 | -5.15 | -3.86 | 9.04 | 0 | 3.9 | 7.76 | 3.89 | 4.85 | 19.15 | 79.36 | 38.13 | 0 | 11.1 | n/a | n/a | 11.6 | 12.9 |
| 46 | -7.47 | -11.33 | -3.86 | 15.12 | 5.26 | 3.79 | 7.65 | 3.79 | 3.55 | 41.55 | 147.7 | 38.65 | 124.21 | 6 | 121.1 | 123.3 | 9.2 | 12.6 |
| 47 | -5.33 | -9.19 | -3.86 | 12.91 | 3.58 | 3.71 | 7.57 | 3.71 | 3.34 | 26.62 | 88.94 | 38.51 | 121.41 | 4.7 | n/a | n/a | 6.5 | 11.9 |
| 48 | -5 | -8.86 | -3.86 | 12.93 | 3.25 | 4.07 | 7.93 | 4.07 | 1.73 | 19.45 | 33.61 | 38.11 | 120.91 | 4.3 | n/a | n/a | 5.3 | 11.5 |
| 49 | -1.51 | -5.37 | -3.86 | 9.35 | 0 | 3.95 | 7.81 | 3.98 | 4.79 | 24.98 | 118.86 | 39.28 | 0 | 5.8 | n/a | n/a | 9.2 | 10.1 |
| 50 | -4.46 | -8.32 | -3.86 | 12.25 | 2.29 | 3.93 | 7.79 | 3.93 | 1.38 | 14.38 | 19.82 | 38.29 | 122.77 | 6.7 | 121.4 | 121.9 | 8.2 | 12 |
| 51 | -2.07 | -5.93 | -3.86 | 9.82 | 0 | 3.9 | 7.76 | 3.9 | 1.89 | 18.46 | 34.83 | 38.77 | 122.99 | 6.6 | 121.3 | 122.4 | 7.9 | 12.1 |
| 52 | -2.63 | -6.49 | -3.86 | 10.33 | 0.53 | 3.84 | 7.7 | 3.84 | 2.33 | 22.59 | 51.74 | 38.45 | 123.09 | 6.6 | 121.3 | 122 | 8.3 | 11.9 |
| 53 | -6.77 | -10.63 | -3.86 | 14.39 | 4.67 | 3.77 | 7.63 | 3.77 | 2.24 | 30.42 | 68.17 | 38.45 | 122.78 | 6.4 | 121.4 | 122.1 | 8.6 | 12.1 |
| 54 | -3.83 | -7.69 | -3.86 | 11.56 | 1.7 | 3.87 | 7.73 | 3.87 | 3.47 | 25.43 | 86 | 38.2 | 122.87 | 6.6 | 121.4 | 122 | 8.6 | 12.1 |
| 55 | -4.31 | -8.17 | -3.86 | 12.08 | 2.16 | 3.91 | 7.77 | 3.91 | 2.12 | 24.91 | 52.8 | 38.18 | 122.86 | 6.6 | 121.4 | 121.9 | 8.4 | 12 |
| 56 | -0.75 | -4.61 | -3.86 | 8.5 | 0 | 3.85 | 7.71 | 3.9 | 4.72 | 19.28 | 69.13 | 39.3 | 0 | 10 | n/a | n/a | 12.2 | 16.5 |
| 57 | -7.55 | -11.41 | -3.86 | 15.21 | 5.35 | 3.8 | 7.66 | 3.8 | 4.35 | 49.51 | 215.3 | 38.68 | 123.82 | 5.7 | 121.2 | 123.3 | 9.1 | 12.5 |
| 58 | -8.77 | -12.63 | -3.86 | 16.54 | 6.9 | 3.9 | 7.77 | 3.9 | 3.99 | 50.32 | 201.03 | 38.77 | 122.27 | 5.9 | 121.4 | n/a | 9.3 | 12 |
| 59 | -9.88 | -13.75 | -3.86 | 17.71 | 8.16 | 3.96 | 7.82 | 3.96 | 2.92 | 51.77 | 151.32 | 38.22 | 120.8 | 4 | n/a | n/a | 5.9 | 13.1 |
| 60 | -11.87 | -15.73 | -3.86 | 19.2 | 10.13 | 3.46 | 7.33 | 3.46 | 3.21 | 45.64 | 146.08 | 39.99 | 121.26 | 5.2 | n/a | n/a | 8.9 | 12.7 |
| 61 | -9.2 | -13.06 | -3.86 | 16.81 | 7.27 | 3.75 | 7.61 | 3.75 | 2.36 | 38.8 | 91.36 | 38.86 | 122.29 | 5.9 | 121.3 | n/a | 9.2 | 12 |
| 62 | 4.27 | 0.61 | -3.66 | 8.33 | 0 | 8.33 | 11.99 | 8.94 | 5.41 | 29.24 | 126.98 | 36.64 | 0 | 27.4 | n/a | n/a | 28 | 29.8 |
| 63 | -6.96 | -10.82 | -3.86 | 14.65 | 4.94 | 3.83 | 7.69 | 3.83 | 2.75 | 32.18 | 72.84 | 38.69 | 122.86 | 6.3 | 121.3 | 122.3 | 8.7 | 12 |
| 64 | 4.02 | 0.16 | -3.86 | 3.03 | 0 | 3.03 | 6.89 | 3.18 | 3.83 | 10.05 | 37.66 | 45.17 | 0 | 33.7 | n/a | n/a | 34.1 | 35.3 |
| 65 | 4.08 | 0.21 | -3.86 | 3 | 0 | 3 | 6.86 | 3.21 | 5.31 | 8.8 | 46.73 | 44.99 | 0 | 35 | n/a | n/a | 35.3 | 37.4 |
| 66 | 3.9 | 0.04 | -3.86 | 3.27 | 0 | 3.27 | 7.13 | 3.31 | 3.66 | 7.65 | 23.33 | 44.98 | 0 | 35.3 | n/a | n/a | 35.5 | 36.5 |
| 67 | 3.33 | -0.53 | -3.86 | 4.08 | 0 | 4.08 | 7.94 | 3.55 | 5.38 | 7.95 | 32.1 | 44.38 | 0 | 38.5 | n/a | n/a | 38.9 | 39.4 |
| 68 | 2.56 | -1.3 | -3.86 | 4.85 | 0 | 4.85 | 8.71 | 3.55 | 3.12 | 13.59 | 42.42 | 40.44 | 0 | 30.1 | n/a | n/a | 30.4 | 31.9 |
| 69 | 5.85 | 2.01 | -3.84 | 2.59 | 0 | 2.59 | 6.43 | 4.6 | 2.28 | 3.65 | 6.68 | 38.82 | 0 | 34.4 | n/a | n/a | 34.7 | 35.8 |
| 70 | -6.53 | -10.39 | -3.86 | 14.35 | 4.57 | 3.96 | 7.82 | 3.96 | 3.15 | 35.07 | 110.59 | 38.96 | 123.42 | 6.3 | 121.5 | n/a | 9.2 | 11.9 |
| 71 | -5.83 | -9.68 | -3.85 | 13.56 | 4.14 | 3.88 | 7.73 | 3.88 | 3.49 | 43.53 | 141.44 | 38.09 | 1.89 | 3.3 | n/a | n/a | 5.4 | 13.8 |
| 72 | 5.55 | 1.83 | -3.71 | 4.27 | 0 | 4.27 | 7.98 | 6.1 | 6.99 | 10.53 | 73.13 | 41.39 | 0 | 34.2 | n/a | n/a | 34.3 | 34.6 |

## Scenario: Alaska-Aleutian subduction zone, MHW

| Gauge | B0 | B | dzi | max h | min h | max zeta | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -2.17 | -2.17 | 0 | 6.63 | 0.65 | 4.46 | 4.46 | 2.72 | 9.42 | 21.82 | 223.97 | 491.51 | 214.9 | 246 | 246.6 | 216.4 | 217.8 |
| 2 | -5.44 | -5.44 | 0 | 10.21 | 1.07 | 4.77 | 4.77 | 1.6 | 12.58 | 18.69 | 222.39 | 263.78 | 215 | 233.3 | 245.4 | 216.5 | 218 |
| 3 | -2.17 | -2.17 | 0 | 7.46 | 0.58 | 5.29 | 5.29 | 3.61 | 10.05 | 16.93 | 222.52 | 491.65 | 215.6 | 232.9 | 233.3 | 217.1 | 218.6 |
| 4 | 3.47 | 3.47 | 0 | 0 | 0 | 0 | 3.47 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 5 | 2.98 | 2.98 | 0 | 0 | 0 | 0 | 2.98 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 6 | -1.74 | -1.74 | 0 | 4.57 | 1.66 | 2.83 | 2.83 | 3 | 12.43 | 37.31 | 228.1 | 777.52 | 223.7 | n/a | n/a | 223.8 | 224.6 |
| 7 | -1.72 | -1.72 | 0 | 3.32 | 1.64 | 1.61 | 1.61 | 5.9 | 16.94 | 99.39 | 248.05 | 777.77 | 223.9 | n/a | n/a | 224 | 226.4 |
| 8 | -1.35 | -1.35 | 0 | 2.9 | 1.26 | 1.55 | 1.55 | 0.69 | 1.73 | 1.04 | 242.67 | 785.81 | 230.3 | n/a | n/a | 230.7 | 232.3 |
| 9 | 0.81 | 0.81 | 0 | 0.51 | 0 | 0.51 | 1.32 | 1.78 | 0.91 | 1.62 | 242.71 | 0 | 232.8 | n/a | n/a | 235.5 | n/a |
| 10 | -32.9 | -32.9 | 0 | 34.77 | 31.27 | 1.87 | 1.87 | 2.34 | 77.39 | 181.1 | 241.87 | 277.8 | 209.3 | 250.9 | 251.8 | 211.1 | 213 |
| 11 | -21.71 | -21.71 | 0 | 23.96 | 20.1 | 2.25 | 2.25 | 1.69 | 35.58 | 60.13 | 231.38 | 275.36 | 207.9 | 250.1 | 250.5 | 209.8 | 211.6 |
| 12 | -14.97 | -14.97 | 0 | 16.77 | 13.37 | 1.8 | 1.8 | 2.39 | 35.13 | 81.43 | 241.37 | 277.71 | 208.8 | 250.7 | 251.2 | 210.6 | 212.4 |
| 13 | -22.07 | -22.07 | 0 | 24.69 | 20.45 | 2.61 | 2.61 | 1.79 | 40.06 | 71.75 | 230.7 | 274.68 | 208.1 | 250.2 | 250.5 | 210 | 211.8 |
| 14 | -15.12 | -15.12 | 0 | 17.26 | 13.42 | 2.14 | 2.14 | 0.86 | 13.62 | 11.76 | 243.1 | 277.23 | 210.8 | 253.6 | 255.1 | 212.6 | 214.6 |
| 15 | -1.1 | -1.1 | 0 | 3.28 | 0 | 2.18 | 2.18 | 0.56 | 1.18 | 0.58 | 242.66 | 308.6 | 211.4 | 254.2 | 254.6 | 213.3 | 215.1 |
| 16 | 28.68 | 28.68 | 0 | 0 | 0 | 0 | 28.68 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 17 | -2.33 | -2.33 | 0 | 4.73 | 0.61 | 2.4 | 2.4 | 1.49 | 6.1 | 8.31 | 230.15 | 290.61 | 213.3 | 260.9 | 261.7 | 215.1 | 217.2 |
| 18 | -1.4 | -1.4 | 0 | 5.03 | 0 | 3.63 | 3.63 | 1.2 | 1.41 | 0.69 | 241.63 | 267.84 | 214.8 | 224.2 | 224.6 | 216.6 | 218.3 |
| 19 | -1.23 | -1.23 | 0 | 3.86 | 0 | 2.63 | 2.63 | 0.22 | 0.39 | 0.06 | 233.98 | 269.55 | 221.1 | 264.4 | 265.1 | 222.8 | 224.4 |
| 20 | -4.22 | -4.22 | 0 | 6.62 | 2.52 | 2.4 | 2.4 | 0.71 | 3.41 | 2.26 | 234.3 | 295 | 220.6 | 263.1 | 264.4 | 222.2 | 224.4 |
| 21 | -6.51 | -6.51 | 0 | 9.26 | 4.19 | 2.75 | 2.75 | 0.46 | 3.96 | 1.77 | 242.17 | 303.72 | 214.4 | 256.4 | 262.7 | 216.3 | 218 |
| 22 | 5.87 | 5.87 | 0 | 0 | 0 | 0 | 5.87 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 23 | -8.9 | -8.9 | 0 | 10.95 | 7.24 | 2.05 | 2.05 | 0.7 | 6.79 | 4.74 | 235.73 | 297.45 | 219.5 | 262.9 | 263.8 | 221.2 | 225 |
| 24 | -11.88 | -11.88 | 0 | 14.34 | 9.85 | 2.47 | 2.47 | 0.46 | 5.63 | 2.28 | 240.81 | 304.32 | 214.4 | 260.4 | 261.9 | 216.3 | 218.1 |
| 25 | -1.8 | -1.8 | 0 | 4.2 | 0.03 | 2.4 | 2.4 | 1.42 | 2.14 | 1.7 | 240.89 | 306.67 | 214.7 | 254.1 | 254.7 | 216.5 | 218.2 |
| 26 | -1.68 | -1.68 | 0 | 3.99 | 0.08 | 2.31 | 2.31 | 1.05 | 3.25 | 2.76 | 237.78 | 299.97 | 218.7 | 262.8 | 263.3 | 220.4 | 227 |
| 27 | -6.12 | -6.12 | 0 | 8.09 | 4.34 | 1.97 | 1.97 | 2.74 | 16.27 | 44.58 | 244.69 | 305.07 | 214.3 | 258.4 | 261.4 | 216.1 | 218.2 |
| 28 | -3.09 | -3.09 | 0 | 5.08 | 1.44 | 1.99 | 1.99 | 1.44 | 5.36 | 6.94 | 243.7 | 304.93 | 215.2 | 259.7 | 260.5 | 216.9 | 219.5 |
| 29 | -3.75 | -3.75 | 0 | 5.61 | 2.19 | 1.86 | 1.86 | 2.9 | 15.06 | 43.61 | 245.09 | 291.09 | 216.6 | 258 | 259.5 | 218.4 | 227.7 |
| 30 | -5.7 | -5.7 | 0 | 7.56 | 4.13 | 1.86 | 1.86 | 2.81 | 17.87 | 46.52 | 230.42 | 306.41 | 216.2 | 259.7 | 260.8 | 218 | 220.6 |
| 31 | -11.45 | -11.45 | 0 | 13.29 | 9.8 | 1.84 | 1.84 | 3.77 | 40.9 | 154.07 | 230.56 | 289.52 | 216.1 | 259.4 | 260.6 | 217.9 | 220.6 |
| 32 | 4.98 | 4.98 | 0 | 0 | 0 | 0 | 4.98 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 33 | 4.9 | 4.9 | 0 | 0 | 0 | 0 | 4.9 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 34 | -12.85 | -12.85 | 0 | 14.95 | 11.21 | 2.1 | 2.1 | 0.59 | 8.1 | 4.81 | 235.09 | 296.91 | 219.8 | 263 | 263.9 | 221.4 | 224.6 |
| 35 | -2.03 | -2.03 | 0 | 4.56 | 0.18 | 2.53 | 2.53 | 0.77 | 1.67 | 0.96 | 234.15 | 294.85 | 221 | 263.4 | 264.6 | 222.6 | 224.3 |

| Gauge | B0 | B | dzi | max h | min h | max zeta | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 2.25 | 2.25 | 0 | 0.18 | 0 | 0.18 | 2.43 | 0.66 | 0.07 | 0.04 | 234.36 | 0 | 233.9 | n/a | n/a | n/a | n/a |
| 37 | 4.44 | 4.44 | 0 | 0 | 0 | 0 | 4.44 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 38 | 4.03 | 4.03 | 0 | 0 | 0 | 0 | 4.03 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 39 | -2.17 | -2.17 | 0 | 4.46 | 0.48 | 2.29 | 2.29 | 0.23 | 0.79 | 0.17 | 234.18 | 295.43 | 220.5 | 263.5 | 264.6 | 222.1 | 224.2 |
| 40 | -4.2 | -4.2 | 0 | 6.49 | 2.5 | 2.29 | 2.29 | 0.16 | 0.82 | 0.11 | 234.2 | 295.41 | 220.5 | 263.5 | 264.6 | 222.1 | 224.2 |
| 41 | -8.31 | -8.31 | 0 | 10.6 | 6.61 | 2.29 | 2.29 | 0.26 | 2.51 | 0.64 | 234.42 | 295.45 | 220.5 | 263.6 | 264.6 | 222.2 | 224.2 |
| 42 | -8.01 | -8.01 | 0 | 10.28 | 6.32 | 2.27 | 2.27 | 0.58 | 5.45 | 3.15 | 234.41 | 295.66 | 220.4 | 263.5 | 264.5 | 222.1 | 224.2 |
| 43 | -7.33 | -7.33 | 0 | 9.63 | 5.62 | 2.3 | 2.3 | 0.24 | 2.16 | 0.52 | 234.35 | 295.39 | 220.5 | 263.8 | 264.7 | 222.2 | 224.2 |
| 44 | -9.04 | -9.04 | 0 | 11.32 | 7.34 | 2.28 | 2.28 | 0.39 | 4.01 | 1.56 | 234.51 | 295.53 | 220.5 | 263.5 | 264.6 | 222.1 | 224.3 |
| 45 | -1.29 | -1.29 | 0 | 3.46 | 0 | 2.17 | 2.17 | 2.75 | 7.01 | 16.85 | 234.73 | 291.72 | 220.7 | 263.8 | 264.7 | 222.2 | 224.2 |
| 46 | -7.47 | -7.47 | 0 | 9.68 | 5.8 | 2.21 | 2.21 | 1.9 | 15.42 | 29.24 | 234.75 | 295.93 | 220.3 | 263.3 | 264.3 | 222.1 | 224.8 |
| 47 | -5.33 | -5.33 | 0 | 7.4 | 3.68 | 2.07 | 2.07 | 0.79 | 4.54 | 3.33 | 236.19 | 296.49 | 219.6 | 263 | 263.9 | 221.2 | 224.7 |
| 48 | -5 | -5 | 0 | 7.09 | 3.37 | 2.09 | 2.09 | 0.52 | 2.28 | 1.05 | 236.99 | 296.58 | 219.2 | 263 | 263.9 | 220.8 | 225 |
| 49 | -1.54 | -1.54 | 0 | 3.67 | 0 | 2.12 | 2.12 | 1.78 | 5.64 | 10.05 | 236.38 | 298.9 | 219.3 | 263.1 | 264 | 220.9 | 224.6 |
| 50 | -4.46 | -4.46 | 0 | 6.76 | 2.74 | 2.3 | 2.3 | 0.16 | 0.73 | 0.1 | 234.28 | 295.24 | 220.6 | 263.9 | 264.7 | 222.2 | 224.2 |
| 51 | -2.07 | -2.07 | 0 | 4.35 | 0.38 | 2.28 | 2.28 | 0.35 | 1.21 | 0.42 | 234.25 | 295.03 | 220.5 | 263.5 | 264.6 | 222.1 | 224.2 |
| 52 | -2.63 | -2.63 | 0 | 4.93 | 0.93 | 2.3 | 2.3 | 0.27 | 0.89 | 0.19 | 234.33 | 295.59 | 220.5 | 263.6 | 264.7 | 222.2 | 224.2 |
| 53 | -6.77 | -6.77 | 0 | 9.05 | 5.07 | 2.29 | 2.29 | 0.34 | 2.69 | 0.9 | 234.49 | 295.53 | 220.5 | 263.5 | 264.6 | 222.1 | 224.2 |
| 54 | -3.83 | -3.83 | 0 | 6.13 | 2.13 | 2.3 | 2.3 | 1.5 | 7.5 | 11.25 | 234.41 | 295.57 | 220.5 | 263.8 | 264.7 | 222.2 | 224.3 |
| 55 | -4.31 | -4.31 | 0 | 6.61 | 2.6 | 2.3 | 2.3 | 0.24 | 1.56 | 0.37 | 234.31 | 295.4 | 220.5 | 263.9 | 264.7 | 222.2 | 224.2 |
| 56 | -0.79 | -0.79 | 0 | 2.88 | 0 | 2.09 | 2.09 | 3.79 | 8.38 | 31.59 | 236.42 | 310.66 | 219.7 | 263.1 | 264.1 | 221.2 | 224.4 |
| 57 | -7.55 | -7.55 | 0 | 9.69 | 5.88 | 2.15 | 2.15 | 2.04 | 16.57 | 33.76 | 235.04 | 296.14 | 220.2 | 263.2 | 264.2 | 222.1 | 224.6 |
| 58 | -8.77 | -8.77 | 0 | 11.02 | 7.13 | 2.25 | 2.25 | 0.66 | 4.81 | 3.13 | 234.69 | 296.47 | 220.2 | 263.1 | 264.2 | 221.9 | 224.3 |
| 59 | -9.88 | -9.88 | 0 | 11.97 | 8.27 | 2.09 | 2.09 | 0.67 | 6.48 | 4.22 | 236.77 | 296.61 | 219.1 | 262.9 | 263.8 | 220.7 | 225.3 |
| 60 | -11.87 | -11.87 | 0 | 13.94 | 10.19 | 2.07 | 2.07 | 0.76 | 8.95 | 6.52 | 236.24 | 296.53 | 219.6 | 263 | 263.9 | 221.2 | 224.7 |
| 61 | -9.2 | -9.2 | 0 | 11.43 | 7.54 | 2.23 | 2.23 | 1.54 | 13.5 | 20.8 | 234.72 | 295.89 | 220.3 | 263.3 | 264.3 | 221.9 | 224.5 |
| 62 | 4.27 | 4.27 | 0 | 0 | 0 | 0 | 4.27 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 63 | -6.96 | -6.96 | 0 | 9.23 | 5.29 | 2.27 | 2.27 | 0.84 | 7.03 | 5.9 | 234.42 | 295.44 | 220.4 | 263.5 | 264.5 | 222.1 | 224.2 |
| 64 | 4.02 | 4.02 | 0 | 0 | 0 | 0 | 4.02 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 65 | 4.08 | 4.08 | 0 | 0 | 0 | 0 | 4.08 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 66 | 3.9 | 3.9 | 0 | 0 | 0 | 0 | 3.9 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 67 | 3.33 | 3.33 | 0 | 0 | 0 | 0 | 3.33 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 68 | 2.56 | 2.56 | 0 | 0 | 0 | 0 | 2.56 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 69 | 5.85 | 5.85 | 0 | 0 | 0 | 0 | 5.85 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 70 | -6.53 | -6.53 | 0 | 8.82 | 4.88 | 2.29 | 2.29 | 0.4 | 2.72 | 1.09 | 234.38 | 296.38 | 220.4 | 263.3 | 264.3 | 222.1 | 224.2 |
| 71 | -5.83 | -5.83 | 0 | 7.9 | 4.24 | 2.07 | 2.07 | 1.22 | 7.26 | 8.06 | 237.2 | 298 | 218.5 | 262.7 | 263.5 | 220.2 | 226.3 |
| 72 | 5.55 | 5.55 | 0 | 0 | 0 | 0 | 5.55 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |

## Scenario: Alaska-Aleutian subduction zone, MLW

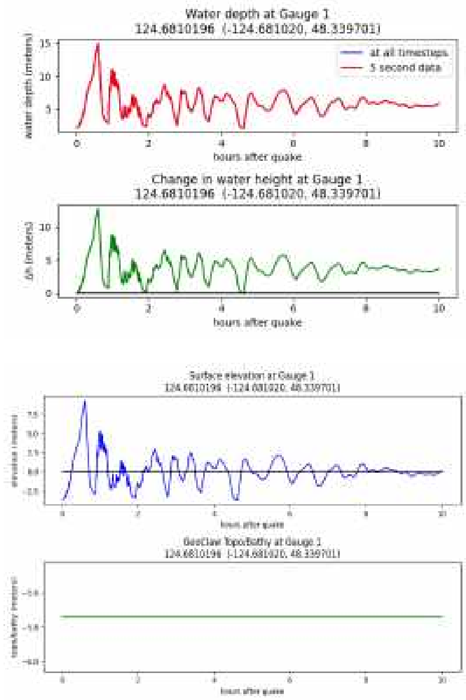
| Gauge | B0 | B | dzi | max h | min h | max zeta | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | -2.17 | -2.17 | 0 | 5.11 | 0.09 | 2.94 | 2.94 | 2.61 | 8.67 | 17.51 | 224.6 | 738.02 | 215.7 | 296 | 588.6 | 217.2 | 218.6 |
| 2 | -5.44 | -5.44 | 0 | 8.57 | 0.01 | 3.13 | 3.13 | 1.64 | 11.57 | 18.87 | 222.97 | 315.21 | 215.5 | 233.4 | 234.2 | 217 | 218.5 |
| 3 | -2.17 | -2.17 | 0 | 6.14 | 0.18 | 3.97 | 3.97 | 2.57 | 9.93 | 23.24 | 222.93 | 759.36 | 216.5 | 300 | n/a | 217.9 | 219.4 |
| 4 | 3.47 | 3.47 | 0 | 0 | 0 | 0 | 3.47 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 5 | 2.98 | 2.98 | 0 | 0 | 0 | 0 | 2.98 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 6 | -1.75 | -1.75 | 0 | 2.68 | 0.07 | 0.94 | 0.93 | 3.87 | 5.72 | 18.31 | 234.8 | 228.14 | 228.2 | n/a | n/a | 228.2 | 228.4 |
| 7 | -1.73 | -1.73 | 0 | 2.49 | 0.04 | 0.77 | 0.76 | 4.34 | 7.37 | 30.29 | 235.16 | 228.38 | 228.4 | n/a | n/a | 228.4 | 228.7 |
| 8 | -1.41 | -1.41 | 0 | 1.67 | 0 | 0.32 | 0.27 | 0.79 | 0.23 | 0.18 | 257.54 | 0 | 246.1 | n/a | n/a | 246.8 | 249.7 |
| 9 | 0.81 | 0.81 | 0 | 0 | 0 | 0 | 0.81 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 10 | -32.9 | -32.9 | 0 | 33.04 | 29.56 | 0.14 | 0.14 | 2.68 | 84.82 | 227.33 | 242.74 | 278.57 | 209.5 | 251.6 | 260.2 | 211.4 | 213.2 |
| 11 | -21.71 | -21.71 | 0 | 22.26 | 18.32 | 0.55 | 0.55 | 0.42 | 8.48 | 3.55 | 232.4 | 275.98 | 208.1 | 251 | 251.8 | 210 | 211.8 |
| 12 | -14.97 | -14.97 | 0 | 15.08 | 11.68 | 0.11 | 0.11 | 1.84 | 24.98 | 45.96 | 242.34 | 279.14 | 209 | 251.5 | 252.1 | 210.8 | 212.7 |
| 13 | -22.07 | -22.07 | 0 | 22.89 | 18.72 | 0.82 | 0.82 | 1.47 | 29.53 | 43.35 | 231.74 | 276.4 | 208.3 | 251.1 | 251.6 | 210.2 | 212 |
| 14 | -15.12 | -15.12 | 0 | 15.42 | 11.78 | 0.3 | 0.3 | 1.07 | 14.82 | 15.71 | 244.29 | 278.17 | 211 | 254.2 | 260.9 | 212.9 | 214.8 |
| 15 | -1.13 | -1.13 | 0 | 1.53 | 0 | 0.43 | 0.4 | 0.69 | 0.46 | 0.24 | 244.53 | 0 | 214.9 | n/a | n/a | 215.3 | 216.3 |
| 16 | 28.68 | 28.68 | 0 | 0 | 0 | 0 | 28.68 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 17 | -2.33 | -2.33 | 0 | 3.3 | 0 | 0.97 | 0.97 | 2.62 | 6.93 | 17.98 | 244.27 | 264.97 | 213.5 | 257 | 262 | 215.3 | 217.4 |
| 18 | -1.41 | -1.41 | 0 | 3.29 | 0 | 1.89 | 1.88 | 1.13 | 1.16 | 0.96 | 242.37 | 0 | 217.9 | n/a | n/a | 218.4 | 219.3 |
| 19 | -1.24 | -1.24 | 0 | 2.38 | 0 | 1.15 | 1.14 | 0.28 | 0.32 | 0.05 | 234.98 | 0 | 224.6 | n/a | n/a | 225.1 | 226.2 |
| 20 | -4.22 | -4.22 | 0 | 4.93 | 0.81 | 0.71 | 0.71 | 0.81 | 3.61 | 2.91 | 235.61 | 294.7 | 221.4 | 264.2 | 265.9 | 222.9 | 225.5 |
| 21 | -6.51 | -6.51 | 0 | 7.69 | 2.28 | 1.18 | 1.18 | 0.55 | 3.73 | 2.07 | 242.88 | 304.9 | 214.7 | 257 | 258.7 | 216.6 | 218.3 |
| 22 | 5.87 | 5.87 | 0 | 0 | 0 | 0 | 5.87 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 23 | -8.9 | -8.9 | 0 | 9.23 | 5.6 | 0.33 | 0.33 | 0.65 | 5.98 | 3.89 | 238.46 | 298.39 | 220.2 | 265.1 | 266.2 | 221.8 | 226.8 |
| 24 | -11.88 | -11.88 | 0 | 12.88 | 7.91 | 1.01 | 1.01 | 0.36 | 4.32 | 1.55 | 242.31 | 304.62 | 214.7 | 257.2 | 263.7 | 216.6 | 218.3 |
| 25 | -1.8 | -1.8 | 0 | 2.87 | 0 | 1.07 | 1.07 | 1.68 | 2.3 | 3.5 | 241.33 | 486.52 | 215.2 | 265.5 | n/a | 217 | 218.7 |
| 26 | -1.68 | -1.68 | 0 | 2.29 | 0 | 0.61 | 0.62 | 1.26 | 2.07 | 2.6 | 239.45 | 0 | 220.3 | n/a | n/a | 221.7 | 228.6 |
| 27 | -6.12 | -6.12 | 0 | 6.52 | 2.46 | 0.4 | 0.4 | 2.79 | 16.65 | 46.43 | 241.64 | 305.38 | 214.5 | 258.4 | 262.5 | 216.3 | 218.5 |
| 28 | -3.09 | -3.09 | 0 | 3.39 | 0 | 0.3 | 0.3 | 1.92 | 3.42 | 5.07 | 245.17 | 294.69 | 215.4 | 260.3 | 260.9 | 217.2 | 219.8 |
| 29 | -3.75 | -3.75 | 0 | 3.96 | 0.3 | 0.21 | 0.21 | 1.28 | 4.3 | 5.43 | 246.46 | 306.77 | 216.9 | 258.4 | 259.2 | 218.7 | 221.2 |
| 30 | -5.7 | -5.7 | 0 | 5.82 | 2.24 | 0.12 | 0.12 | 2.55 | 14.31 | 36.45 | 245.47 | 306.25 | 216.5 | 260.3 | 261.8 | 218.3 | 220.8 |
| 31 | -11.45 | -11.45 | 0 | 11.62 | 8 | 0.17 | 0.17 | 3.41 | 30.76 | 104.99 | 245.94 | 306.25 | 216.4 | 259.6 | 261.1 | 218.2 | 220.7 |
| 32 | 4.98 | 4.98 | 0 | 0 | 0 | 0 | 4.98 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 33 | 4.9 | 4.9 | 0 | 0 | 0 | 0 | 4.9 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 34 | -12.85 | -12.85 | 0 | 13.23 | 9.6 | 0.38 | 0.38 | 0.58 | 7.29 | 4.07 | 236.24 | 298.61 | 220.5 | 264.9 | 266.1 | 222.1 | 226 |
| 35 | -2.03 | -2.03 | 0 | 2.87 | 0 | 0.84 | 0.84 | 0.74 | 1.59 | 1.07 | 235.82 | 780.33 | 222.1 | 264.1 | 269.2 | 223.6 | 225.2 |

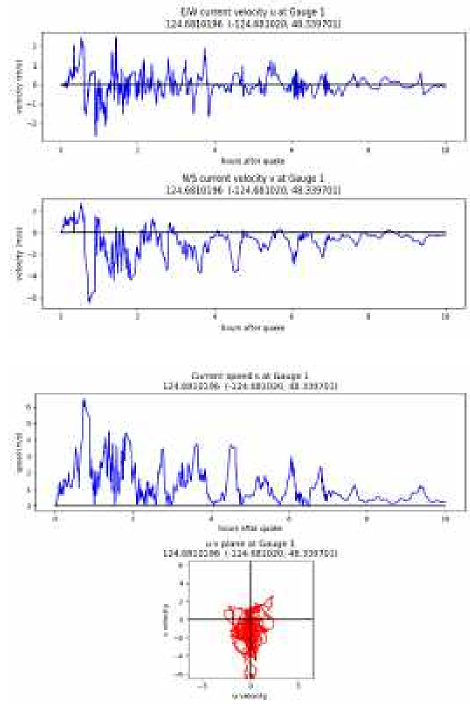
| Gauge | B0 | B | dzi | max h | min h | max zeta | max eta post-quake | max s | max hs | max hss | tmax | tmin | tfirstPOS | tfirstNEG | tfirstDRAW | tfirstADVIS | tfirstWARN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 2.25 | 2.25 | 0 | 0 | 0 | 0 | 2.25 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 37 | 4.44 | 4.44 | 0 | 0 | 0 | 0 | 4.44 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 38 | 4.03 | 4.03 | 0 | 0 | 0 | 0 | 4.03 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 39 | -2.17 | -2.17 | 0 | 2.76 | 0 | 0.59 | 0.59 | 0.18 | 0.42 | 0.08 | 236.66 | 278.2 | 221.3 | 264.8 | 265.6 | 222.9 | 225 |
| 40 | -4.2 | -4.2 | 0 | 4.79 | 0.8 | 0.59 | 0.59 | 0.12 | 0.48 | 0.06 | 236.77 | 294.21 | 221.4 | 264.7 | 265.6 | 222.9 | 225 |
| 41 | -8.31 | -8.31 | 0 | 8.91 | 4.92 | 0.6 | 0.6 | 0.18 | 1.51 | 0.27 | 237.2 | 294.2 | 221.4 | 264.7 | 265.6 | 222.9 | 225 |
| 42 | -8.01 | -8.01 | 0 | 8.58 | 4.65 | 0.57 | 0.57 | 0.51 | 3.89 | 2 | 236.72 | 293.99 | 221.3 | 264.6 | 265.7 | 222.9 | 225.1 |
| 43 | -7.33 | -7.33 | 0 | 7.94 | 3.92 | 0.61 | 0.61 | 0.11 | 0.84 | 0.09 | 237.13 | 294.27 | 221.4 | 264.7 | 265.5 | 223 | 225 |
| 44 | -9.04 | -9.04 | 0 | 9.63 | 5.66 | 0.59 | 0.59 | 0.24 | 2.18 | 0.52 | 237.12 | 294.13 | 221.3 | 264.7 | 265.6 | 222.9 | 225.1 |
| 45 | -1.29 | -1.29 | 0 | 1.87 | 0 | 0.58 | 0.58 | 0.82 | 1.53 | 1.25 | 237.2 | 0 | 223.7 | n/a | n/a | 224.4 | 230.1 |
| 46 | -7.47 | -7.47 | 0 | 7.95 | 4.16 | 0.48 | 0.48 | 1.8 | 12.86 | 23.15 | 236.78 | 299.9 | 221.1 | 264.5 | 265.8 | 222.9 | 225.7 |
| 47 | -5.33 | -5.33 | 0 | 5.73 | 2.06 | 0.39 | 0.39 | 0.94 | 4.75 | 4.45 | 238.02 | 298.74 | 220.3 | 265 | 266.1 | 221.9 | 226.3 |
| 48 | -5 | -5 | 0 | 5.48 | 1.7 | 0.48 | 0.48 | 0.43 | 2.26 | 0.97 | 238.33 | 298.44 | 219.9 | 265.1 | 266.2 | 221.5 | 227.2 |
| 49 | -1.51 | -1.51 | 0 | 2.07 | 0 | 0.53 | 0.55 | 0.8 | 1.16 | 0.89 | 238.31 | 0 | 221.4 | n/a | n/a | 222.1 | 228.2 |
| 50 | -4.46 | -4.46 | 0 | 5.08 | 1.04 | 0.62 | 0.62 | 0.21 | 0.73 | 0.12 | 237.18 | 300.47 | 221.4 | 264.8 | 265.5 | 223 | 225 |
| 51 | -2.07 | -2.07 | 0 | 2.66 | 0 | 0.59 | 0.59 | 0.27 | 0.49 | 0.13 | 236.53 | 404.62 | 221.3 | 264.7 | 265.9 | 222.9 | 225 |
| 52 | -2.63 | -2.63 | 0 | 3.23 | 0 | 0.6 | 0.6 | 0.23 | 0.62 | 0.14 | 237.01 | 302.98 | 221.4 | 264.7 | 265.5 | 223 | 225 |
| 53 | -6.77 | -6.77 | 0 | 7.36 | 3.38 | 0.59 | 0.59 | 0.22 | 1.55 | 0.35 | 237.15 | 294.15 | 221.3 | 264.7 | 265.6 | 222.9 | 225.1 |
| 54 | -3.83 | -3.83 | 0 | 4.45 | 0.43 | 0.61 | 0.61 | 0.34 | 1.25 | 0.42 | 237.05 | 294.26 | 221.4 | 264.7 | 265.5 | 223 | 225 |
| 55 | -4.31 | -4.31 | 0 | 4.93 | 0.9 | 0.62 | 0.62 | 0.17 | 0.54 | 0.07 | 237.19 | 294.29 | 221.4 | 264.7 | 265.5 | 223 | 225 |
| 56 | -0.75 | -0.75 | 0 | 1.29 | 0 | 0.5 | 0.54 | 2.73 | 2.09 | 5.66 | 238.35 | 0 | 228.2 | n/a | n/a | 228.8 | 231.4 |
| 57 | -7.55 | -7.55 | 0 | 7.97 | 4.26 | 0.43 | 0.43 | 1.84 | 14.53 | 26.68 | 236.23 | 299.75 | 221 | 264.5 | 265.7 | 223.1 | 225.6 |
| 58 | -8.77 | -8.77 | 0 | 9.29 | 5.5 | 0.52 | 0.52 | 0.57 | 4.08 | 2.12 | 236.48 | 293.56 | 221 | 264.5 | 266.1 | 222.6 | 225.2 |
| 59 | -9.88 | -9.88 | 0 | 10.34 | 6.58 | 0.46 | 0.46 | 0.59 | 5.23 | 3.07 | 238.26 | 298.19 | 219.7 | 265.2 | 266.2 | 221.3 | 227.3 |
| 60 | -11.87 | -11.87 | 0 | 12.26 | 8.6 | 0.39 | 0.39 | 0.72 | 7.89 | 5.7 | 238.07 | 298.57 | 220.2 | 265 | 266.1 | 221.9 | 226.3 |
| 61 | -9.2 | -9.2 | 0 | 9.72 | 5.89 | 0.52 | 0.52 | 1.28 | 9.97 | 11.72 | 236.81 | 300 | 221 | 264.6 | 265.8 | 222.7 | 225.4 |
| 62 | 4.27 | 4.27 | 0 | 0 | 0 | 0 | 4.27 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 63 | -6.96 | -6.96 | 0 | 7.52 | 3.6 | 0.57 | 0.57 | 0.52 | 3.5 | 1.84 | 236.61 | 293.94 | 221.3 | 264.6 | 265.8 | 222.8 | 225.1 |
| 64 | 4.02 | 4.02 | 0 | 0 | 0 | 0 | 4.02 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 65 | 4.08 | 4.08 | 0 | 0 | 0 | 0 | 4.08 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 66 | 3.9 | 3.9 | 0 | 0 | 0 | 0 | 3.9 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 67 | 3.33 | 3.33 | 0 | 0 | 0 | 0 | 3.33 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 68 | 2.56 | 2.56 | 0 | 0 | 0 | 0 | 2.56 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 69 | 5.85 | 5.85 | 0 | 0 | 0 | 0 | 5.85 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |
| 70 | -6.53 | -6.53 | 0 | 7.09 | 3.19 | 0.56 | 0.56 | 0.44 | 2.43 | 1.08 | 236.34 | 293.74 | 221.3 | 264.3 | 265.9 | 222.8 | 225 |
| 71 | -5.83 | -5.83 | 0 | 6.2 | 2.52 | 0.37 | 0.37 | 1.44 | 8.91 | 12.82 | 238.55 | 297.44 | 219.1 | 265.1 | 266 | 220.8 | 227.7 |
| 72 | 5.55 | 5.55 | 0 | 0 | 0 | 0 | 5.55 | 0 | 0 | 0 | 0 | 0 | n/a | n/a | n/a | n/a | n/a |

# Appendix D. All study gauge plots

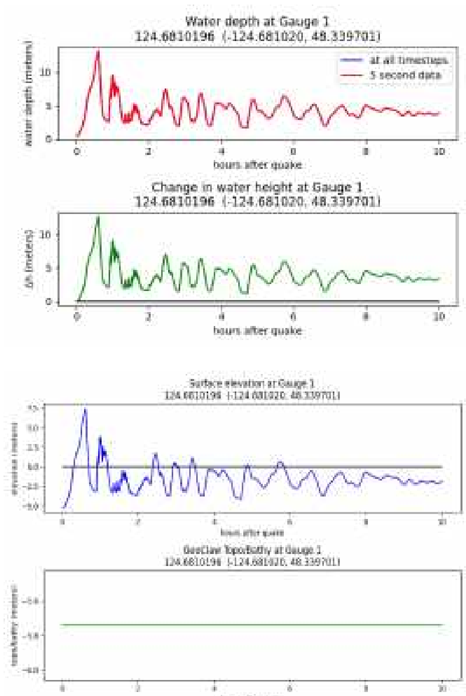
## Gauge 1: Wa'atch River mouth

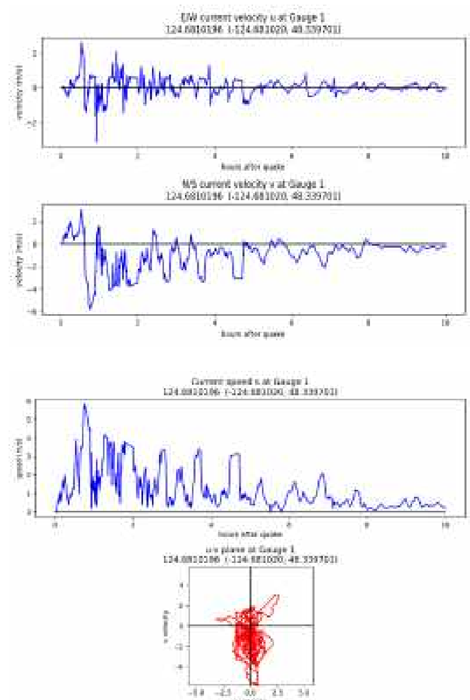
### Cascadia subduction zone scenario, MHW:



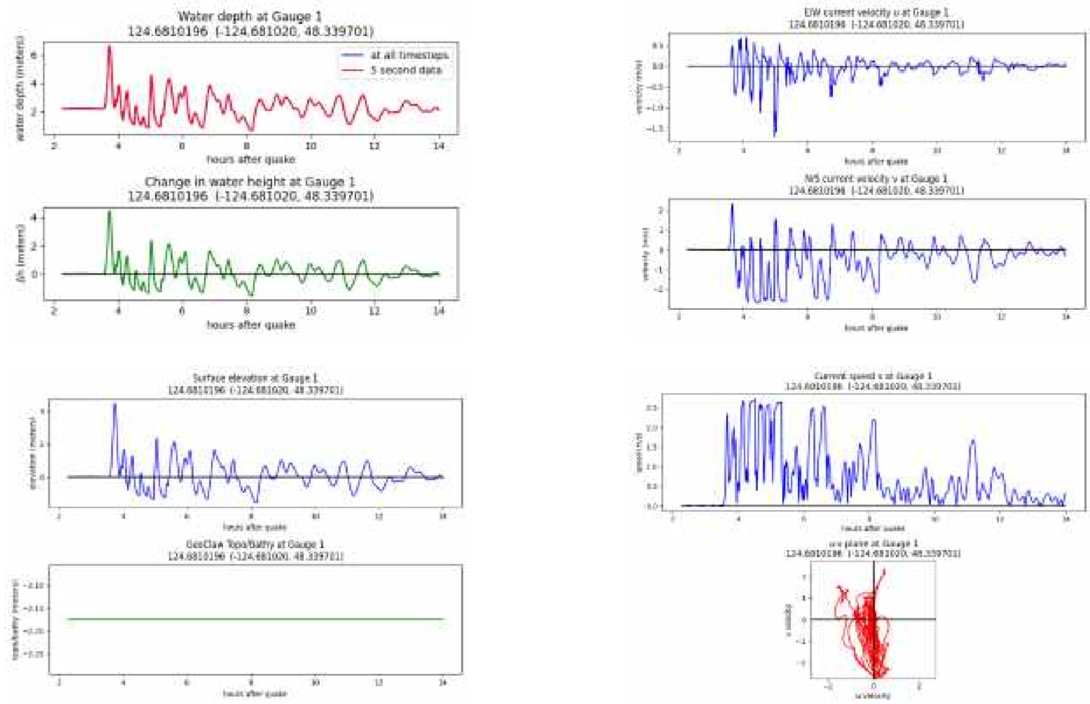



### Cascadia subduction zone scenario, MLW:

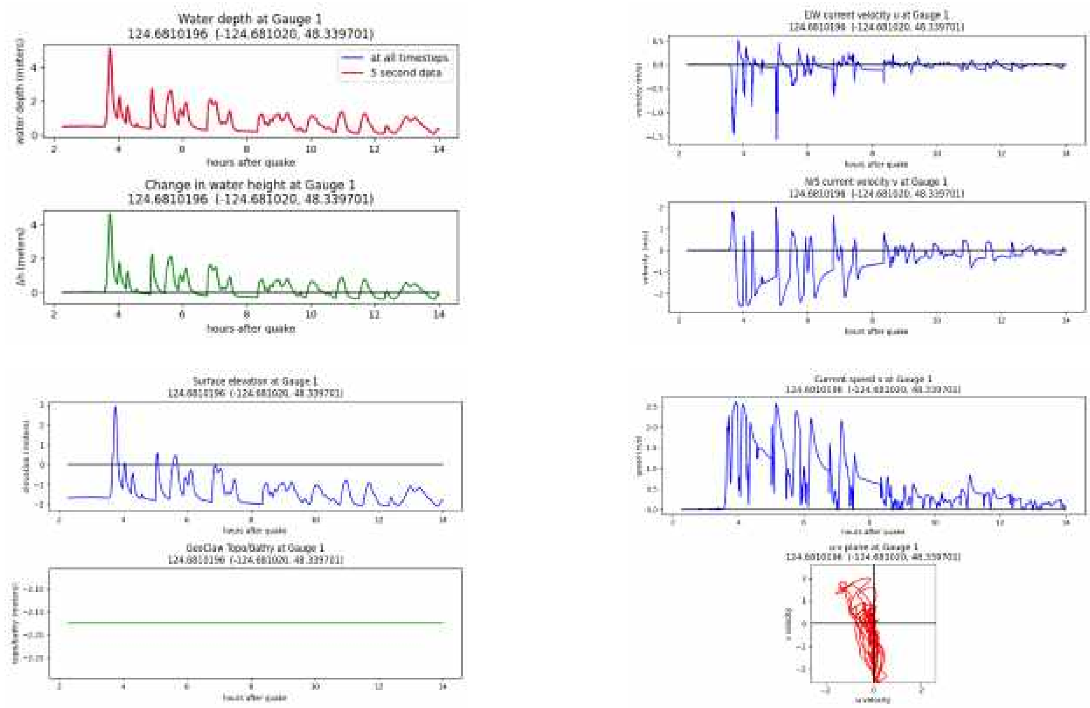


Alaska-Aleutian subduction zone scenario, MHW:

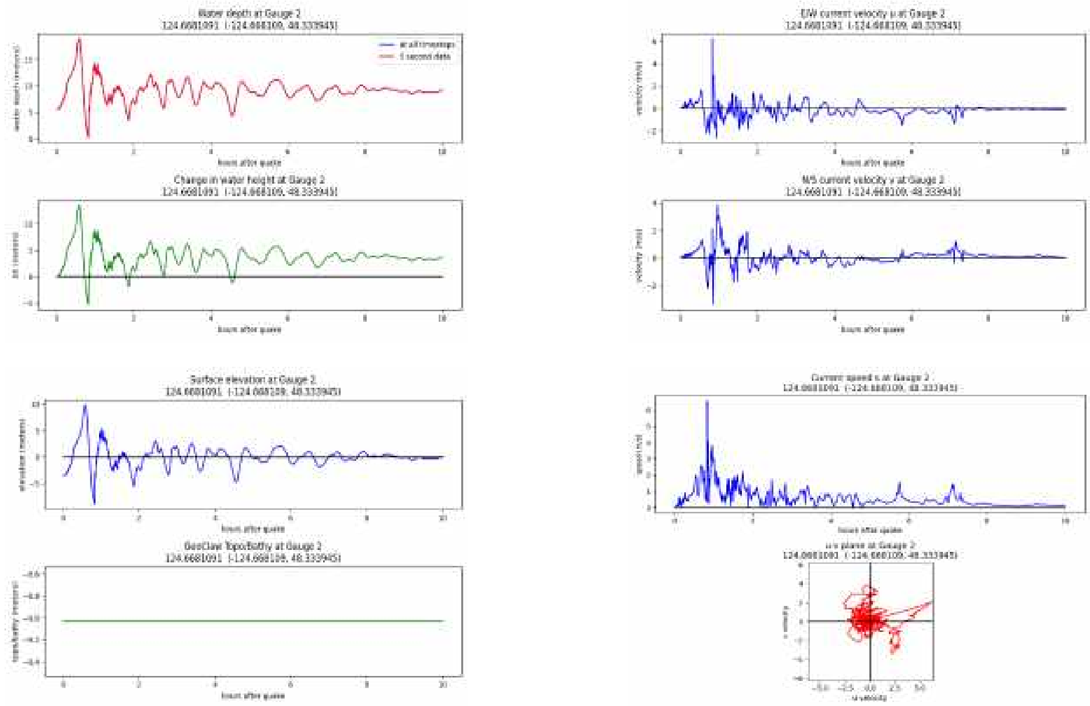



Alaska-Aleutian subduction zone scenario, MLW:

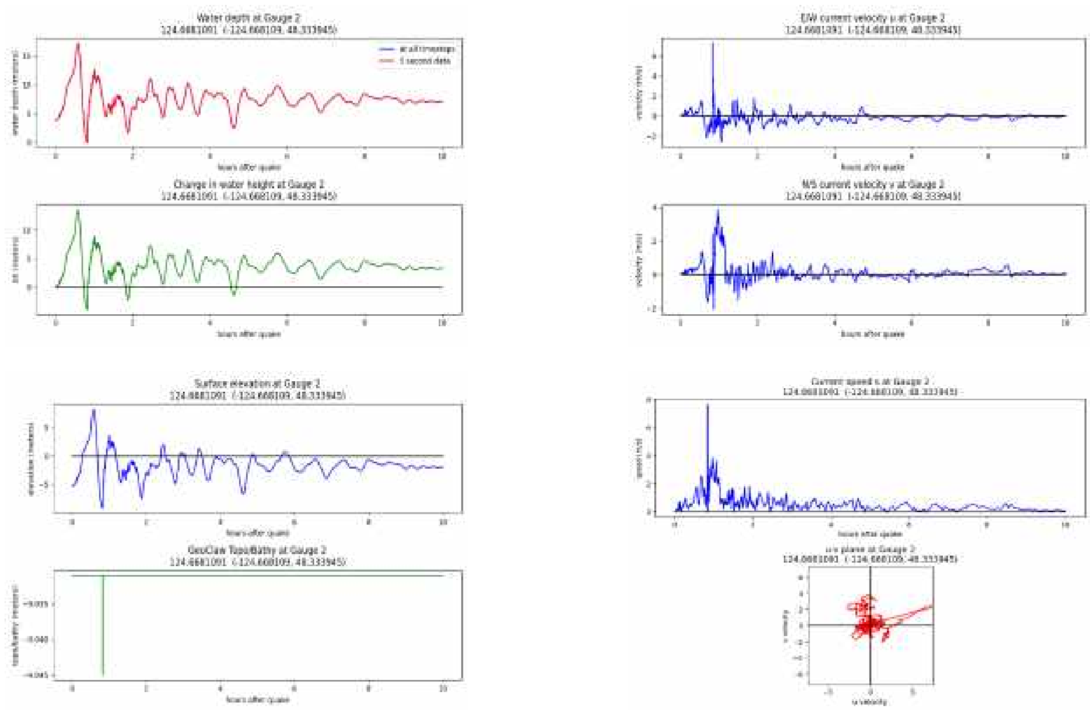


## Gauge 2: Makah Bay, center

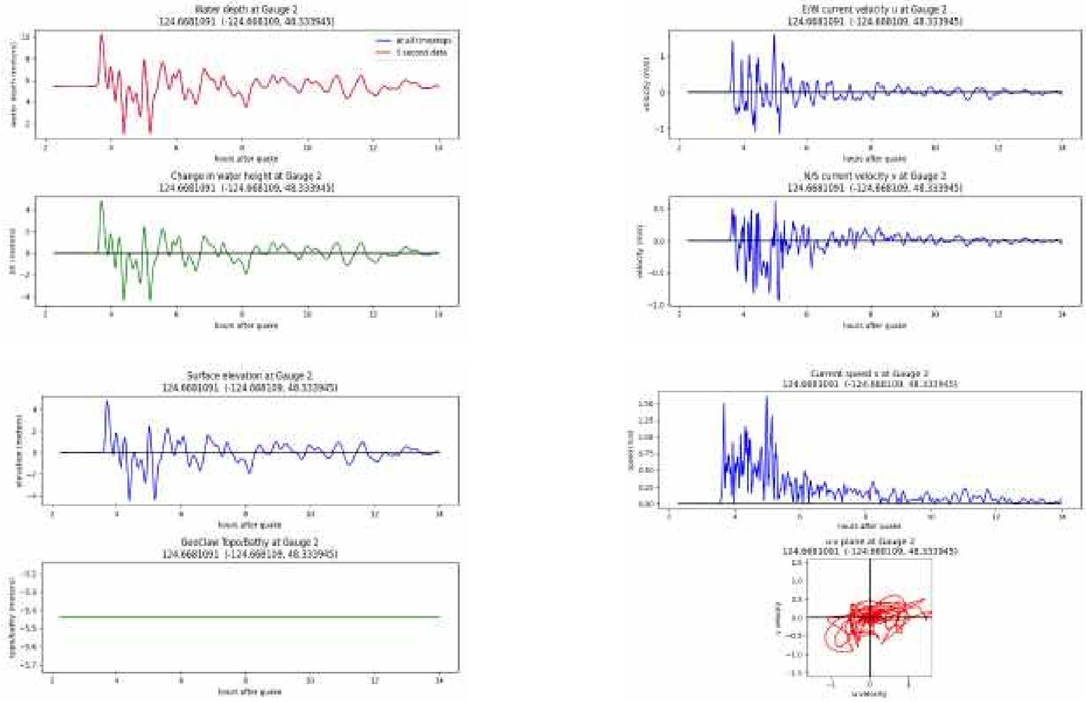
### Cascadia subduction zone scenario, MHW:



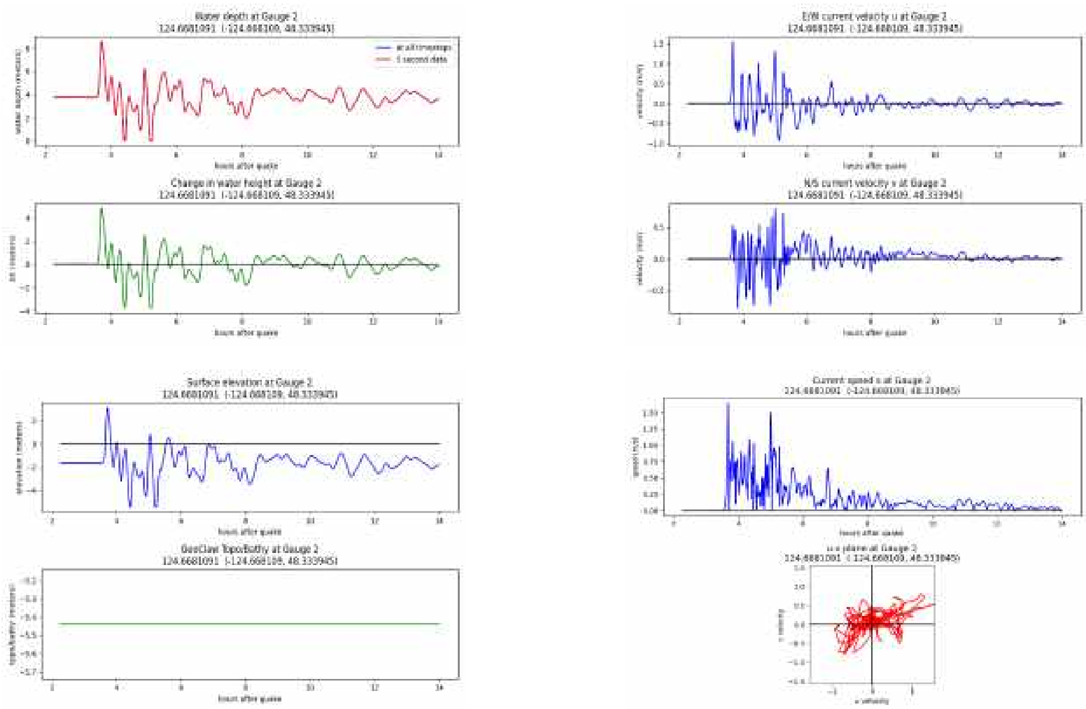
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

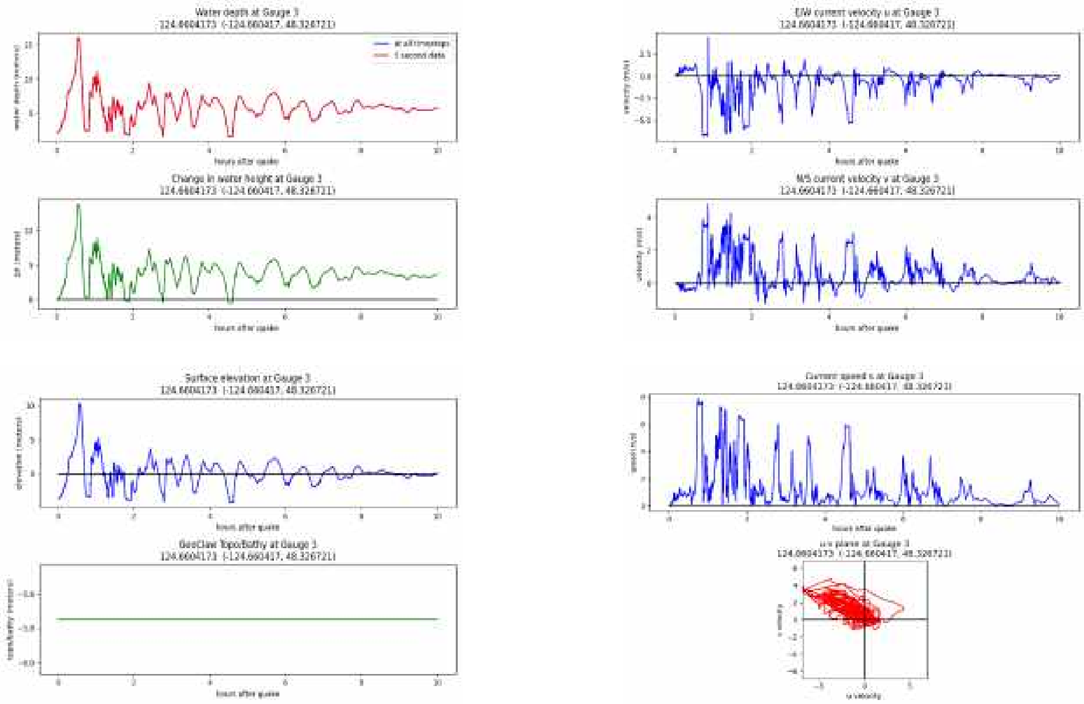



Alaska-Aleutian subduction zone scenario, MLW:

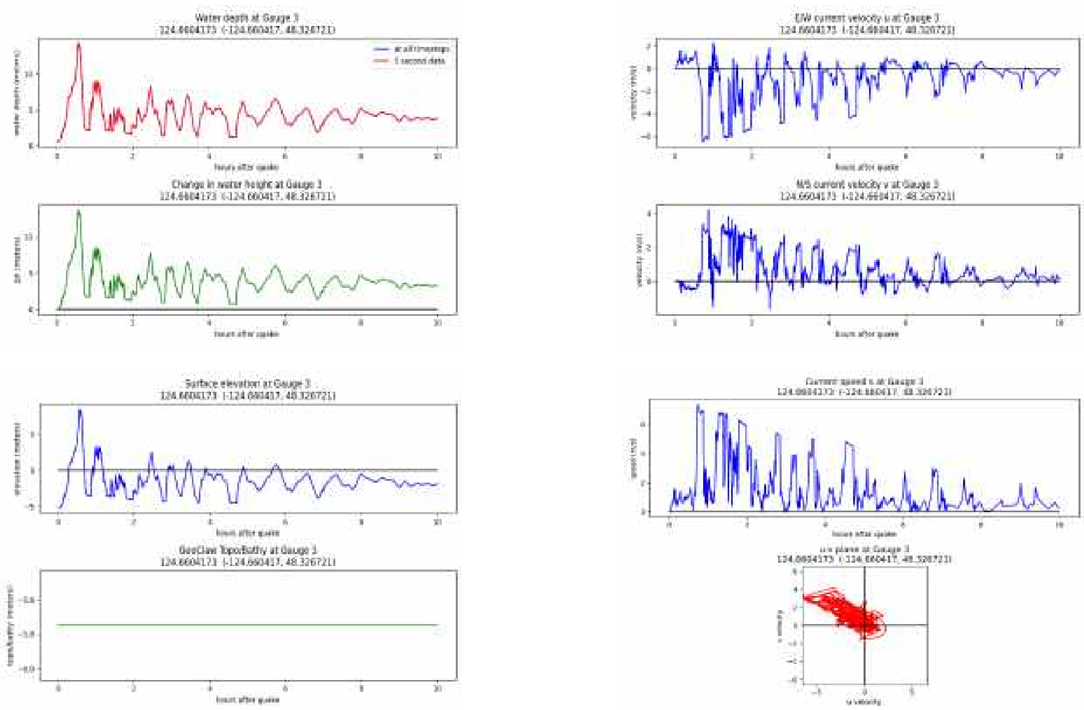


## Gauge 3: Tsoo-yess River mouth

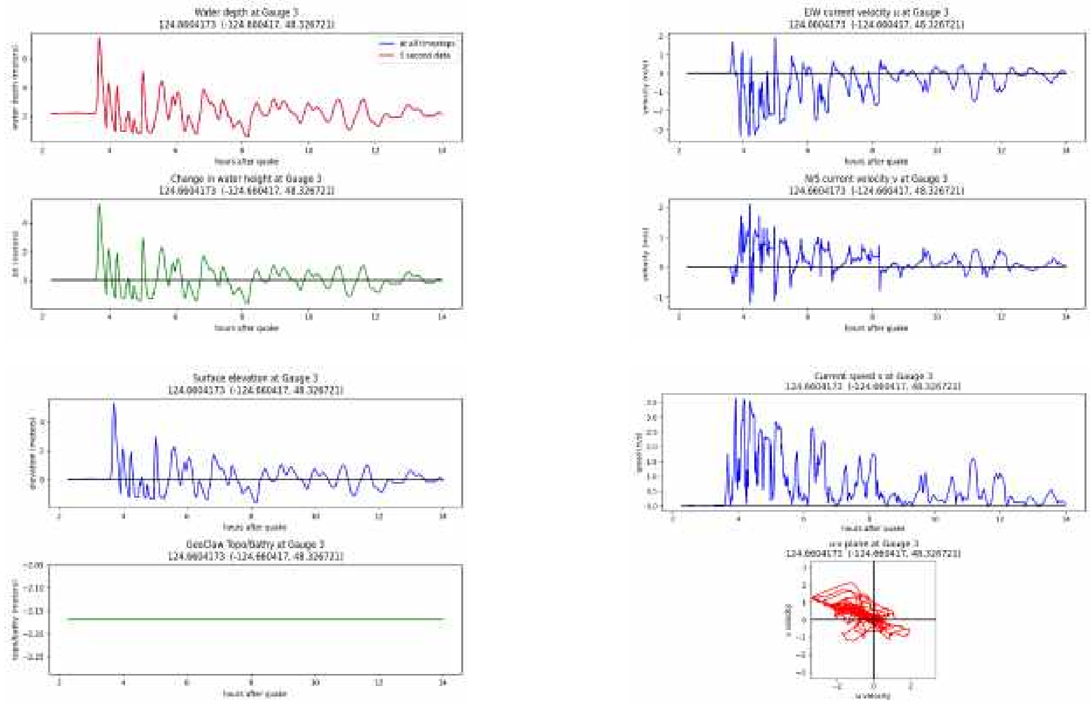
### Cascadia subduction zone scenario, MHW:



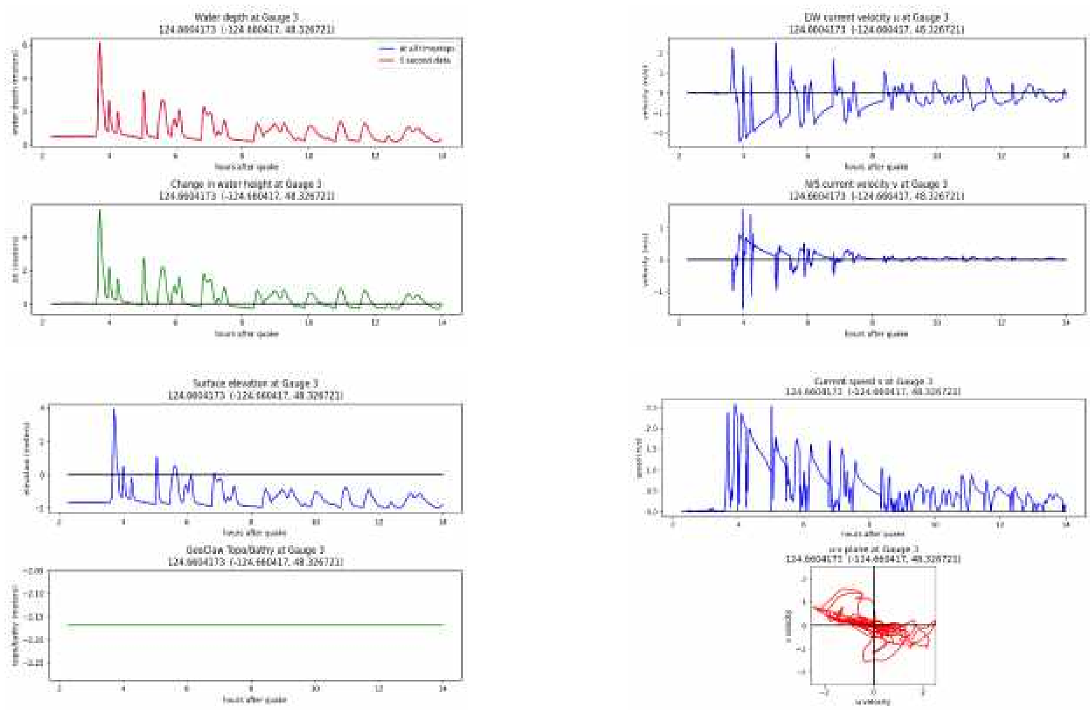
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

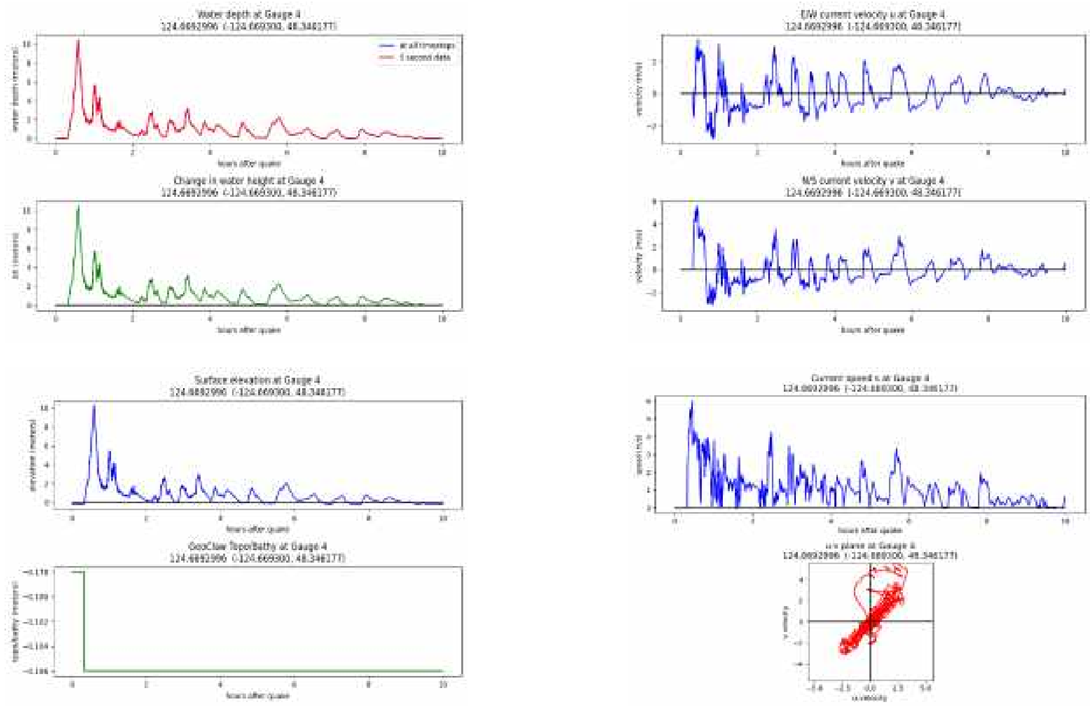



Alaska-Aleutian subduction zone scenario, MLW:

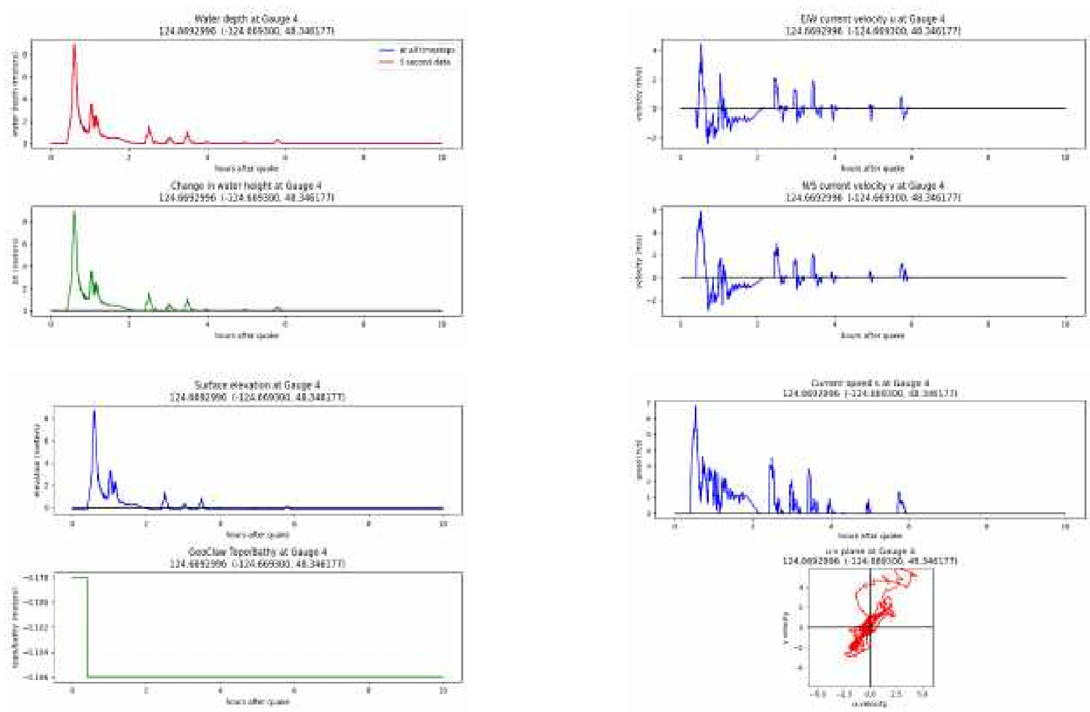


## Gauge 4: Cape Flattery Rd, Resort Dr

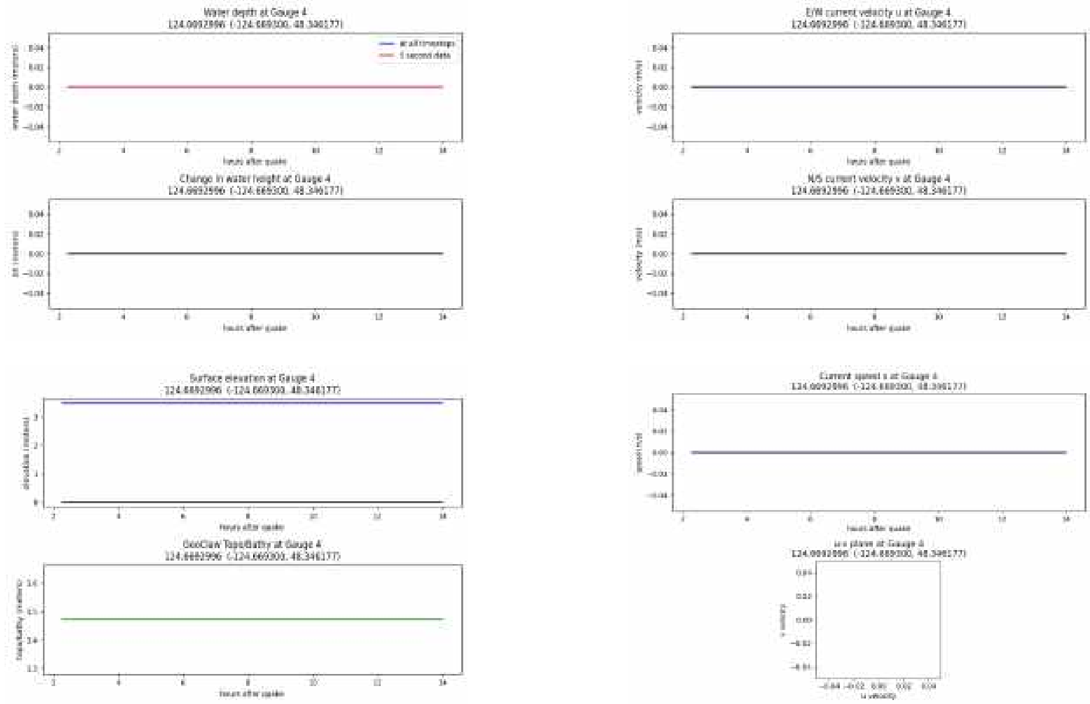
### Cascadia subduction zone scenario, MHW:



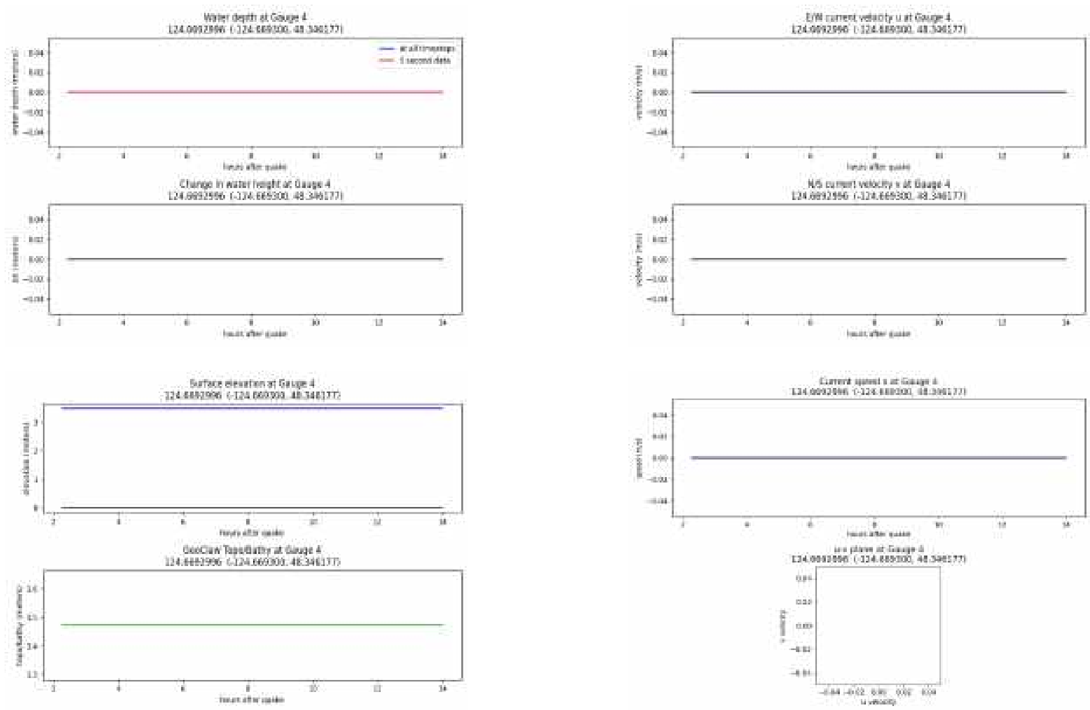

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

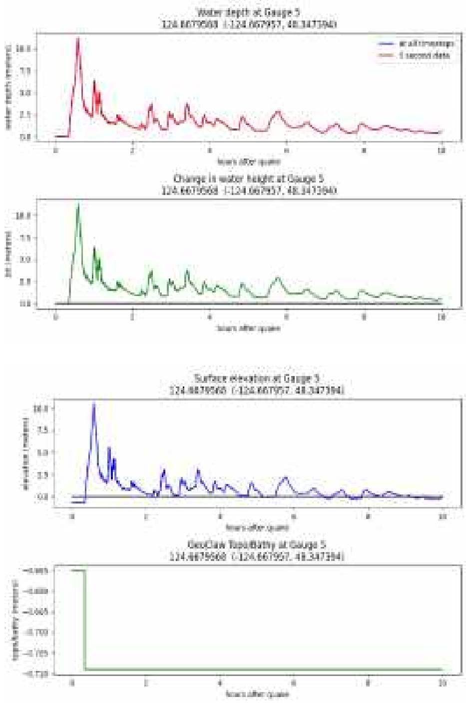


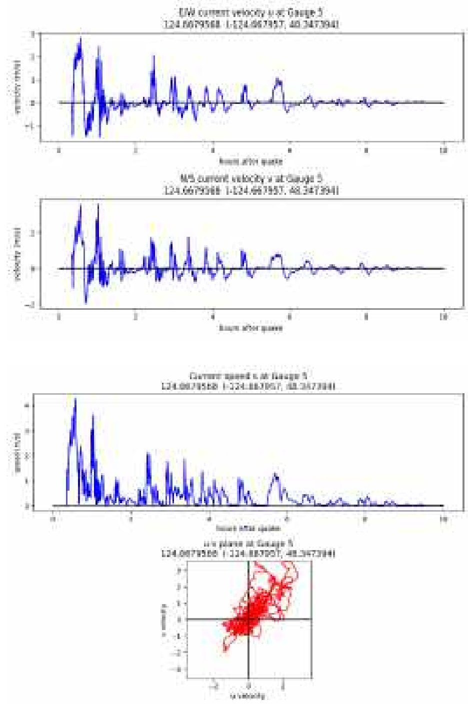

## Alaska-Aleutian subduction zone scenario, MLW:



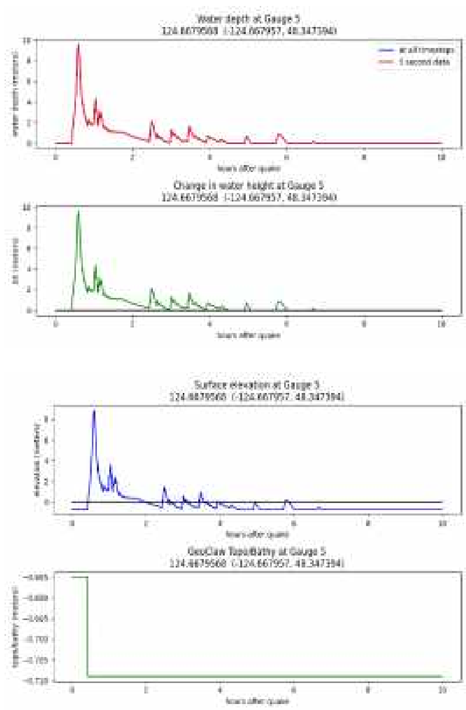
## Gauge 5: Makah Tribal Headquarters

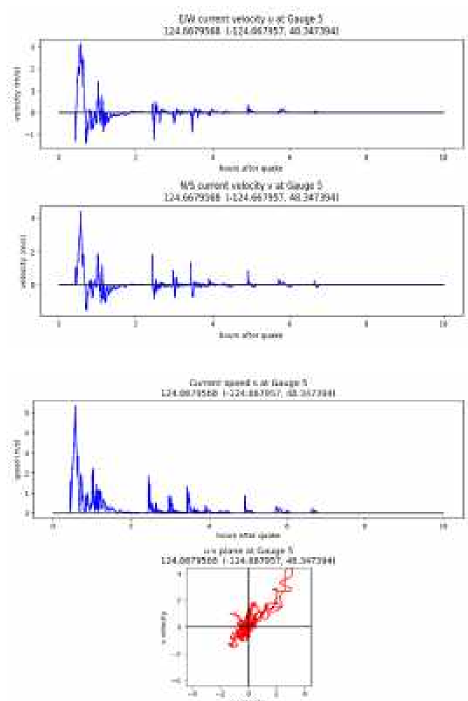
### Cascadia subduction zone scenario, MHW:



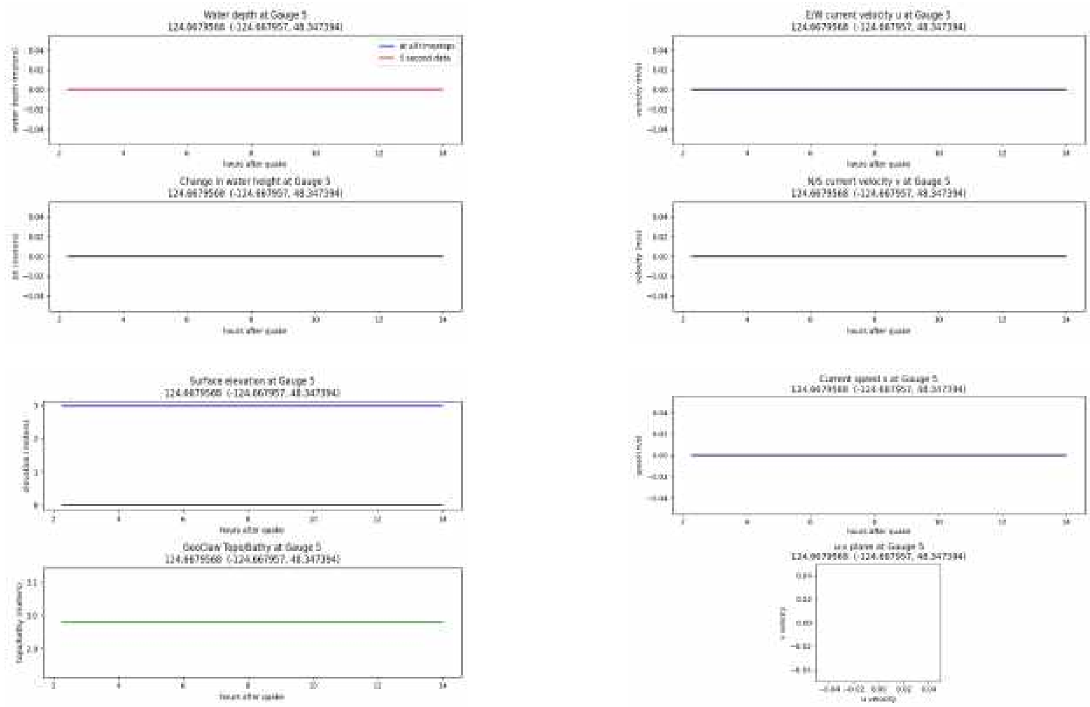




### Cascadia subduction zone scenario, MLW:

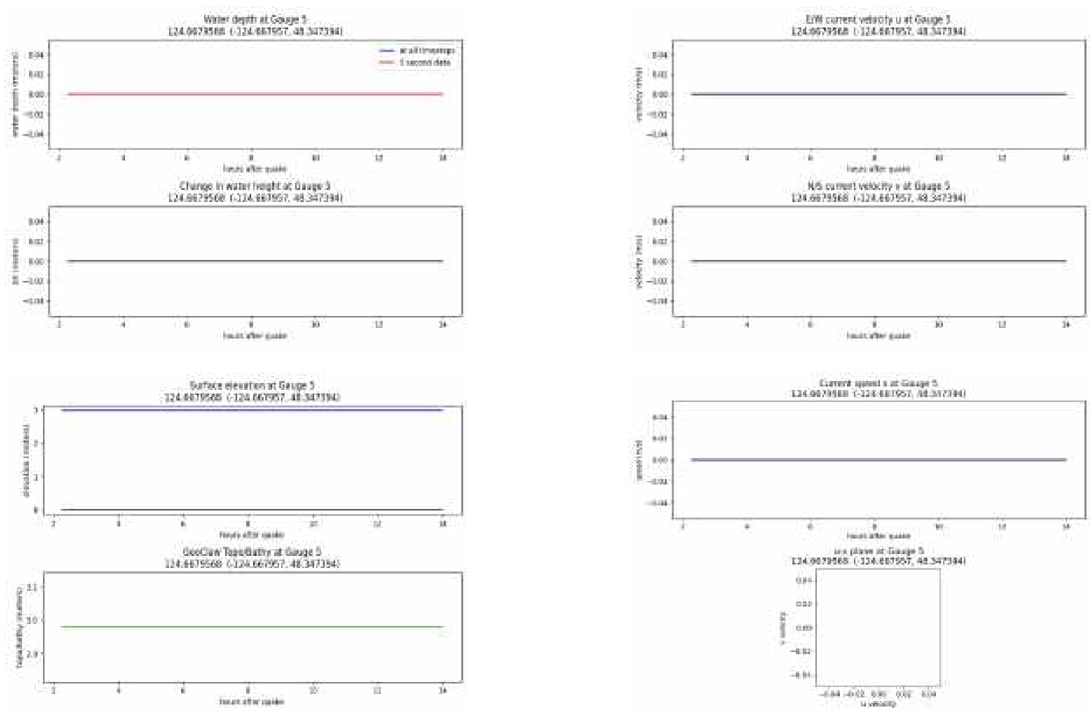


Alaska-Aleutian subduction zone scenario, MHW:

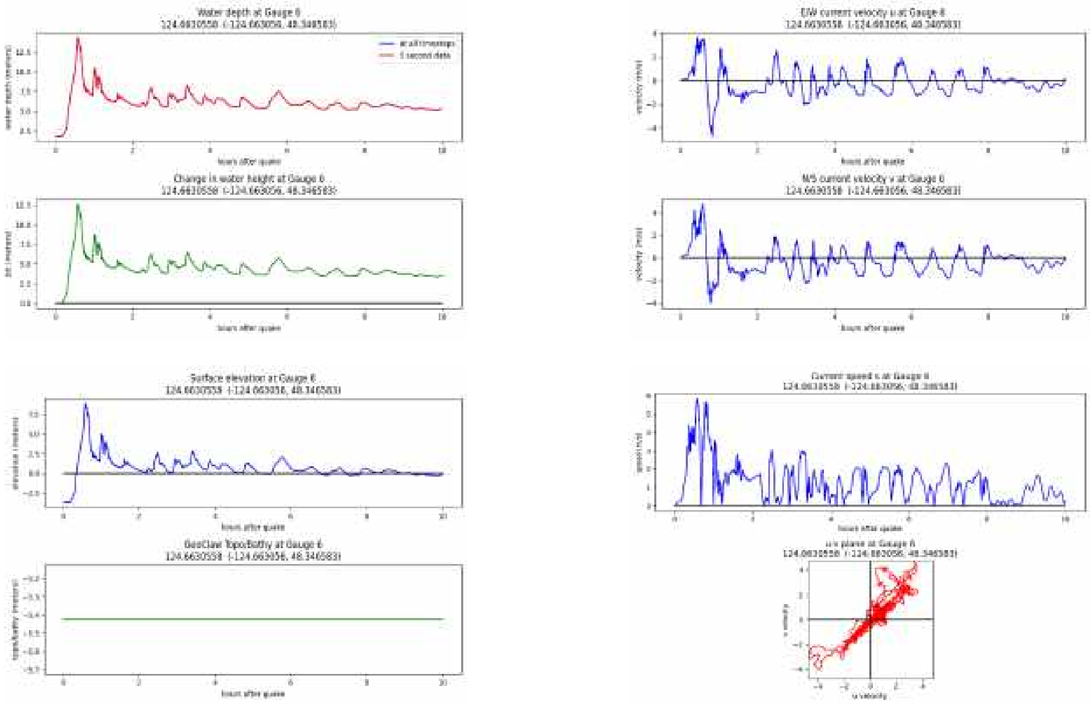



Alaska-Aleutian subduction zone scenario, MLW:

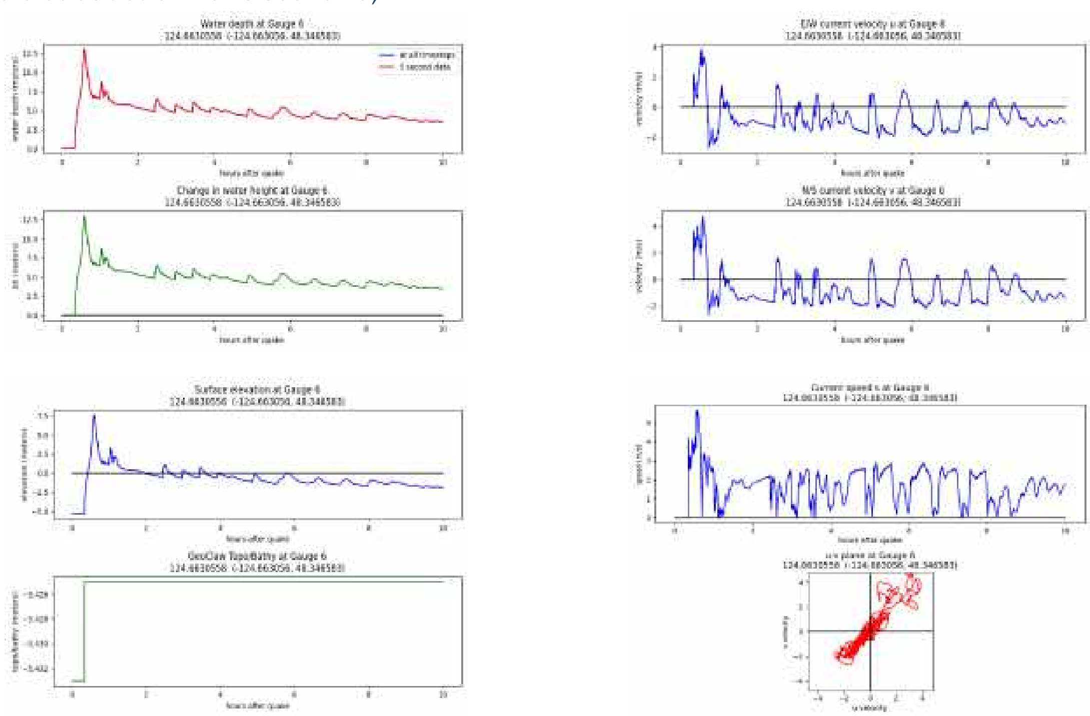


# Gauge 6: Wa'atch River, south of Hobuck Rd

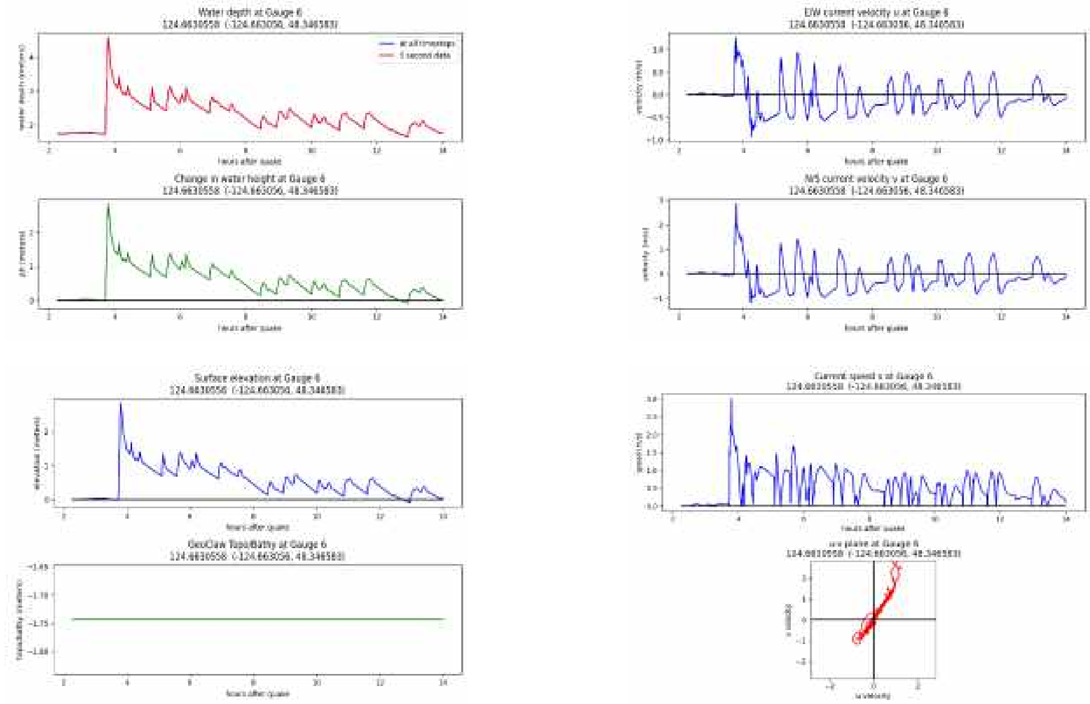
## Cascadia subduction zone scenario, MHW:



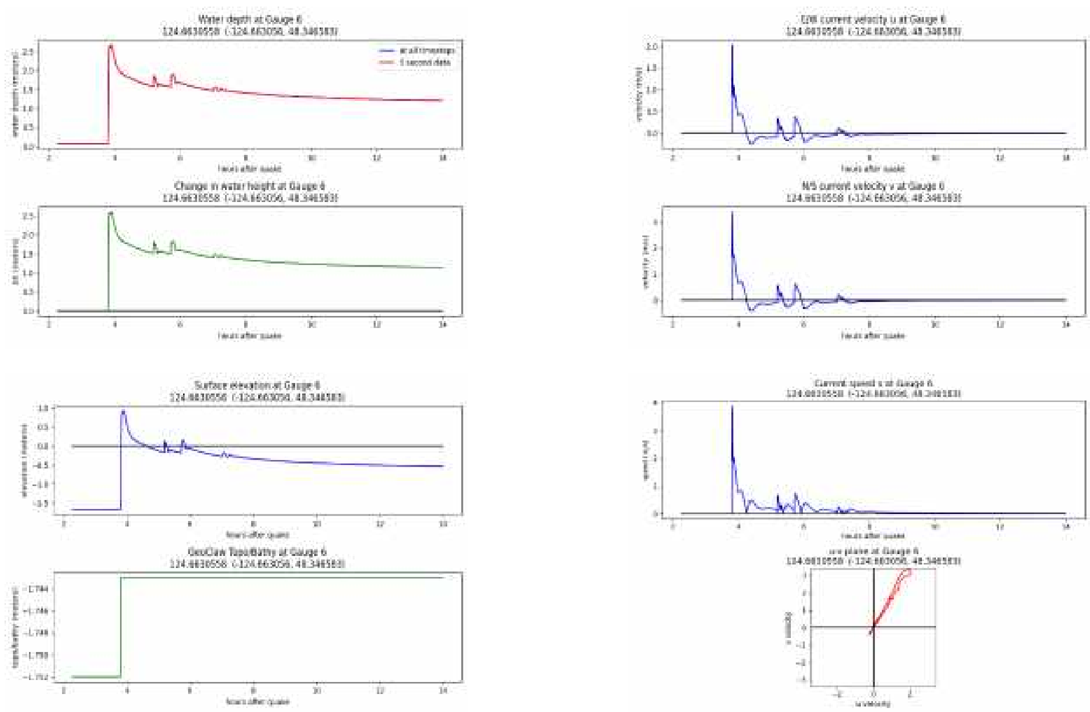

## Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

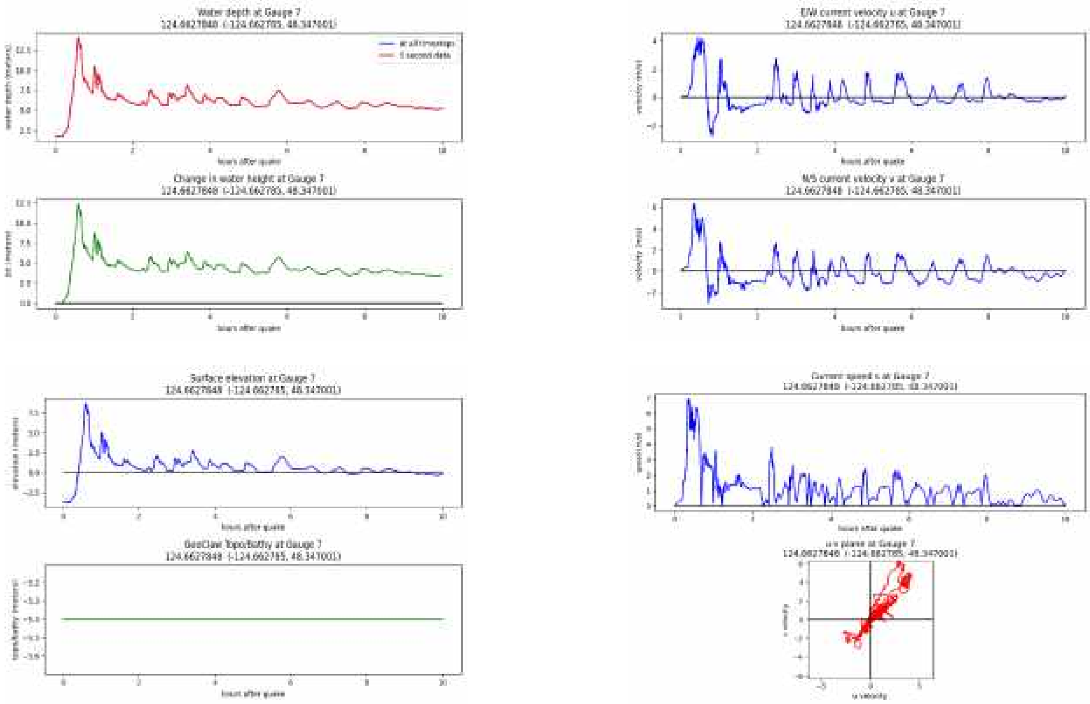



Alaska-Aleutian subduction zone scenario, MLW:

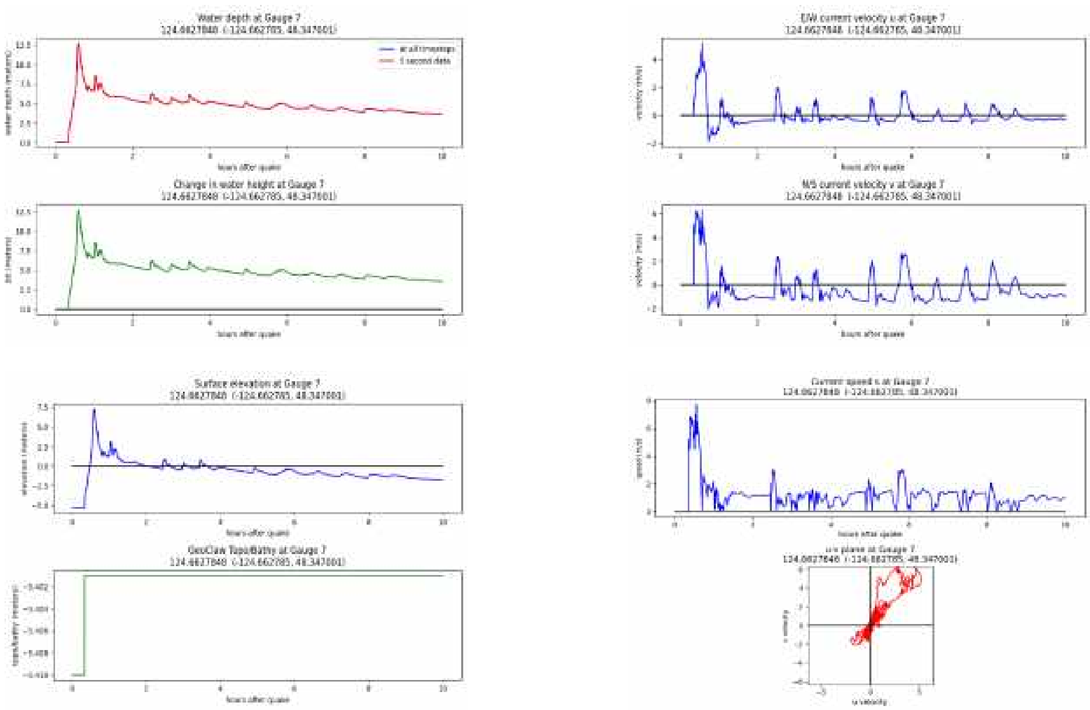


## Gauge 7: Wa'atch River, north of Hobuck Rd

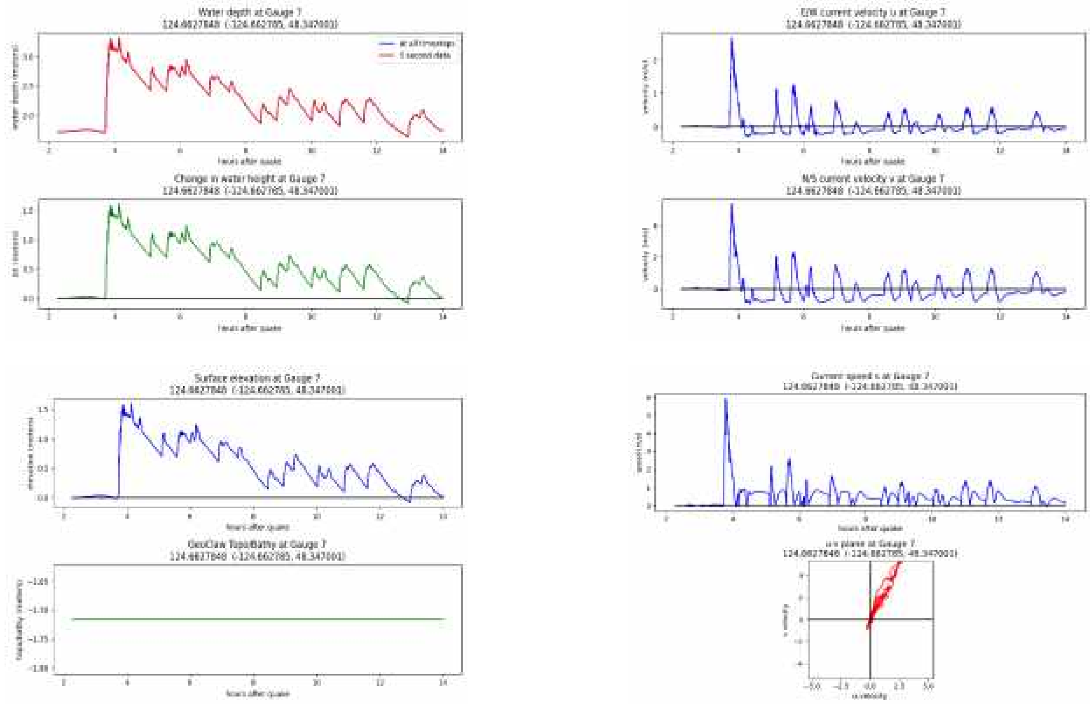
### Cascadia subduction zone scenario, MHW:



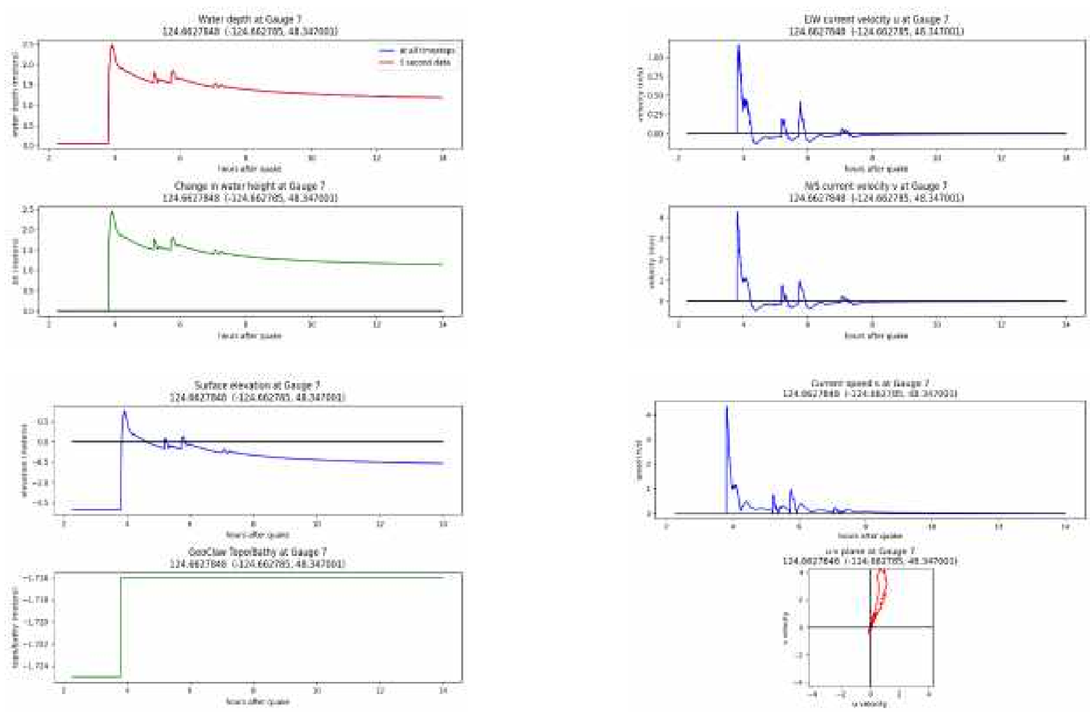

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW

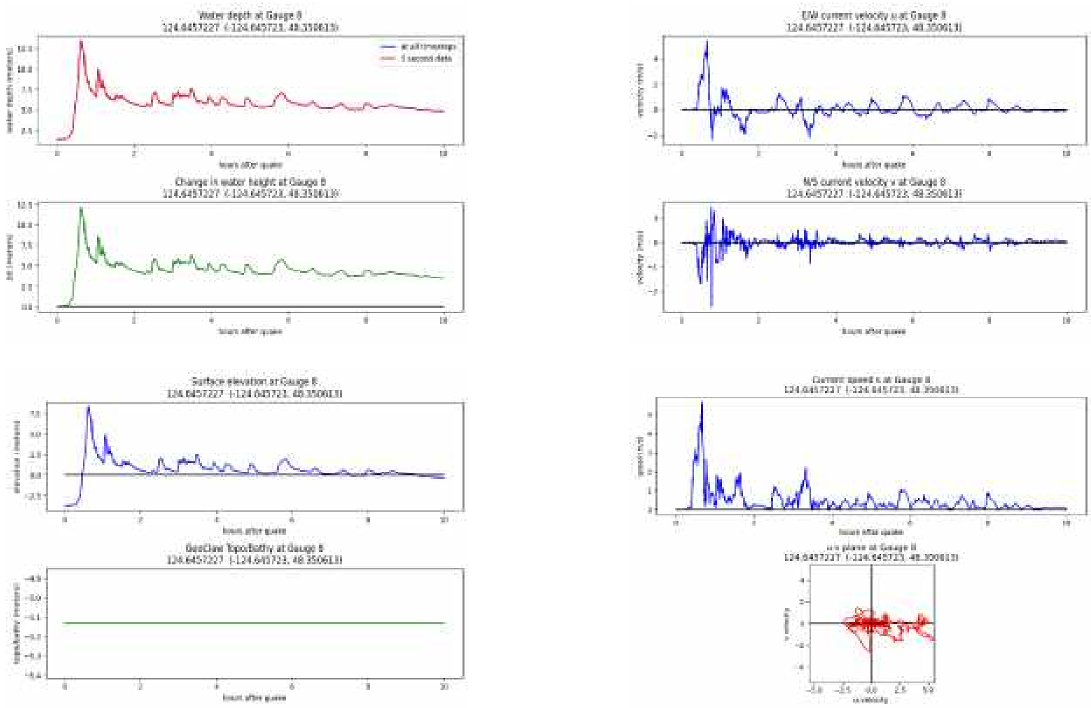


## Alaska-Aleutian subduction zone scenario, MLW:

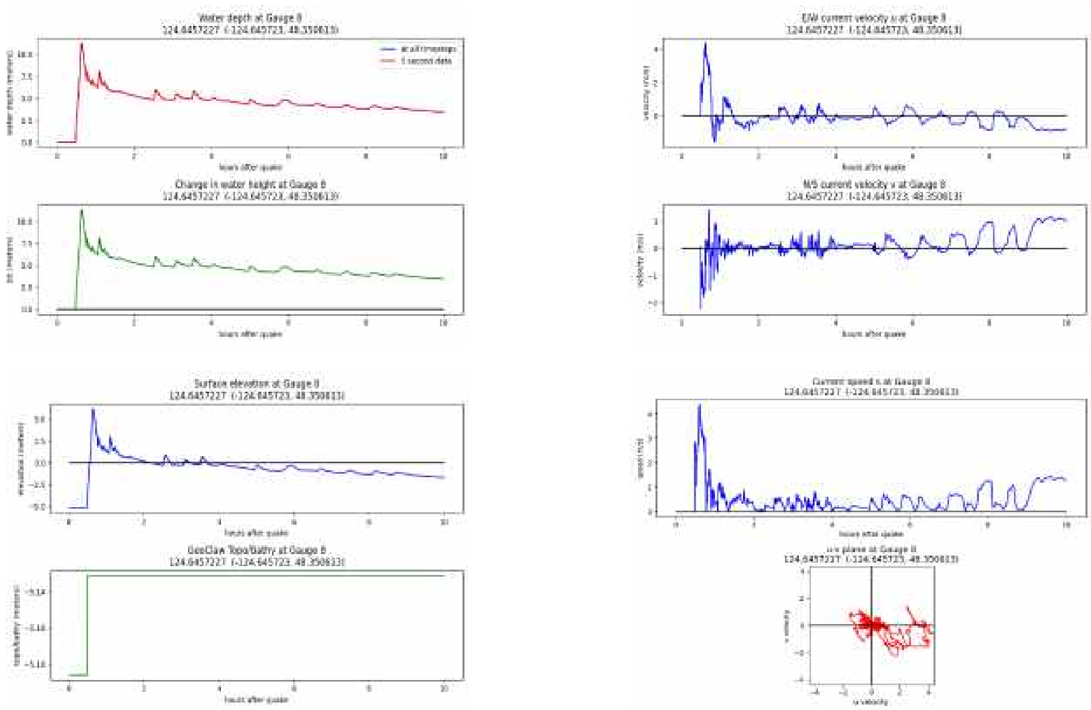


## Gauge 8: Wa'atch River, north of Makah Psge

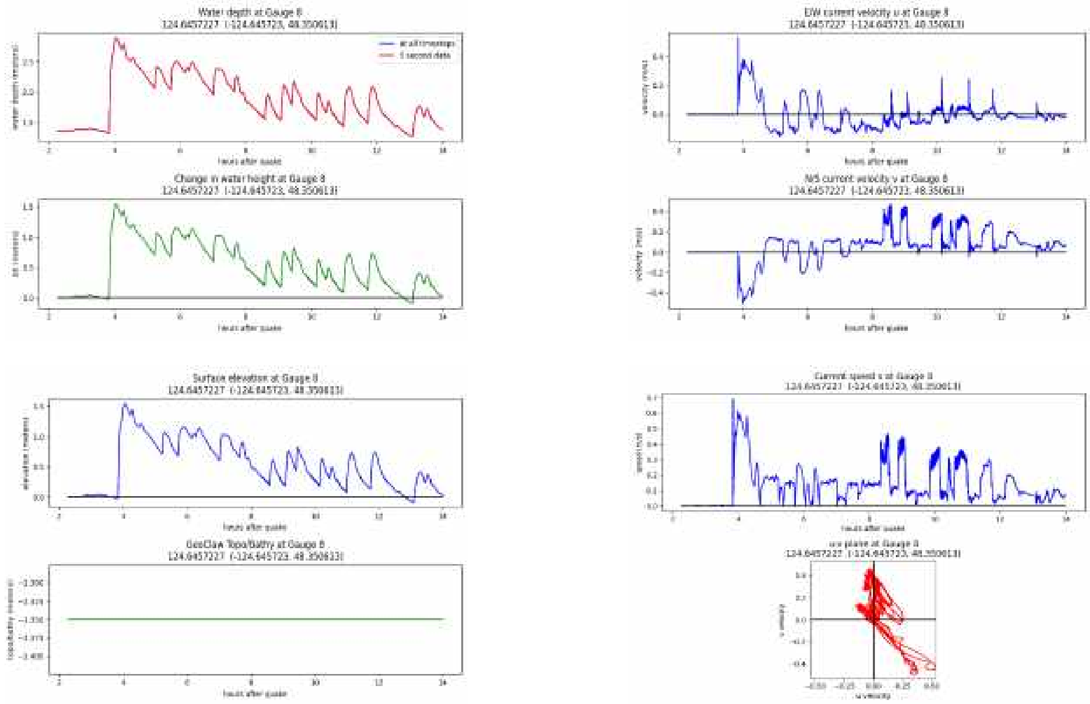
### Cascadia subduction zone scenario, MHW:



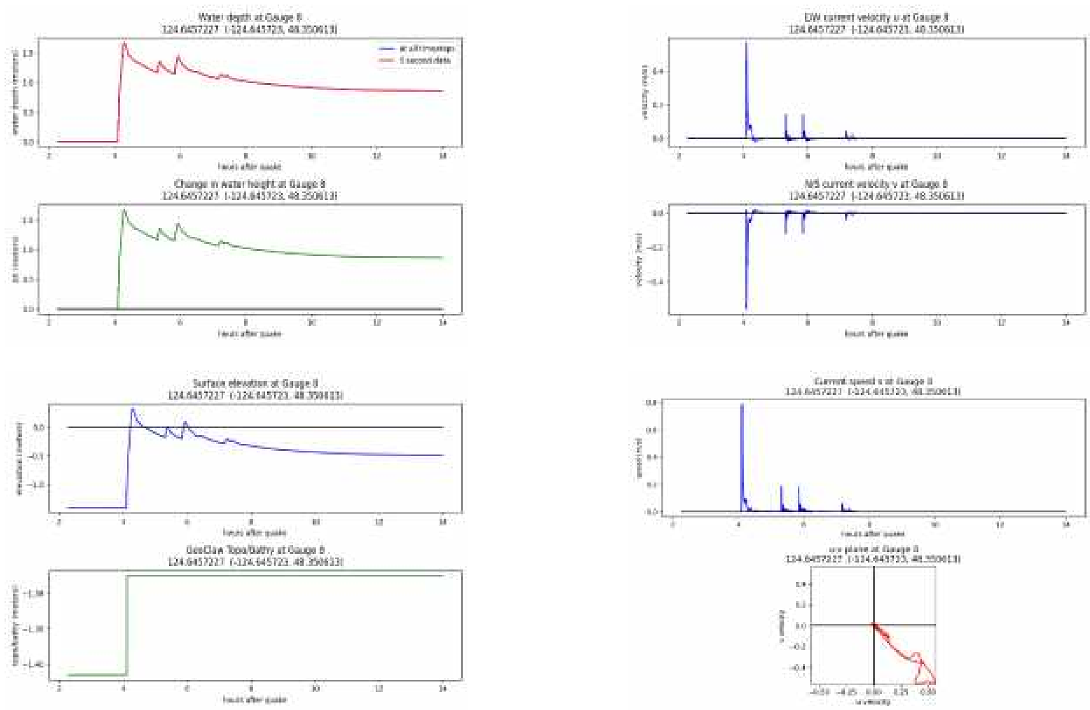

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

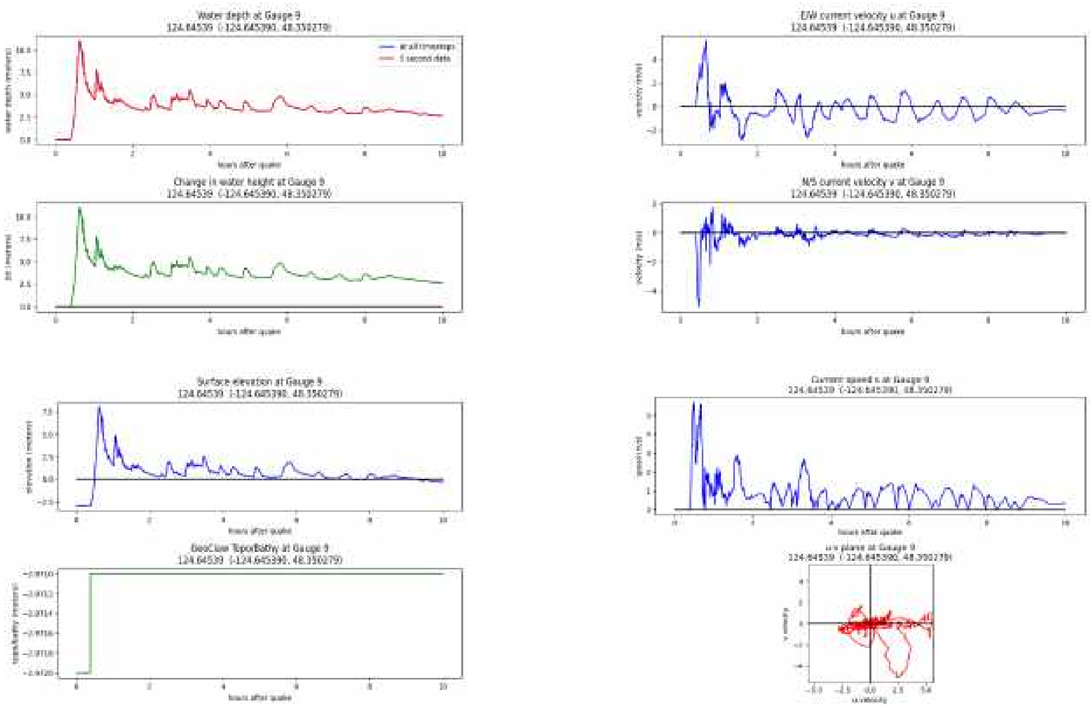



## Alaska-Aleutian subduction zone scenario, MLW:

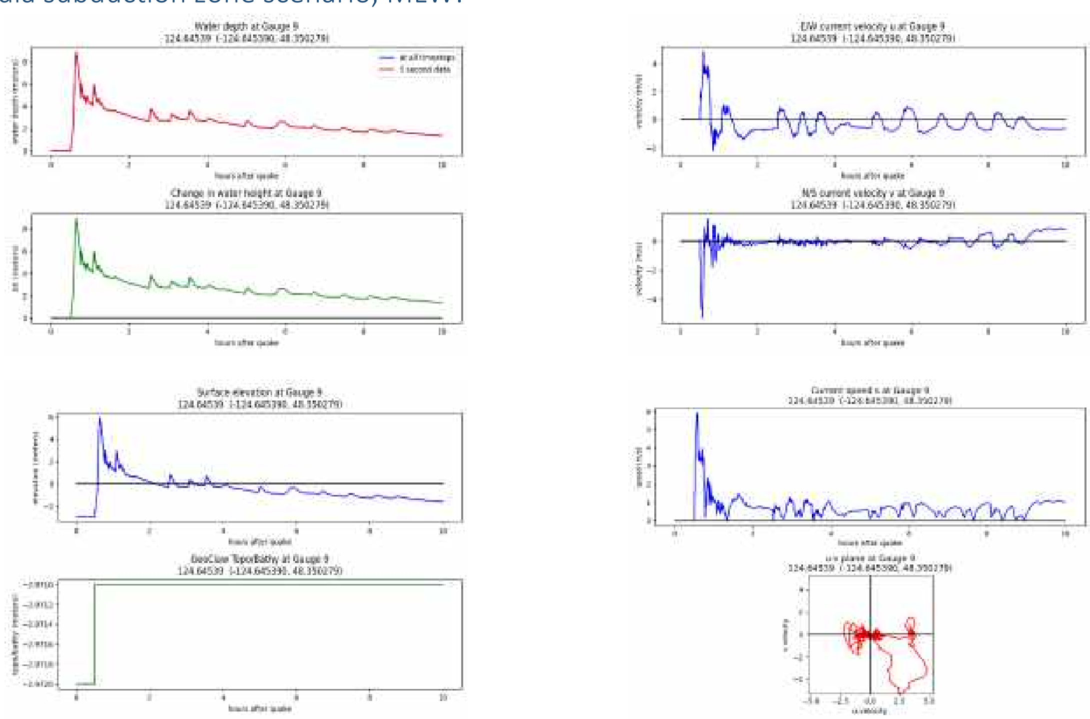


## Gauge 9: Wa’atch River, south of Makah Psge

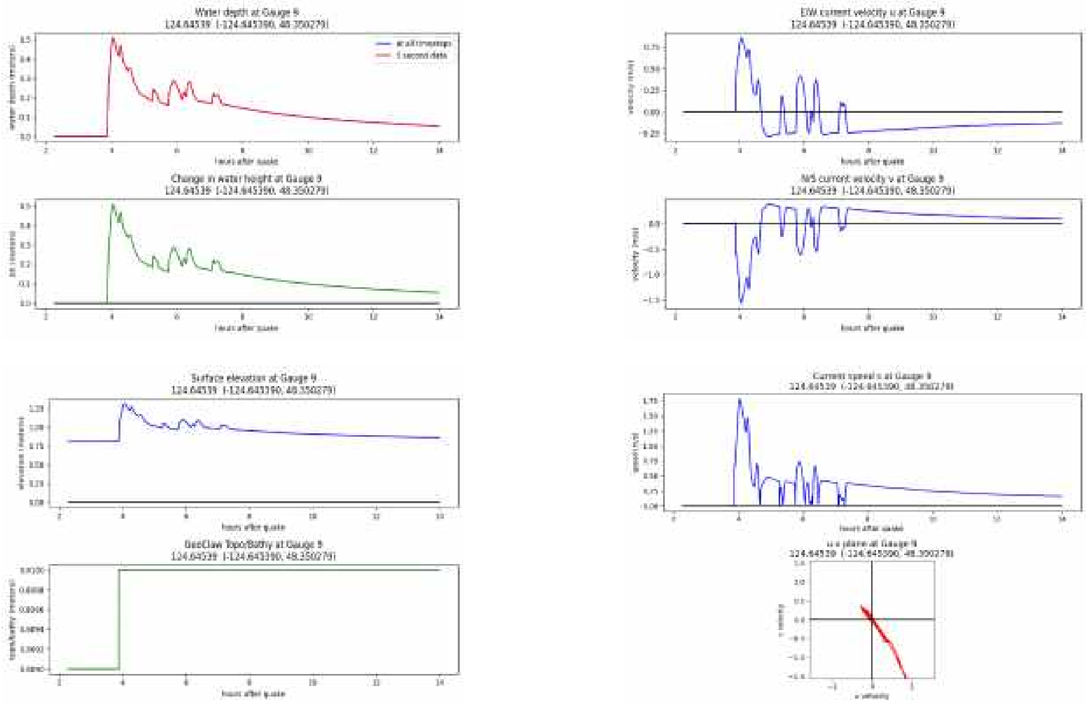
### Cascadia subduction zone scenario, MHW:



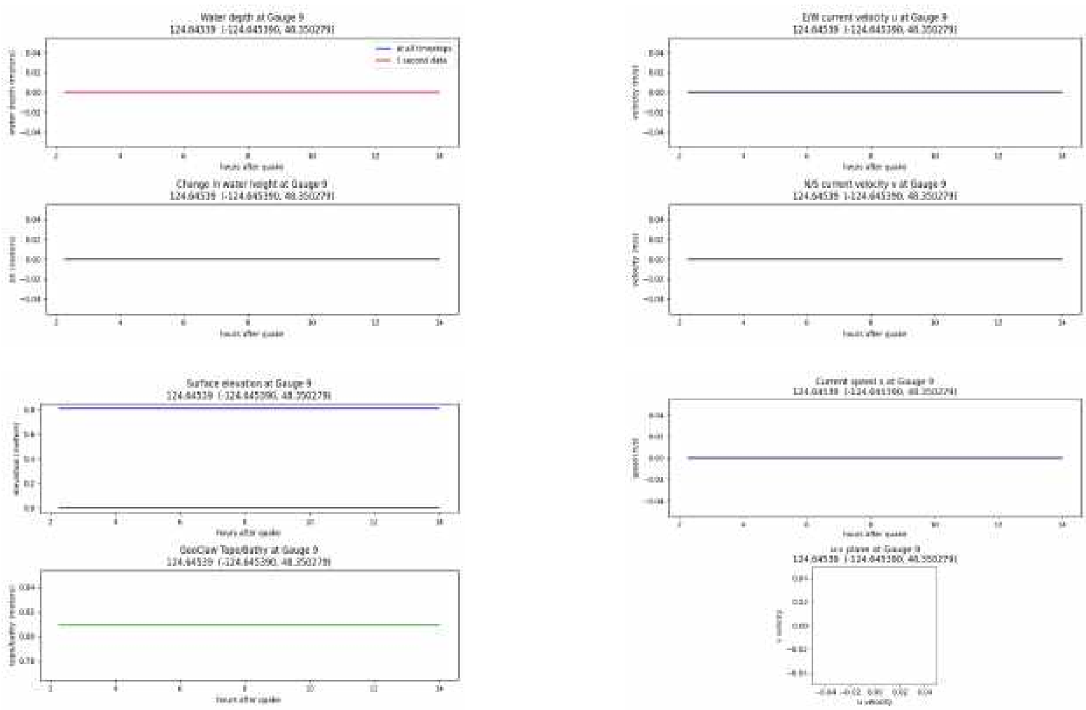

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

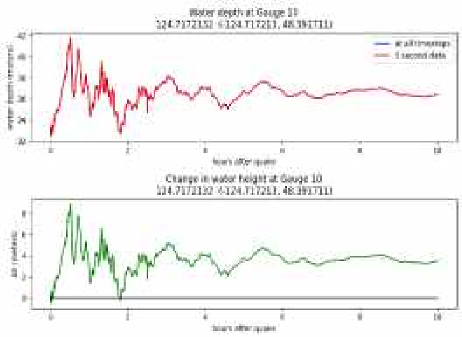


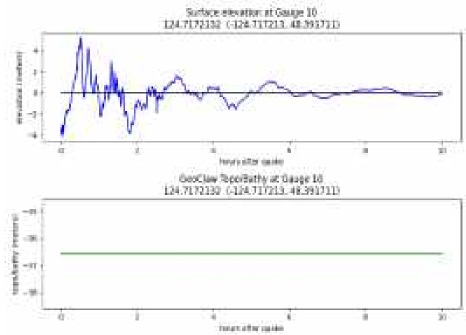

## Alaska-Aleutian subduction zone scenario, MLW:

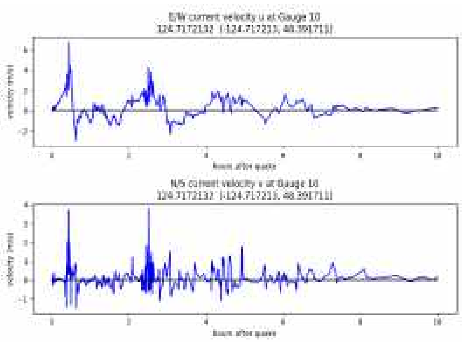


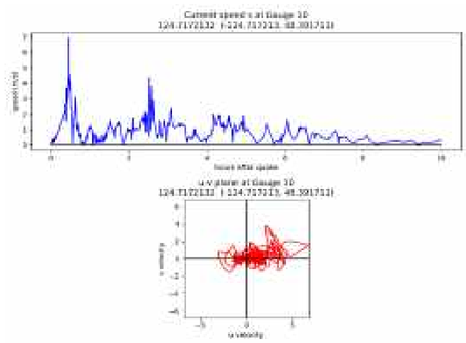
## Gauge 10: Offshore Cape Flattery

### Cascadia subduction zone scenario, MHW:

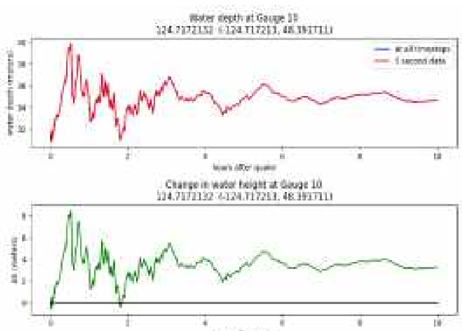


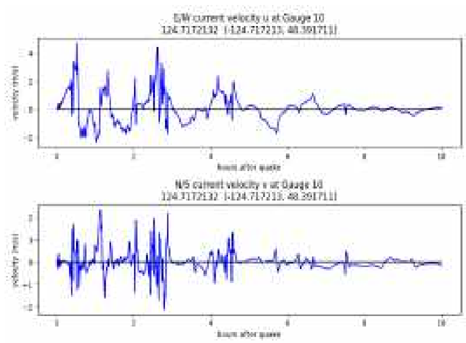


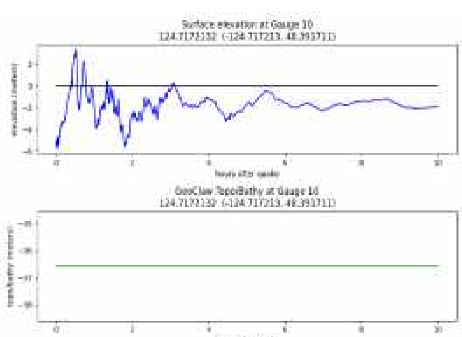


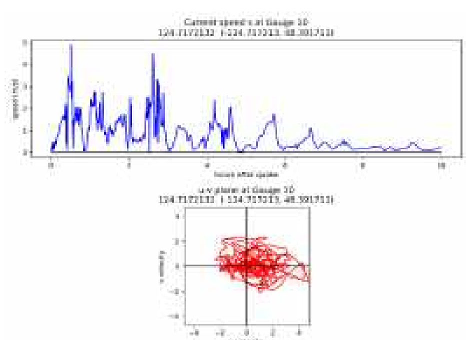


### Cascadia subduction zone scenario, MLW:

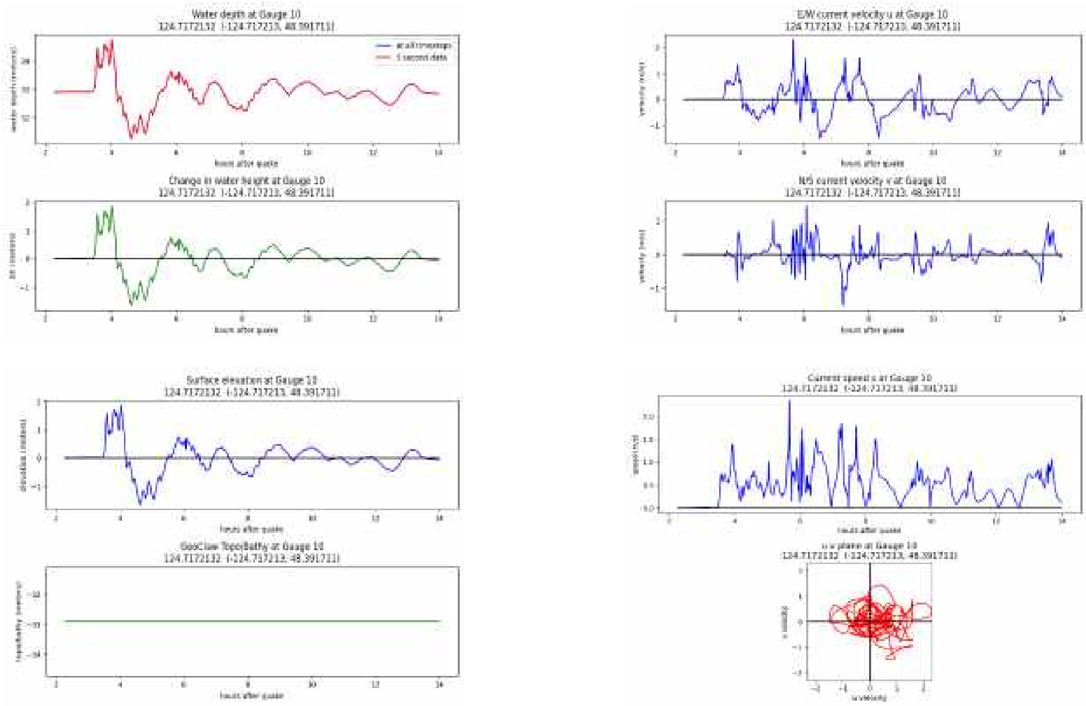




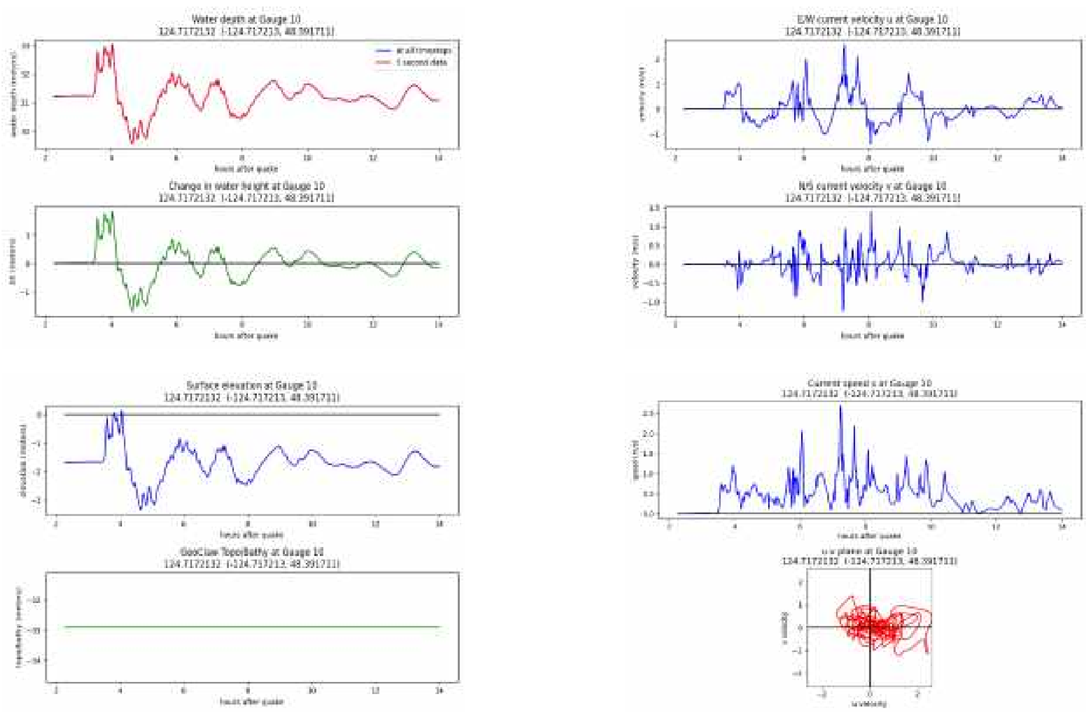




## Alaska-Aleutian subduction zone scenario, MHW:

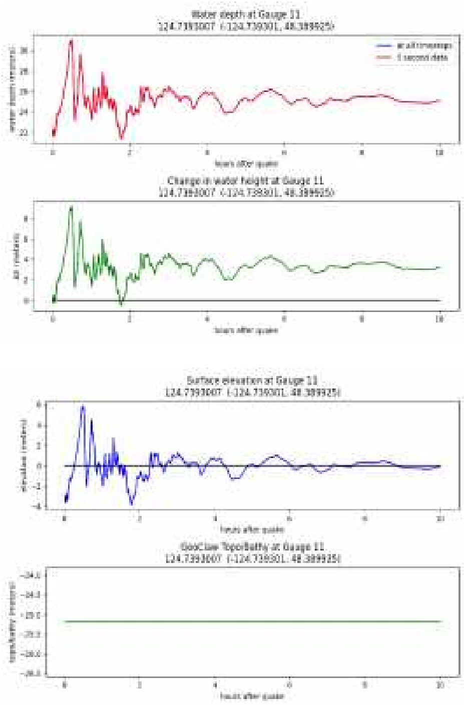


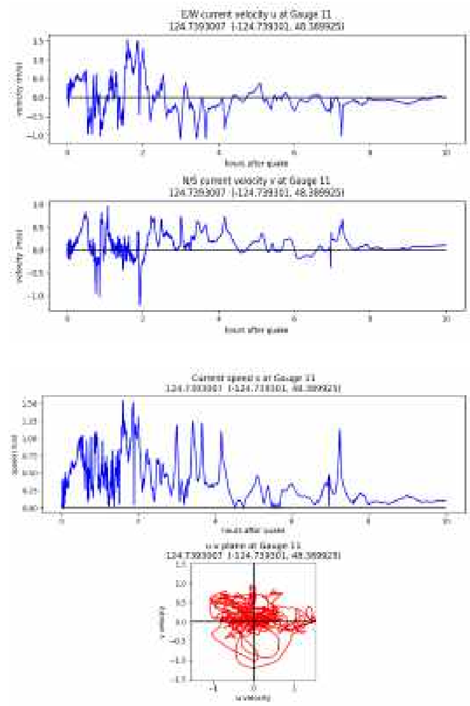

## Alaska-Aleutian subduction zone scenario, MLW:



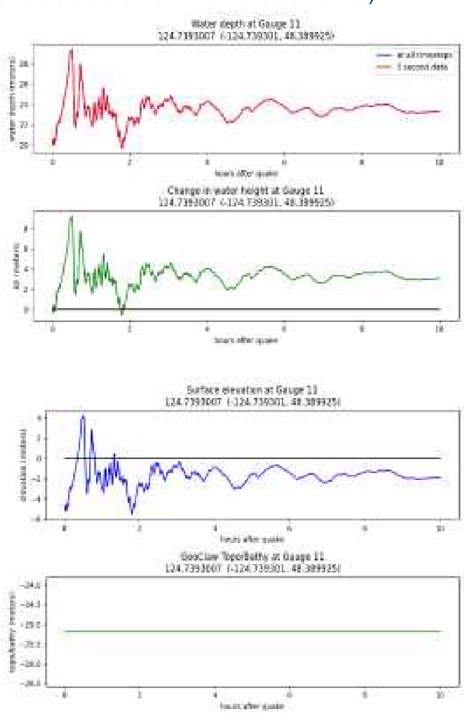
## Gauge 11: West of Tatoosh Island

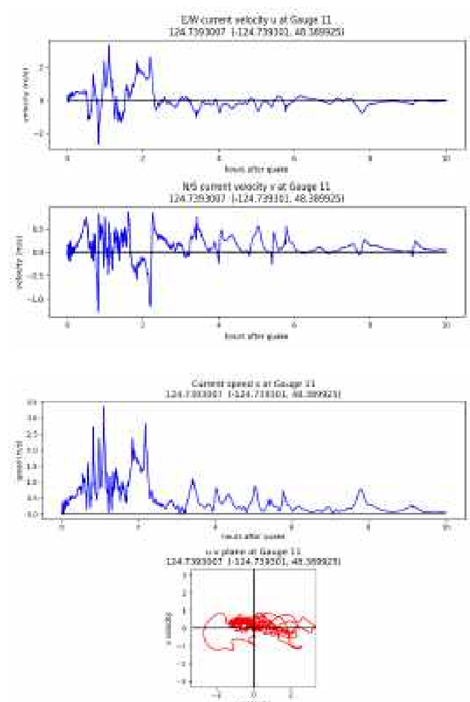
### Cascadia subduction zone scenario, MHW:



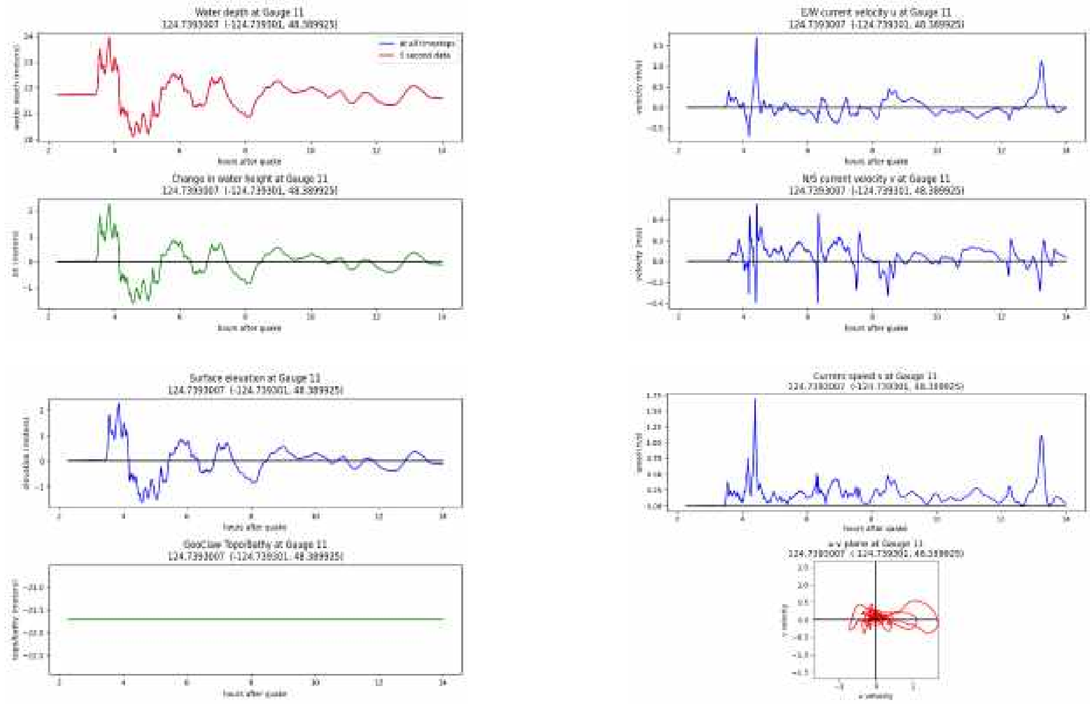


### Cascadia subduction zone scenario, MLW:

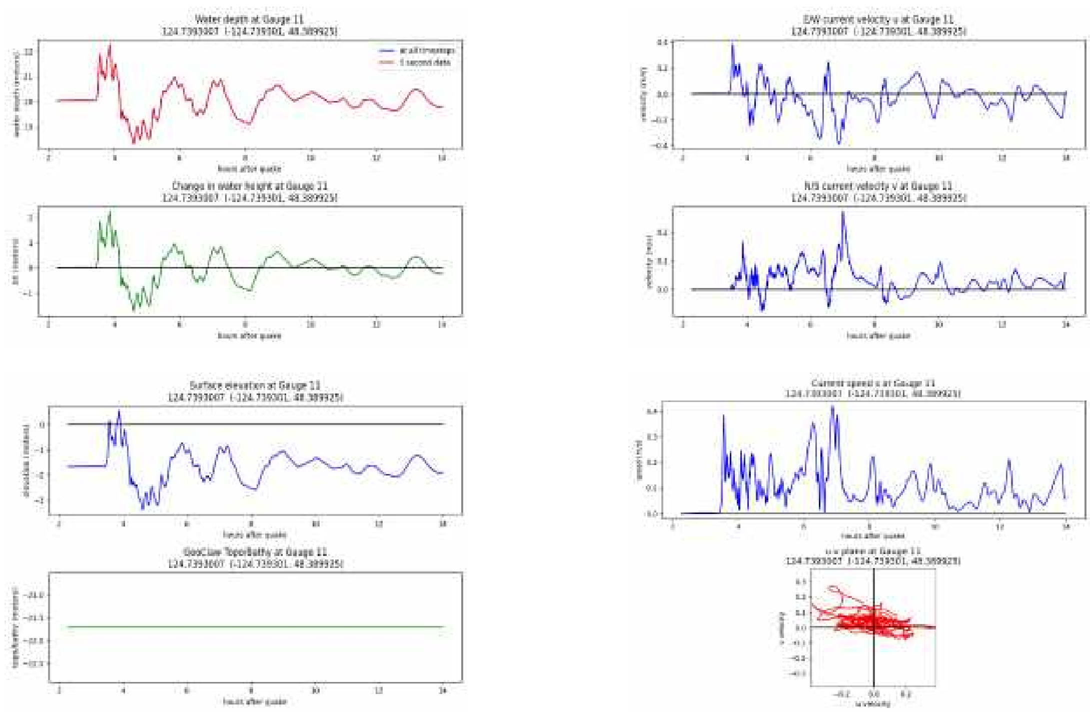




Alaska-Aleutian subduction zone scenario, MHW:

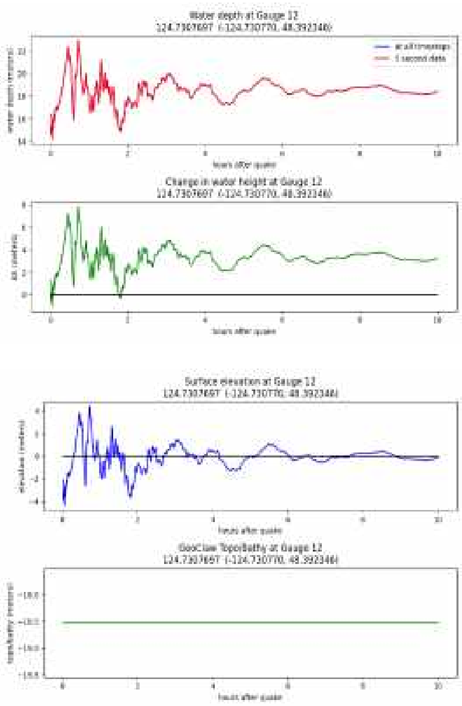


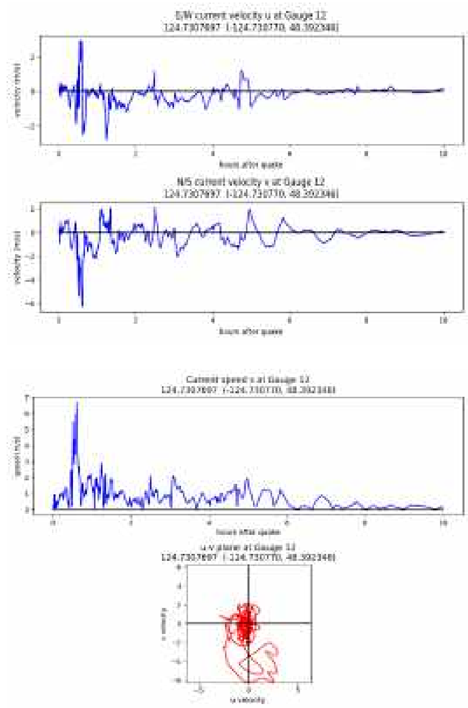

Alaska-Aleutian subduction zone scenario, MLW:



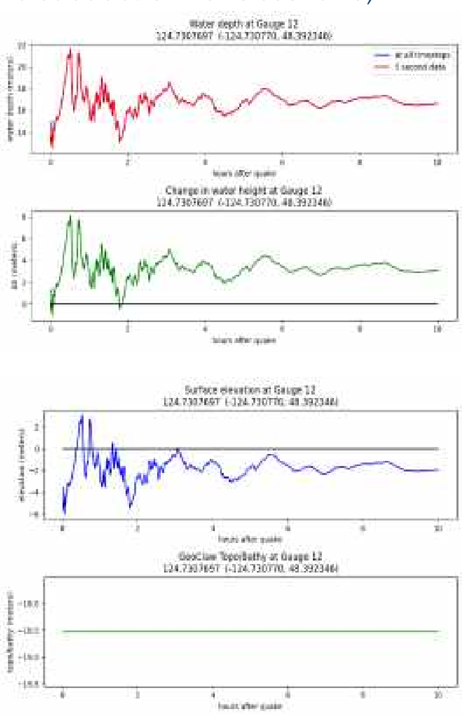
## Gauge 12: East of Tatoosh Island

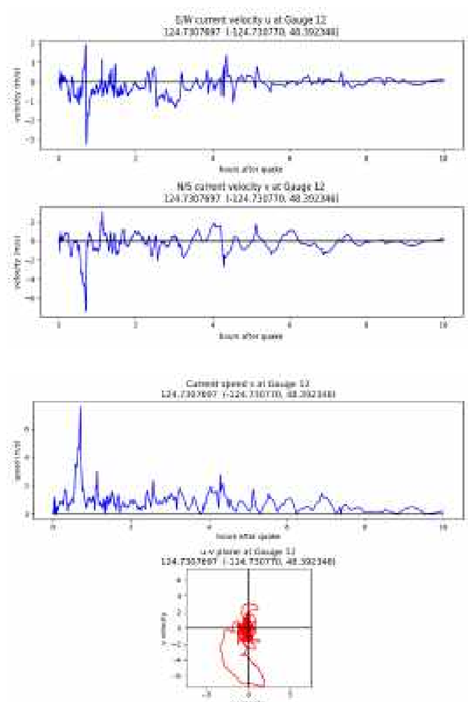
### Cascadia subduction zone scenario, MHW:



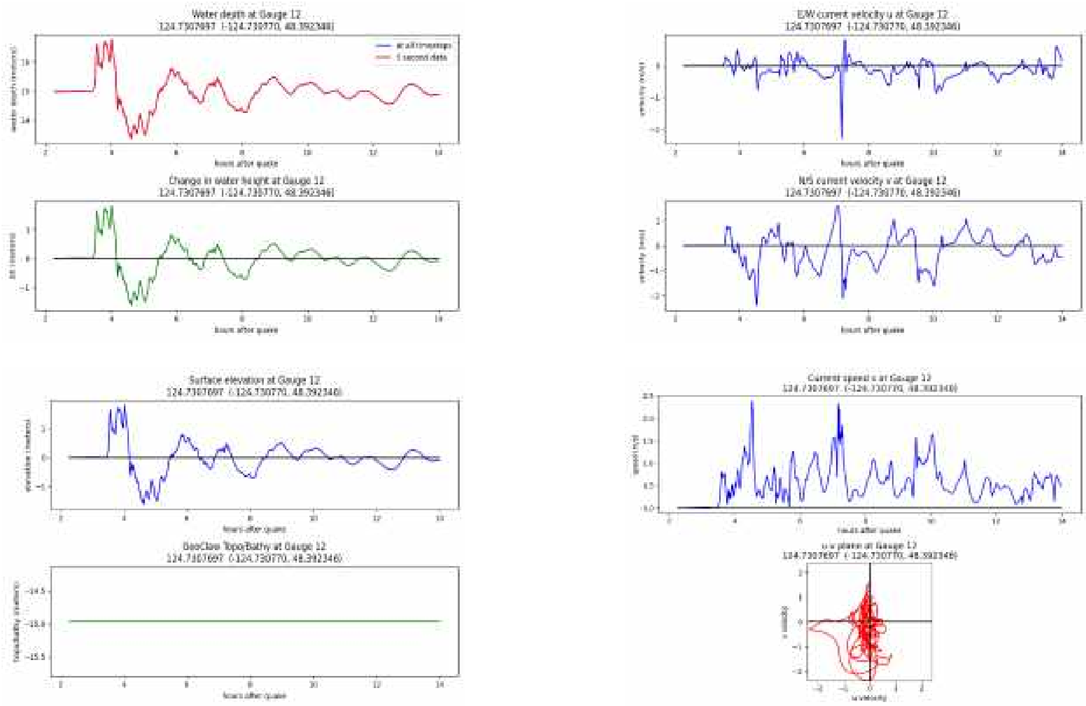


### Cascadia subduction zone scenario, MLW:

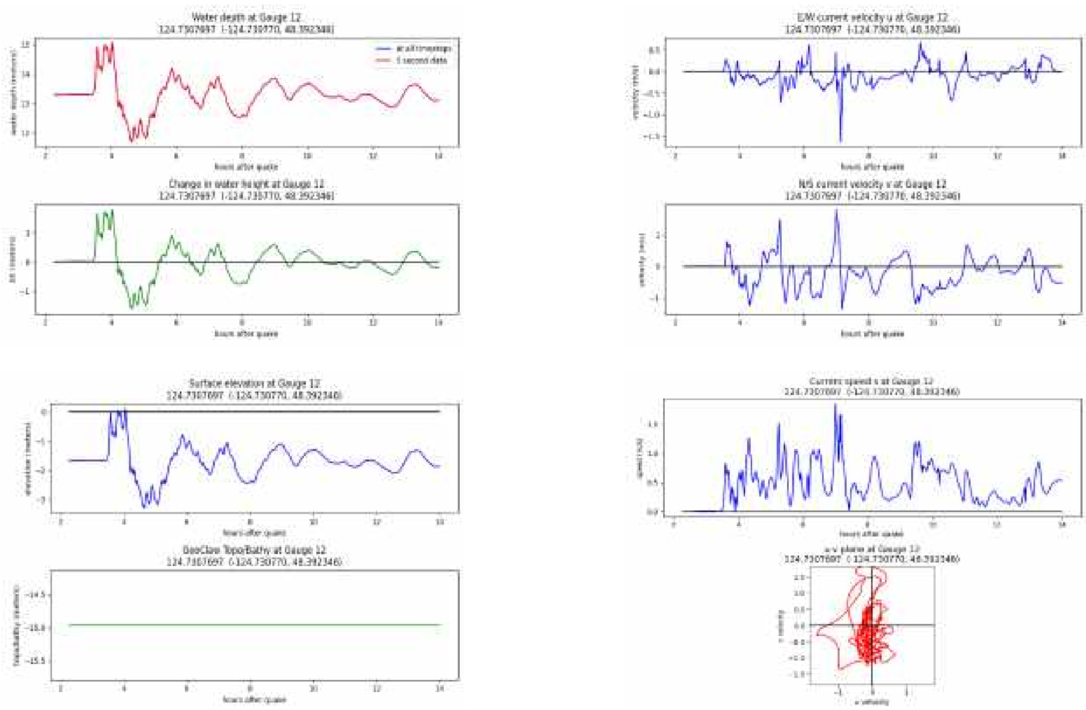




Alaska-Aleutian subduction zone scenario, MHW:

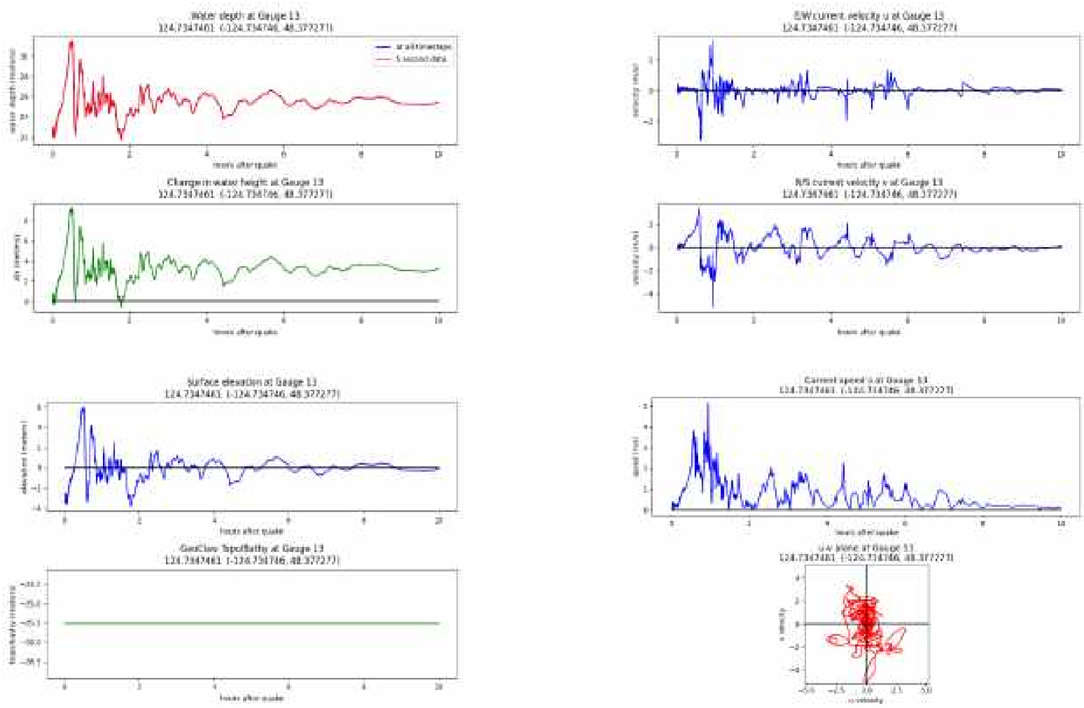



Alaska-Aleutian subduction zone scenario, MLW:

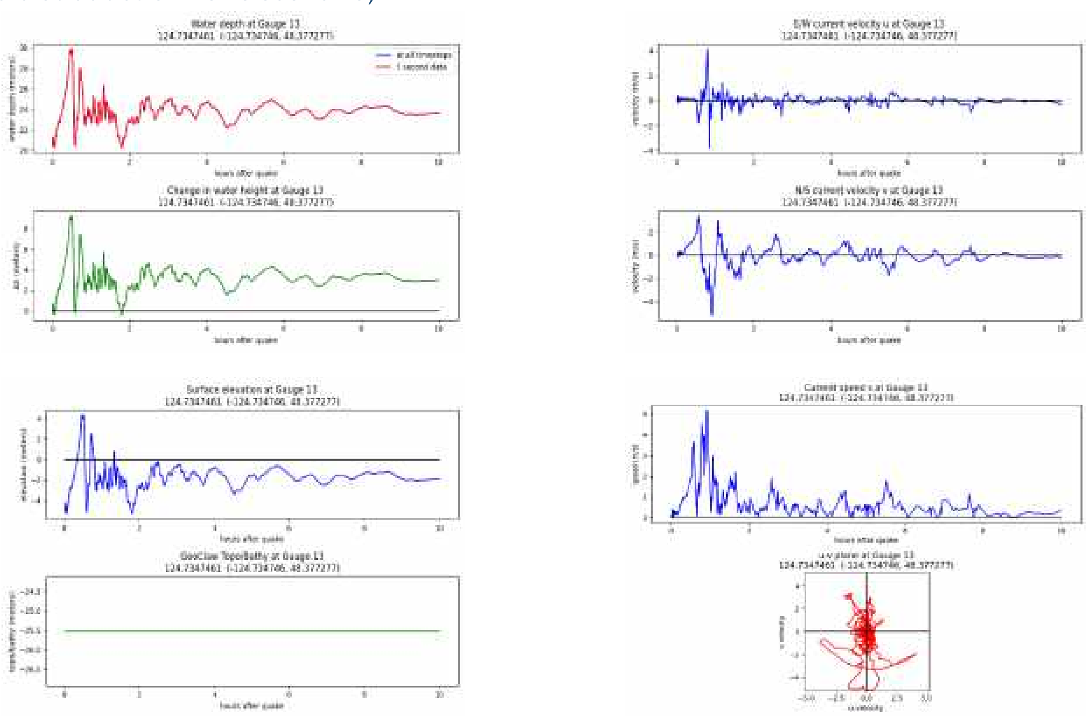


## Gauge 13: West of Cape Flattery

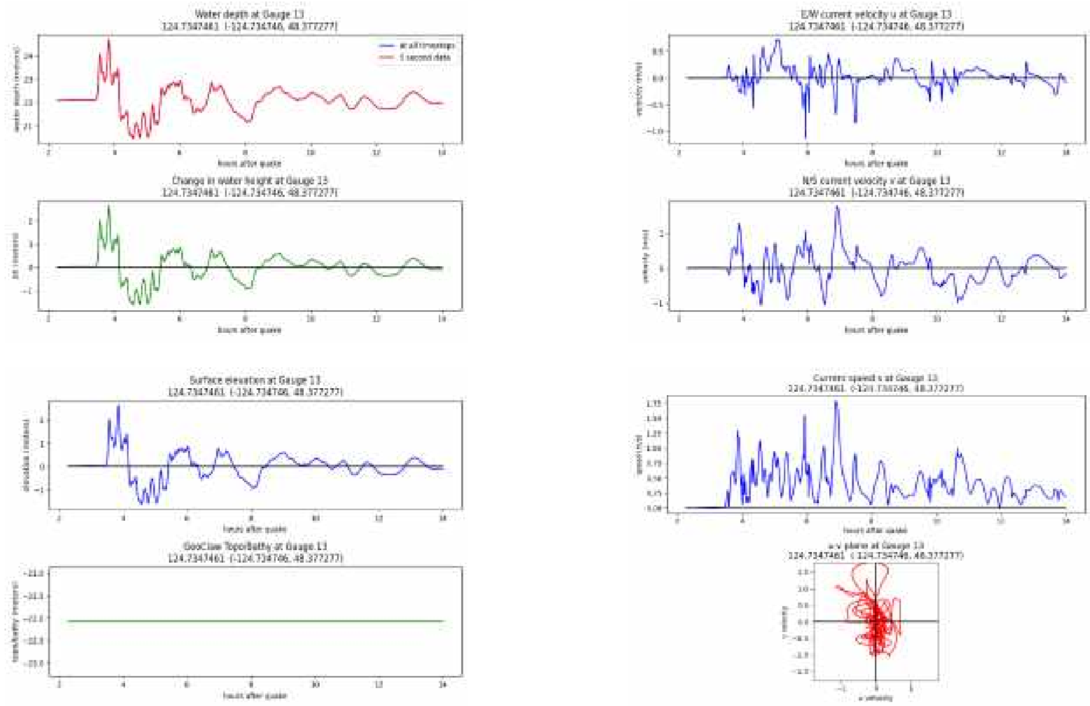
### Cascadia subduction zone scenario, MHW:



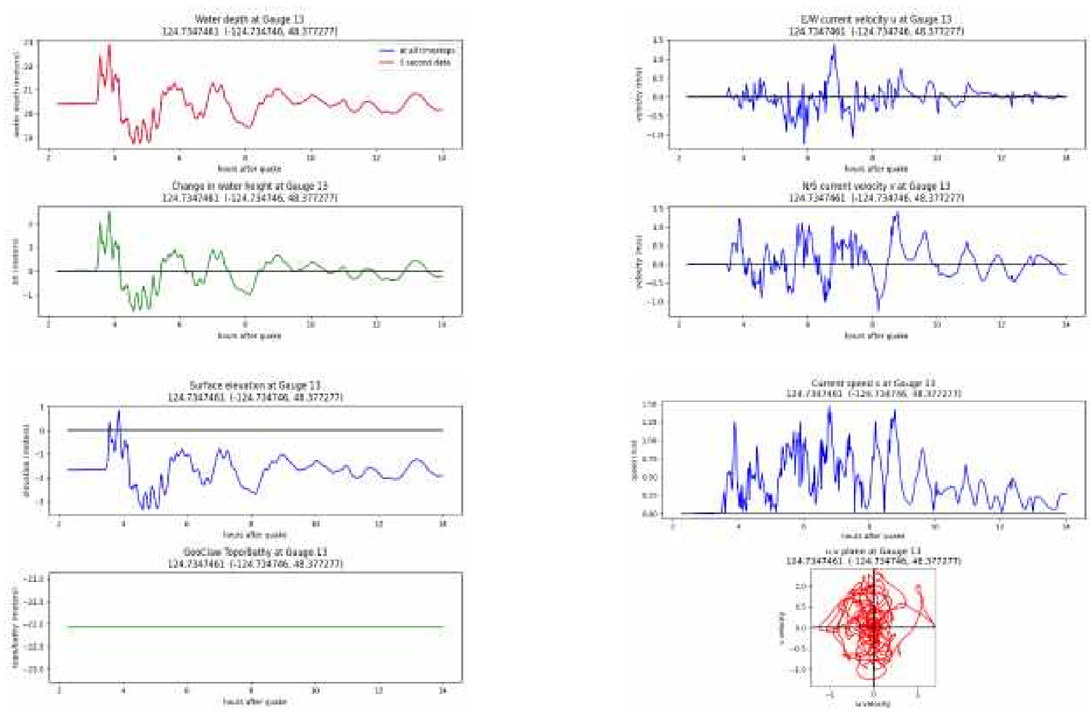
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

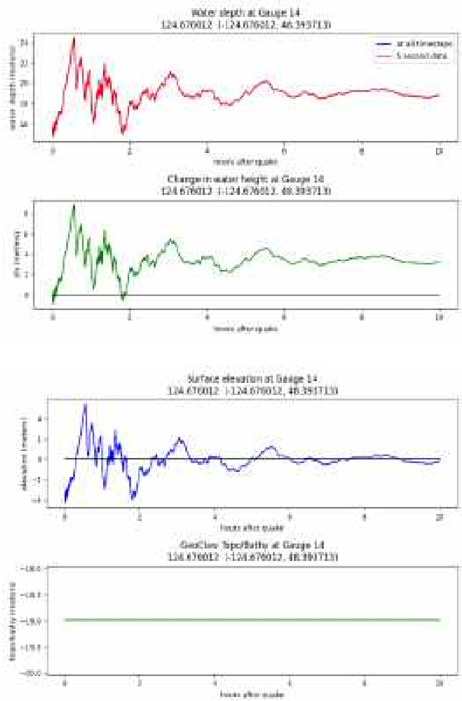


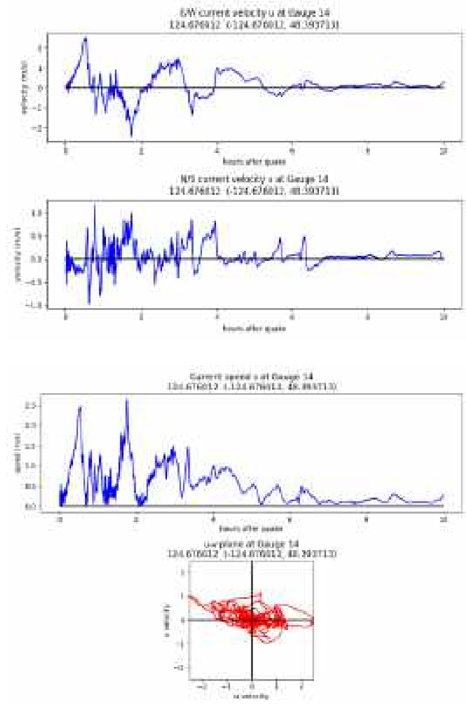

Alaska-Aleutian subduction zone scenario, MLW:



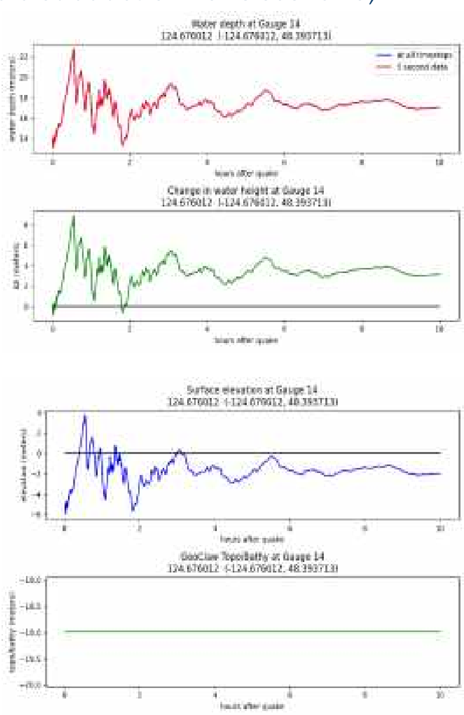
## Gauge 14: Chibahdehl Rocks

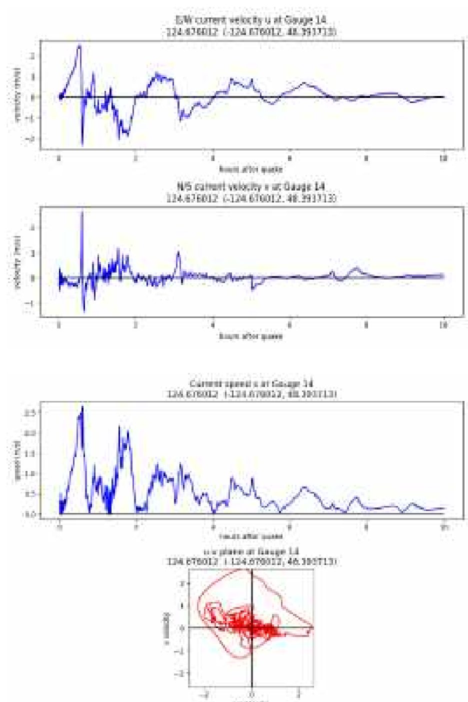
### Cascadia subduction zone scenario, MHW:



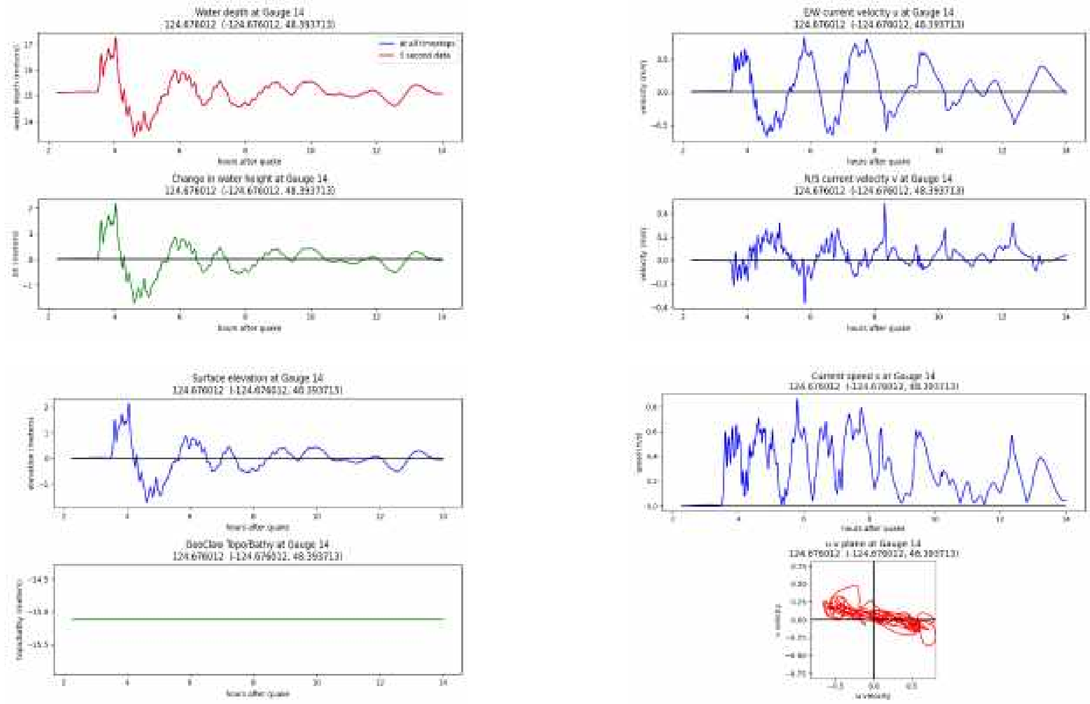


### Cascadia subduction zone scenario, MLW:

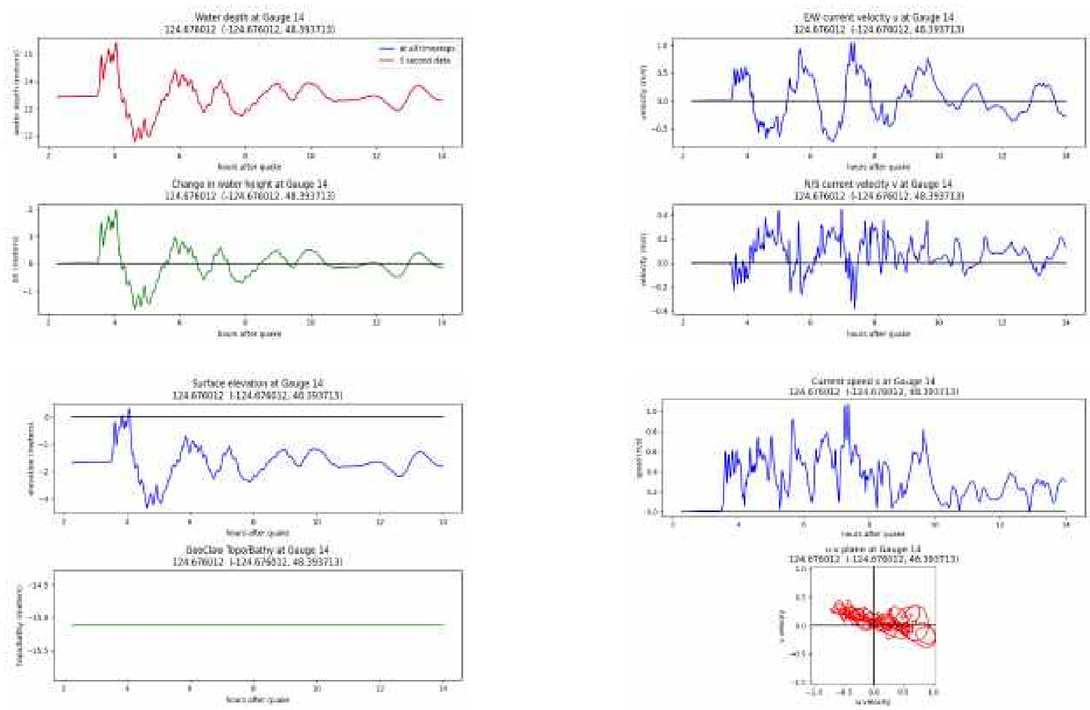




## Alaska-Aleutian subduction zone scenario, MHW:

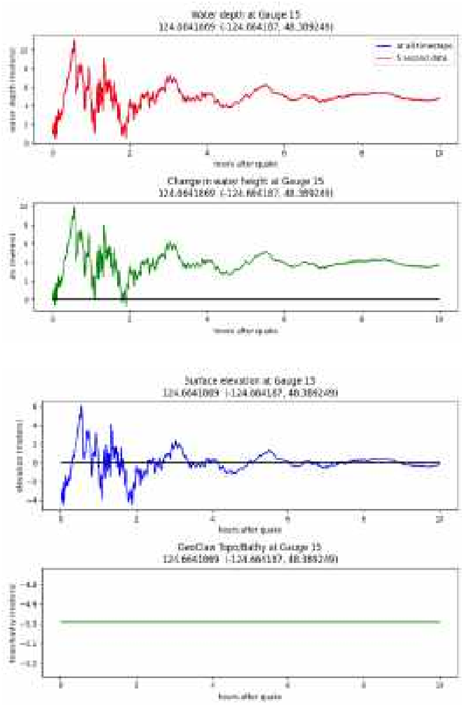


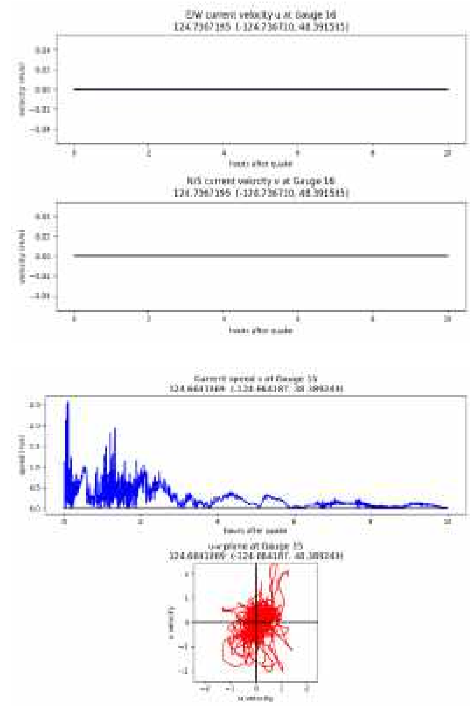

## Alaska-Aleutian subduction zone scenario, MLW:



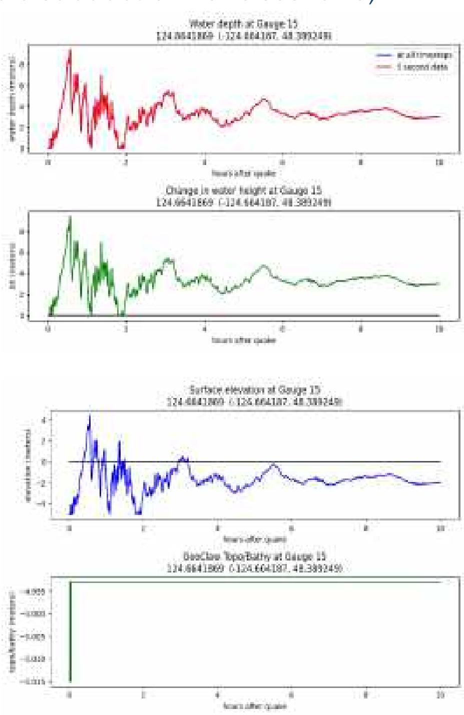
## Gauge 15: Warmhouse Beach

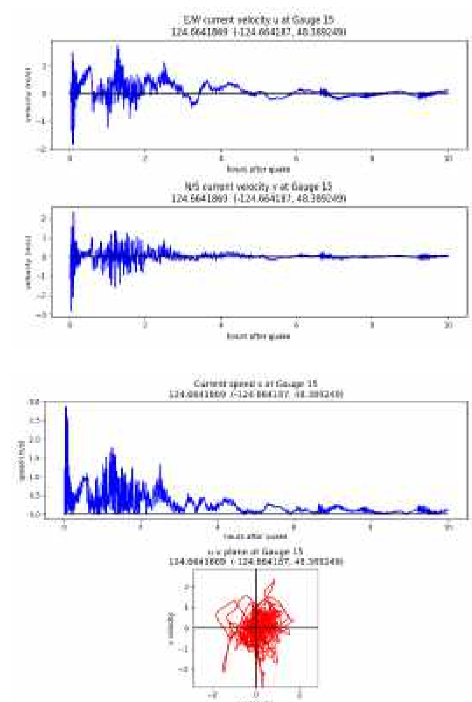
### Cascadia subduction zone scenario, MHW:



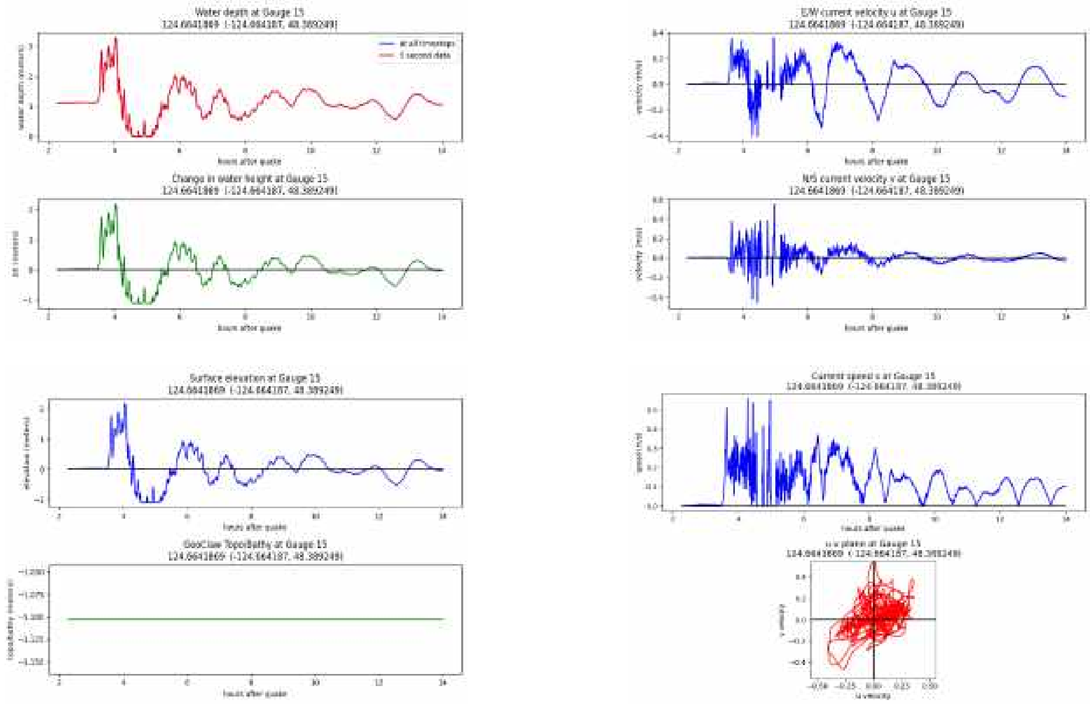


### Cascadia subduction zone scenario, MLW:

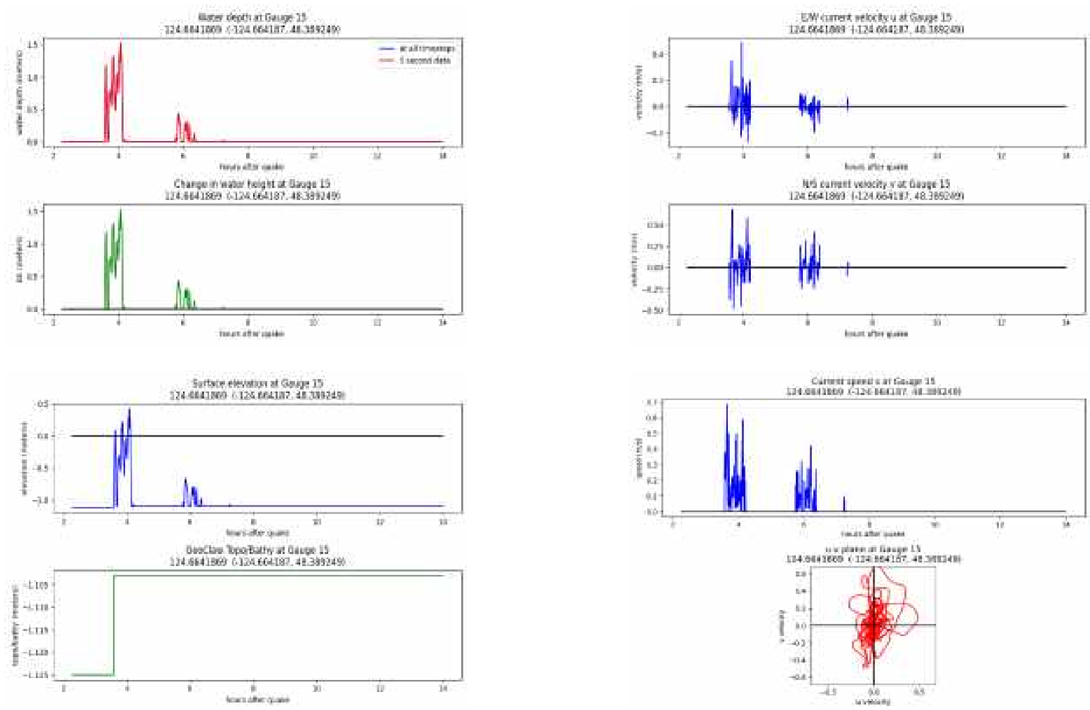




Alaska-Aleutian subduction zone scenario, MHW:

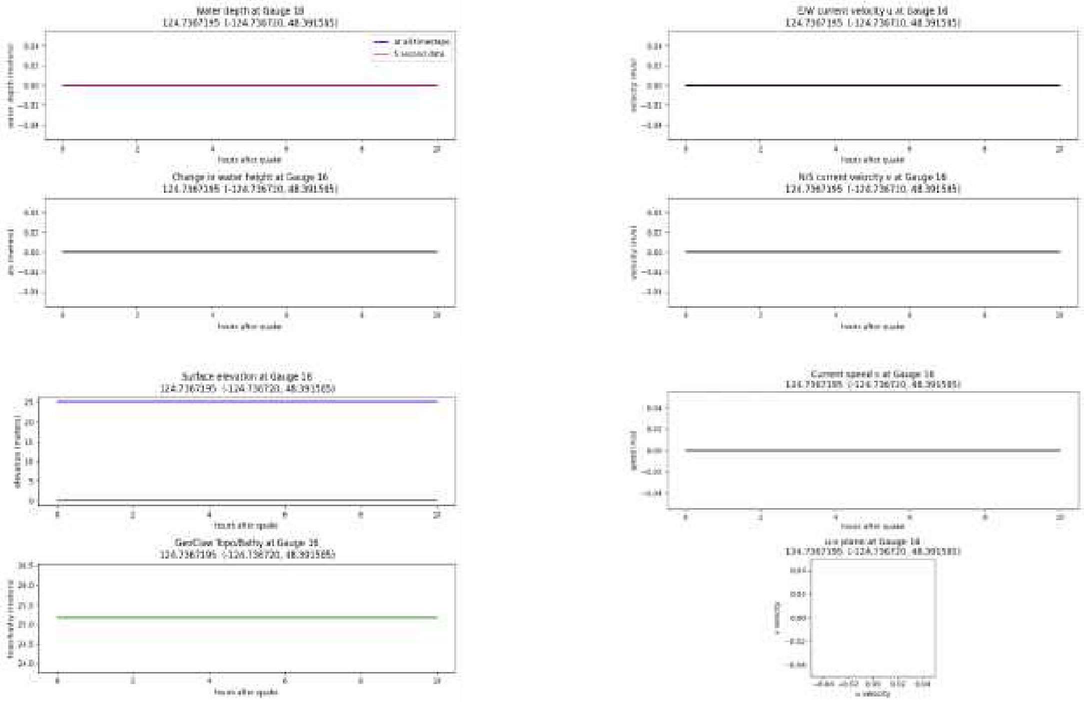



Alaska-Aleutian subduction zone scenario, MLW:

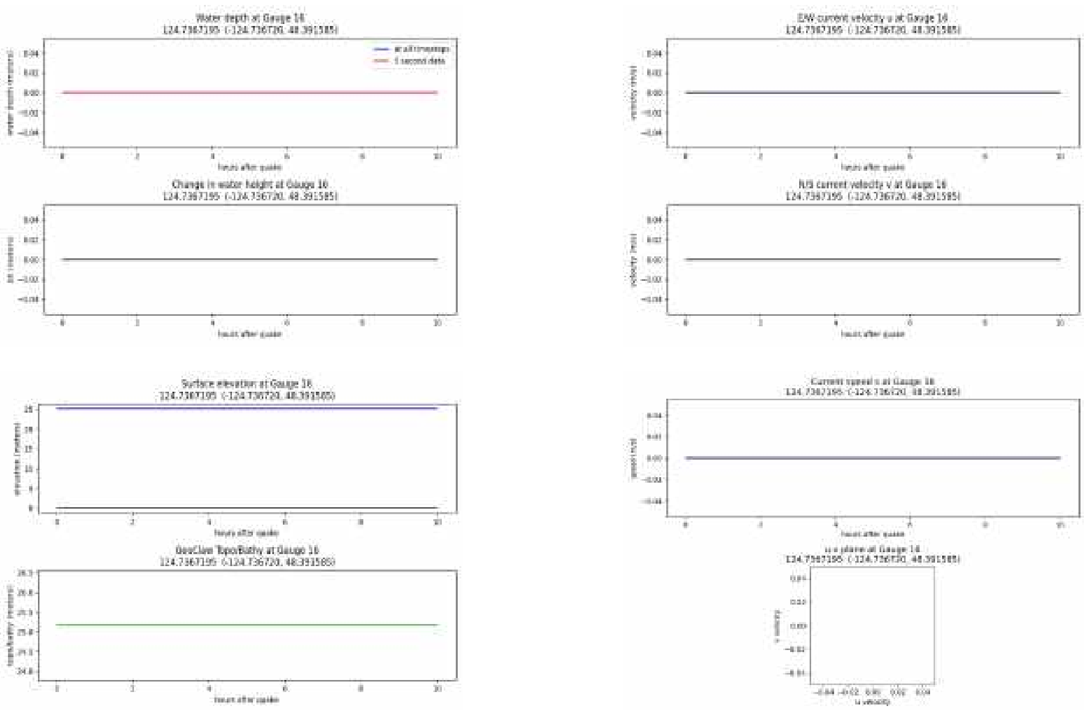


## Gauge 16: Cape Flattery Lighthouse

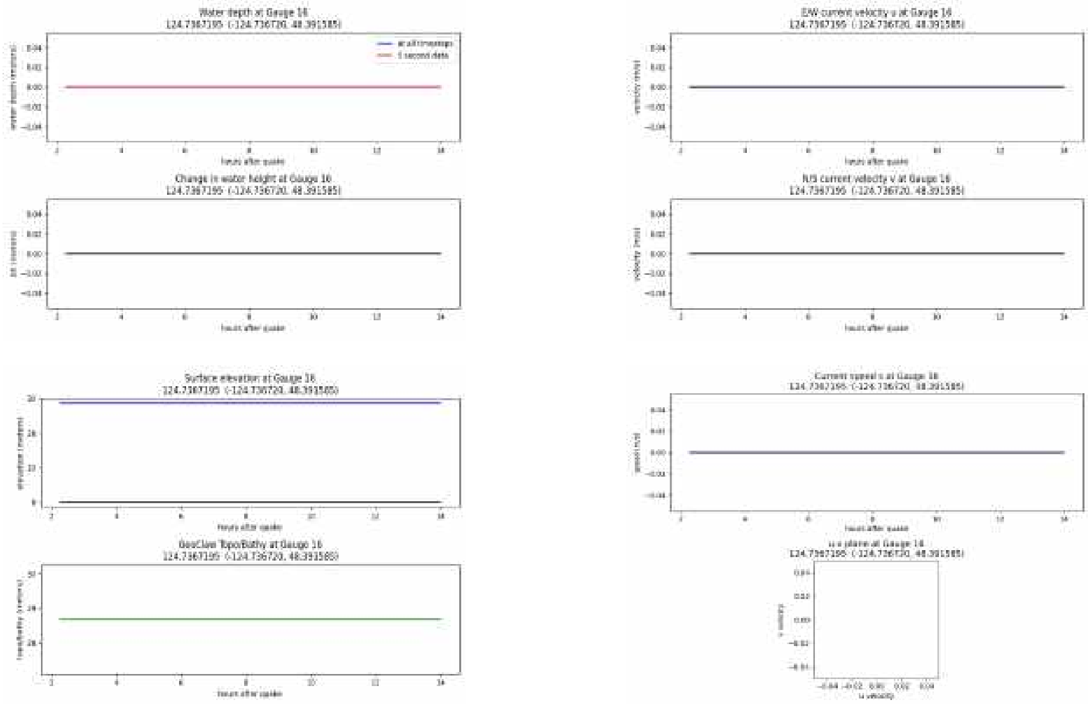
### Cascadia subduction zone scenario, MHW:



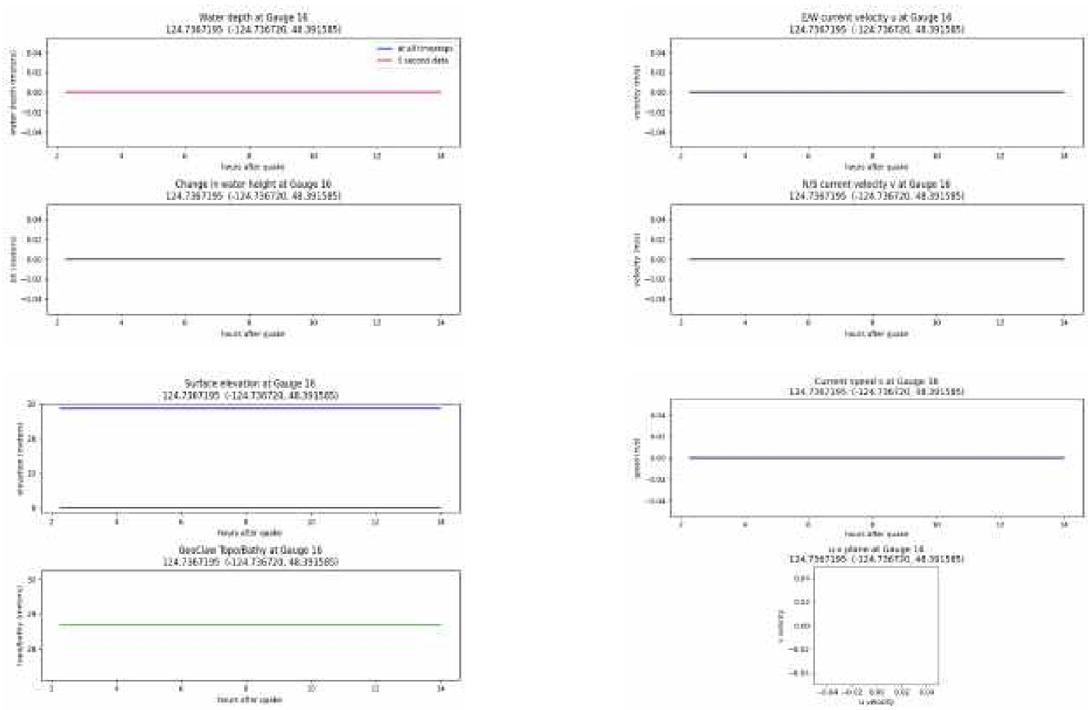
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

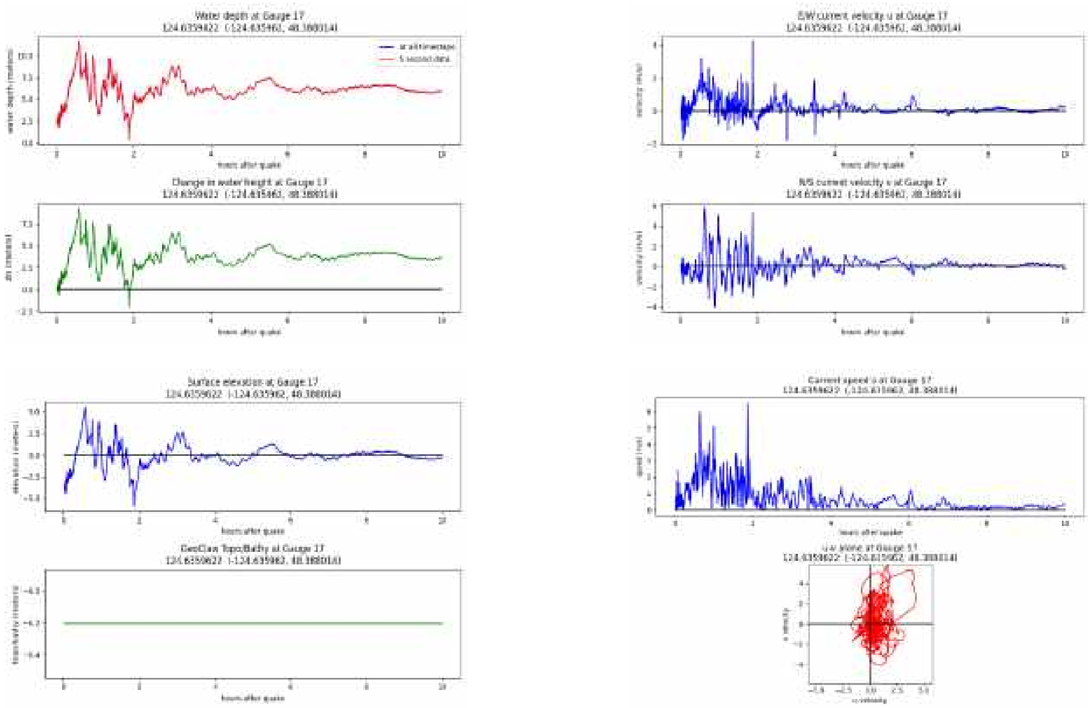



## Alaska-Aleutian subduction zone scenario, MLW:

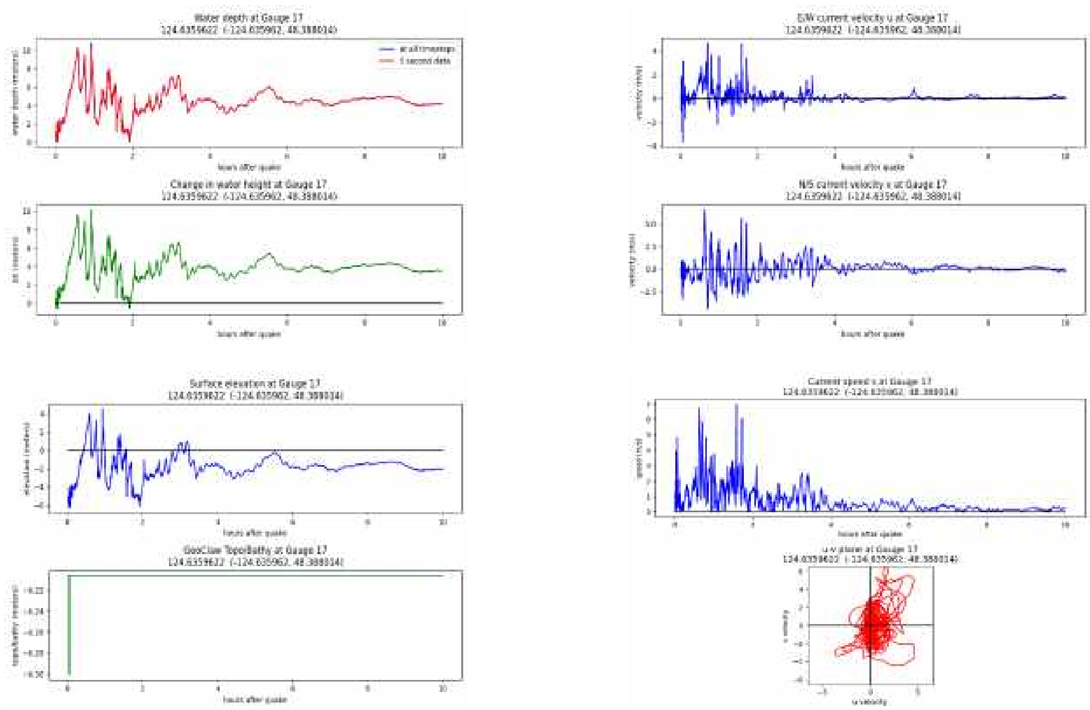


## Gauge 17: Koitlah Point

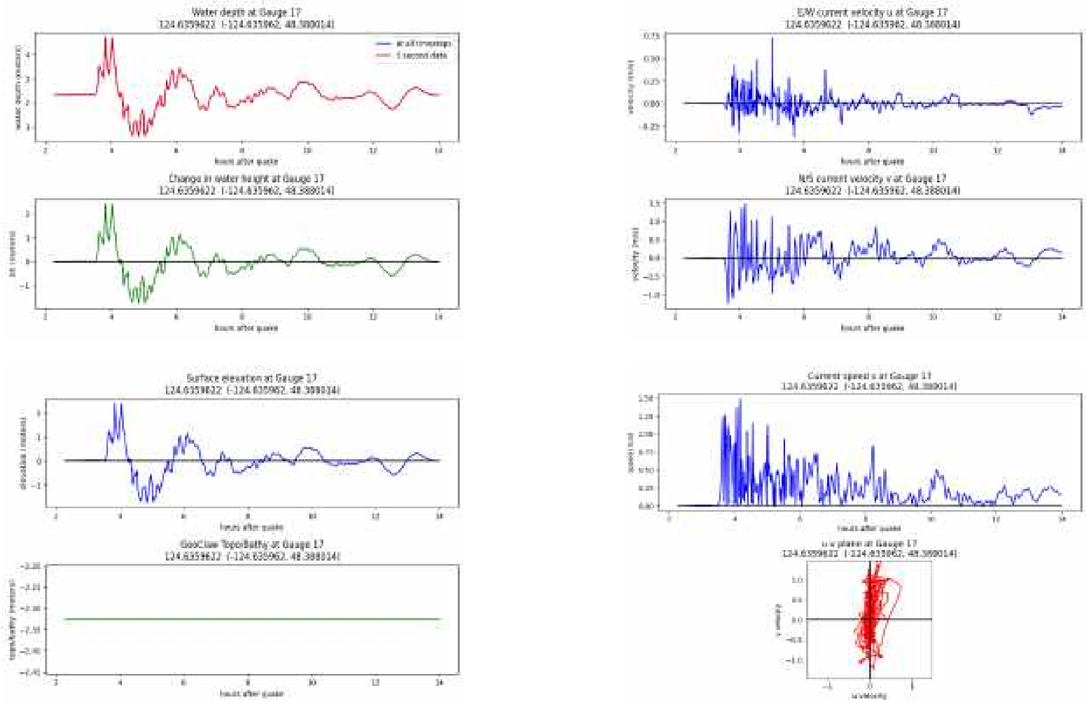
### Cascadia subduction zone scenario, MHW:



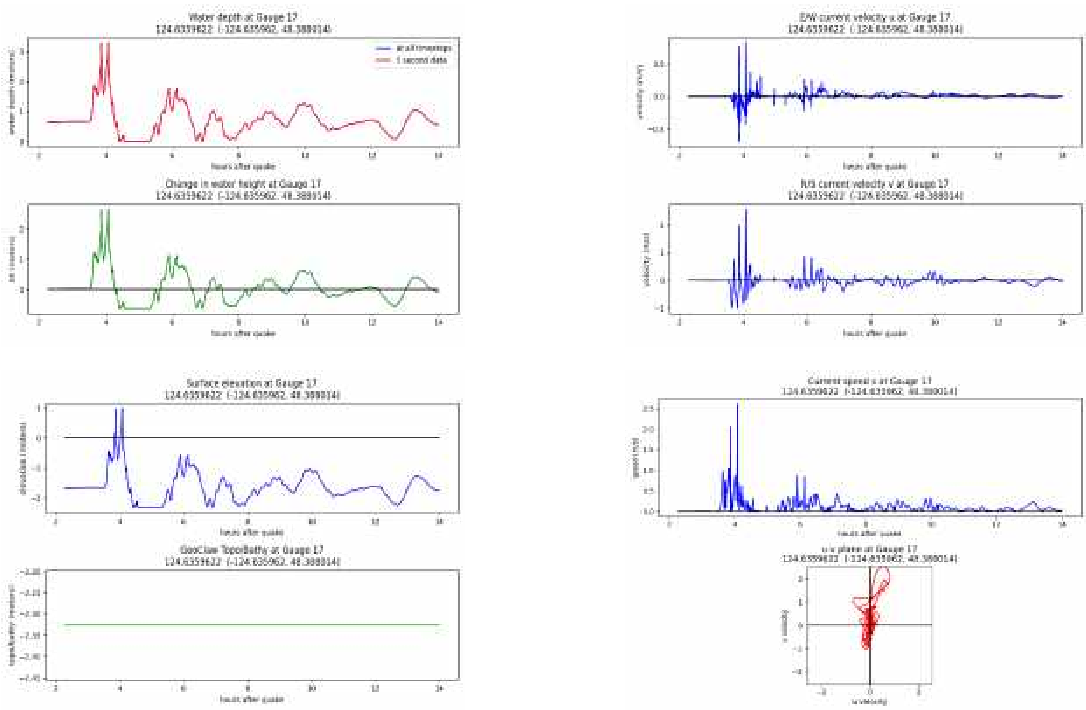
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

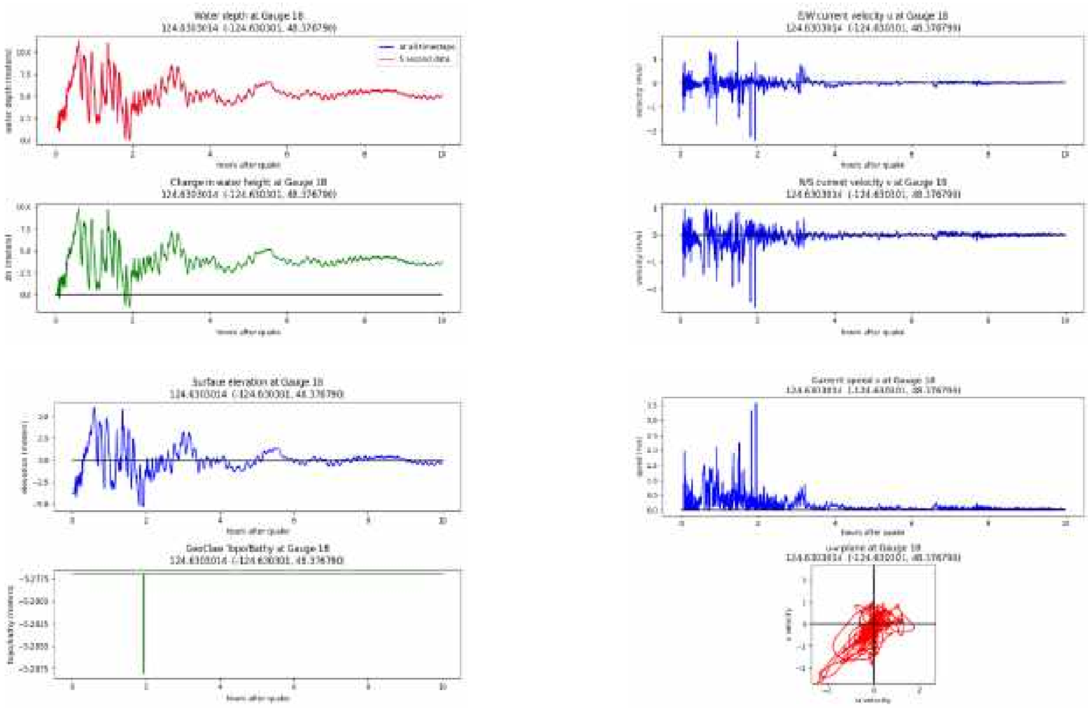



## Alaska-Aleutian subduction zone scenario, MLW:

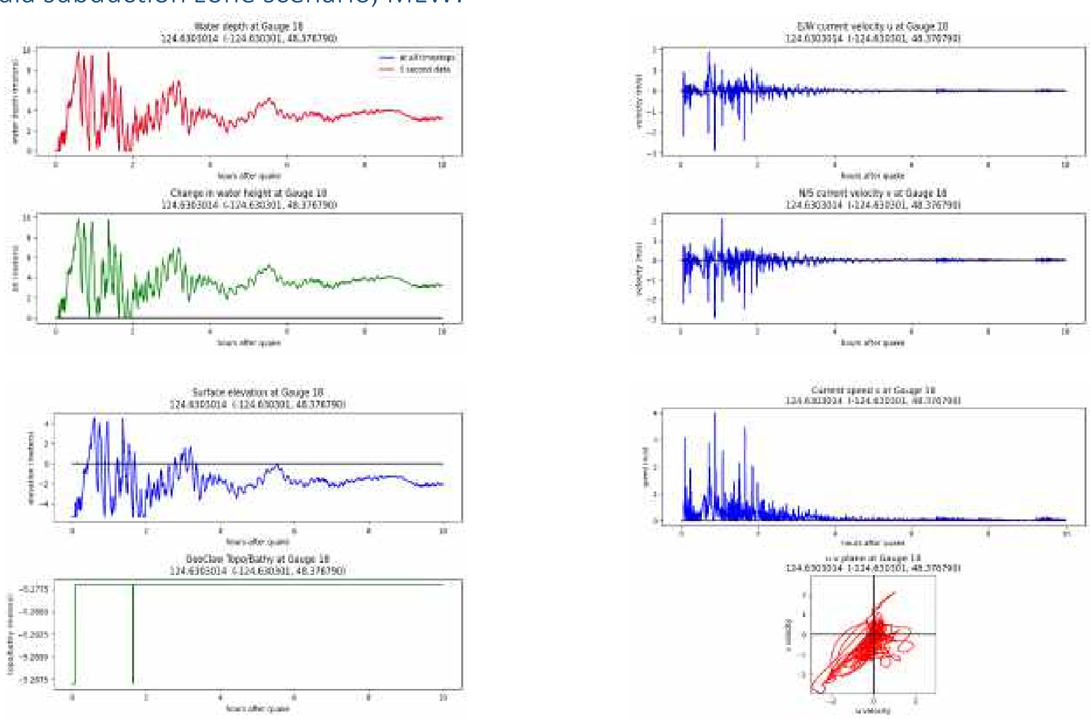


## Gauge 18: North of Boom Rd Jetty entrance

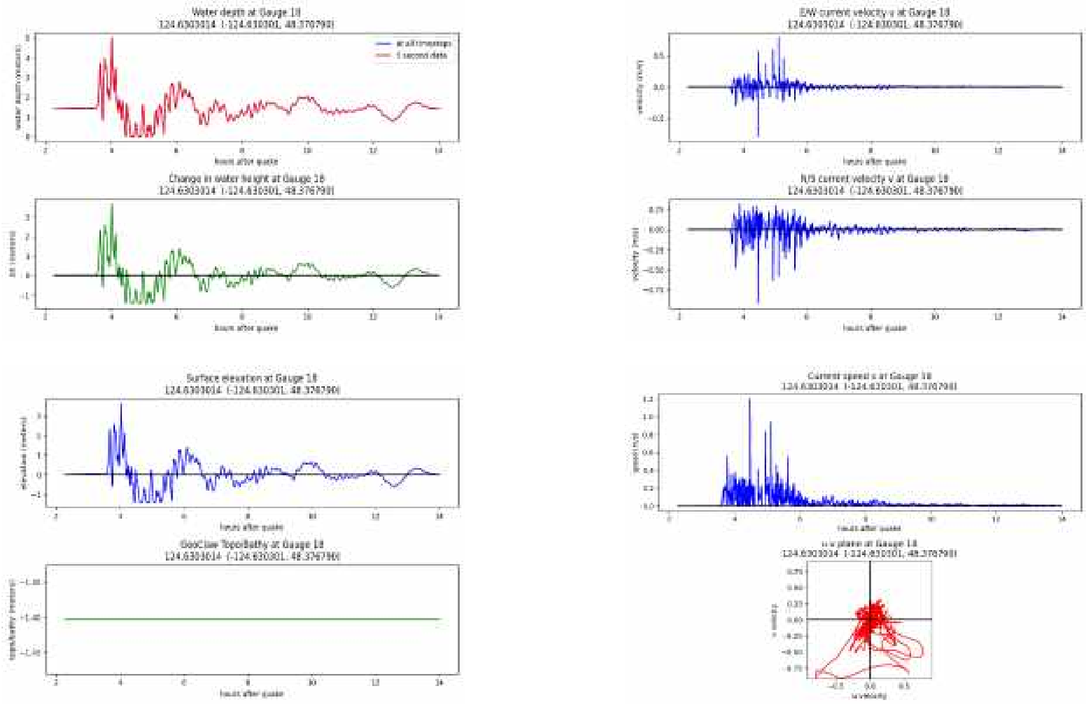
### Cascadia subduction zone scenario, MHW:



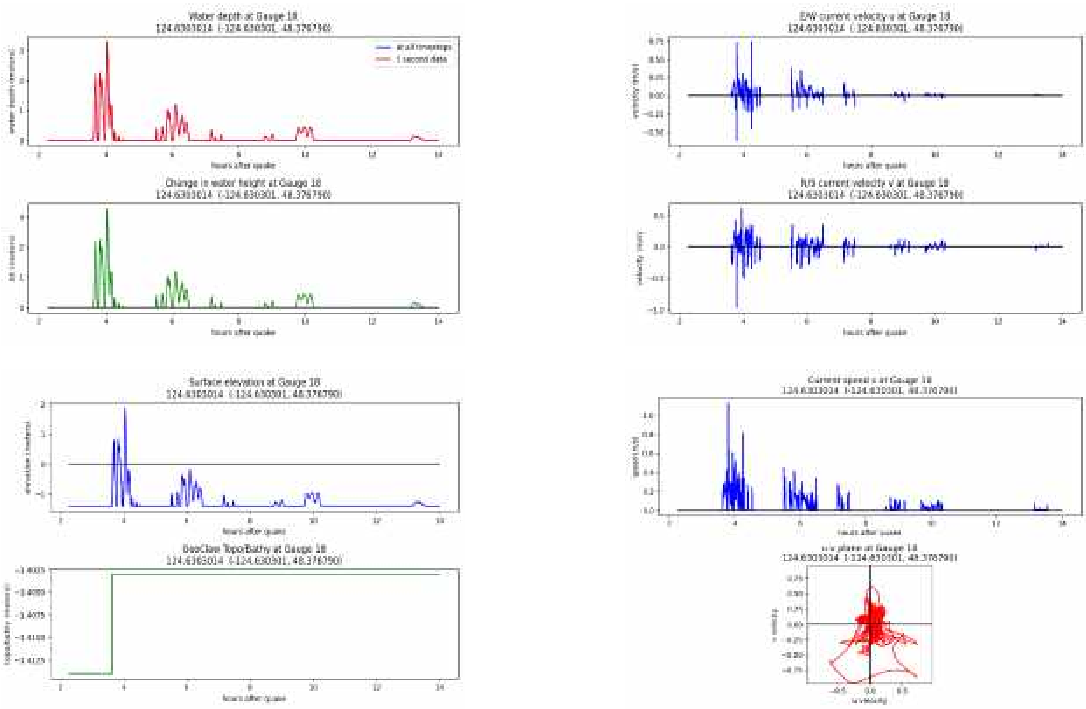
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

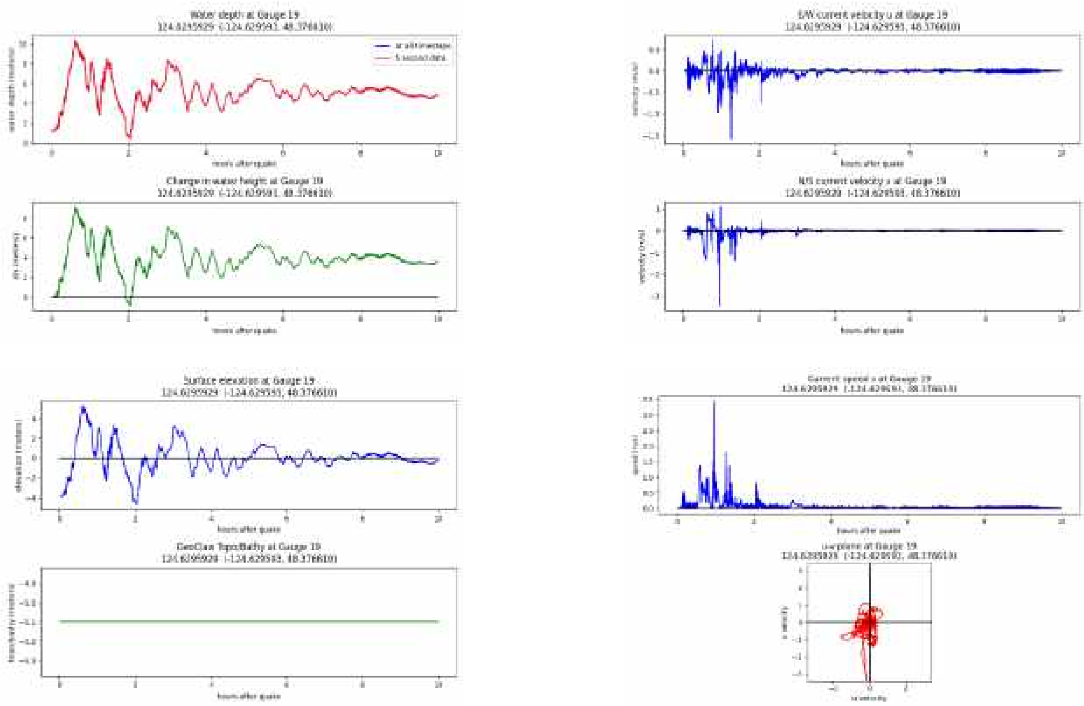



## Alaska-Aleutian subduction zone scenario, MLW:

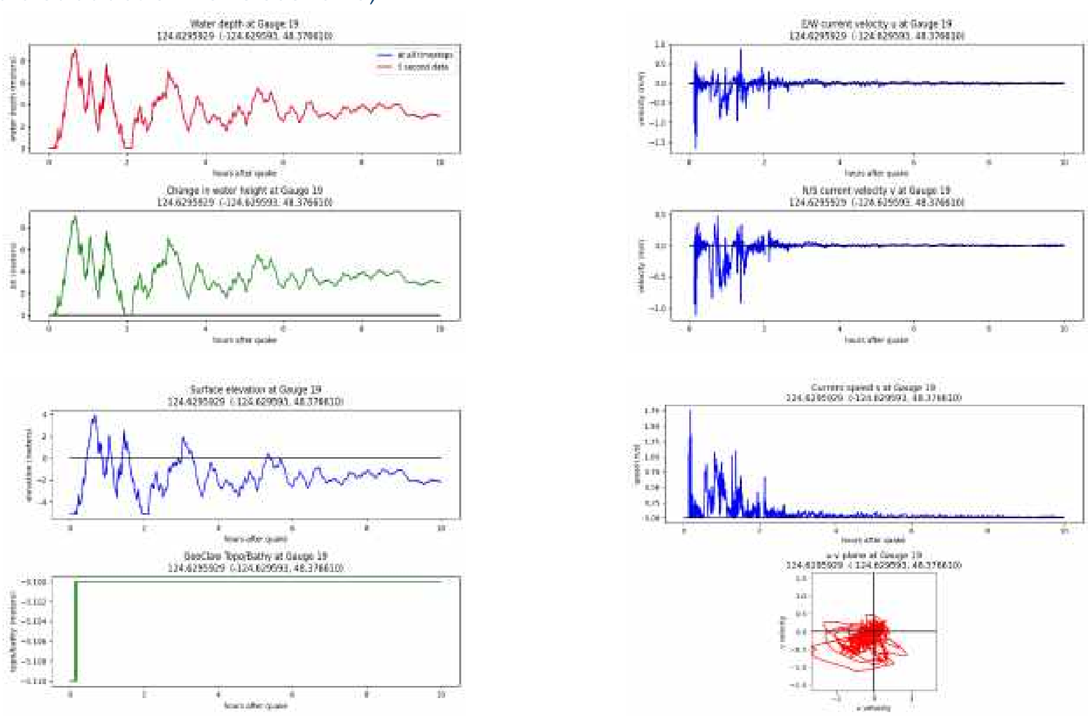


## Gauge 19: South of Boom Rd Jetty entrance

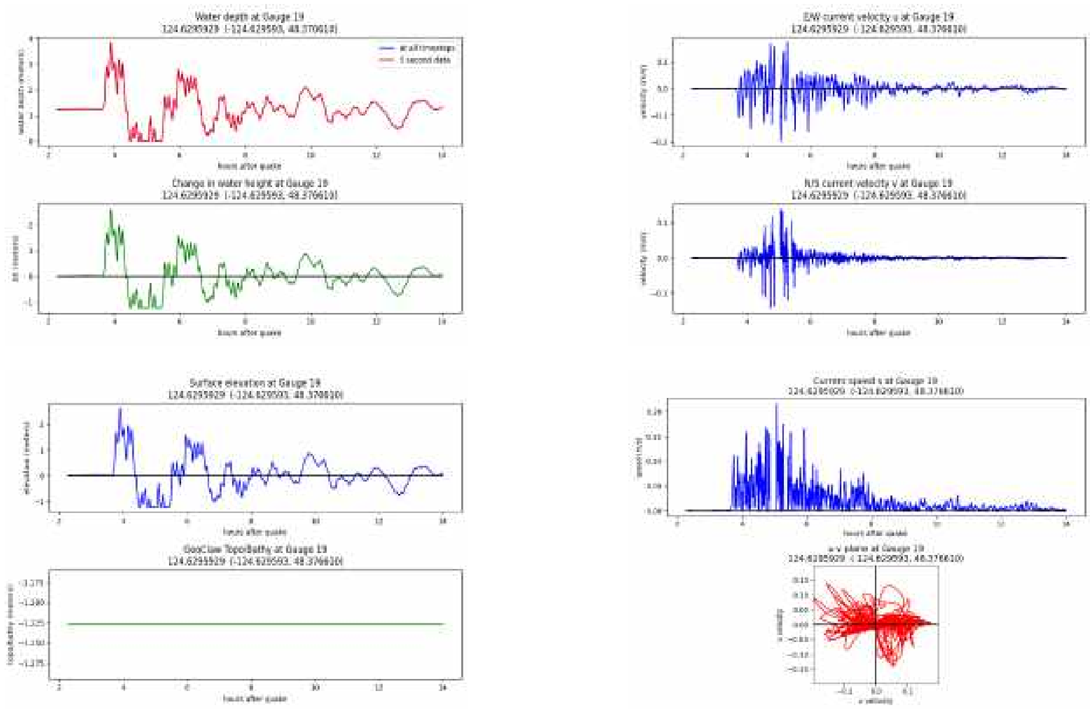
### Cascadia subduction zone scenario, MHW:



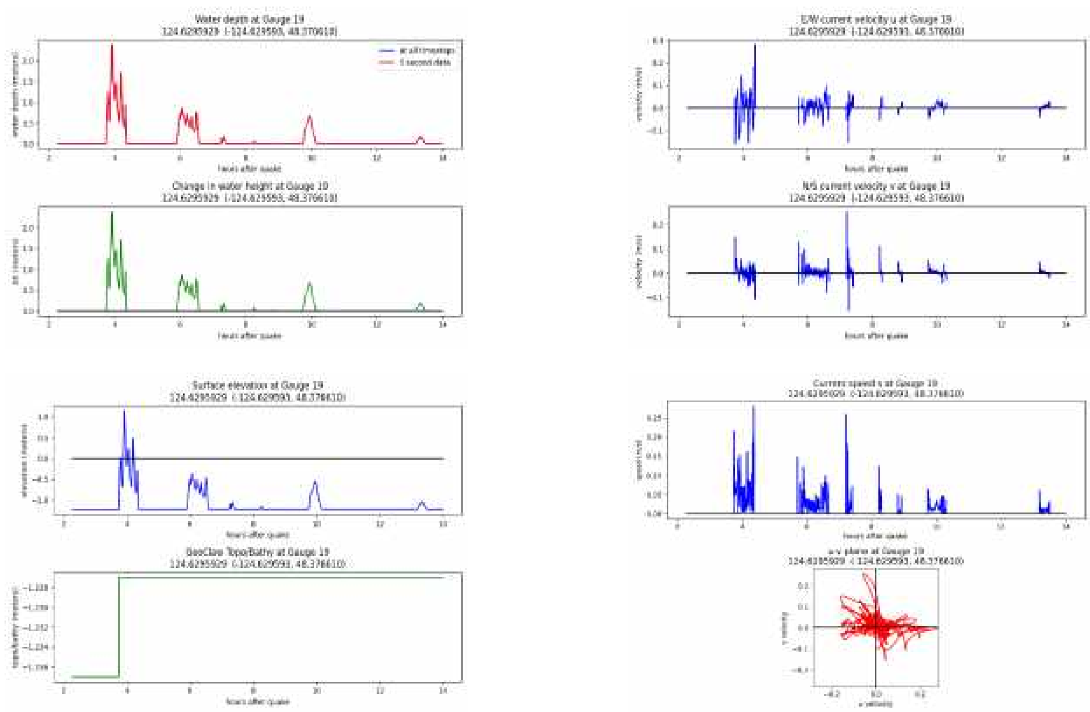
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

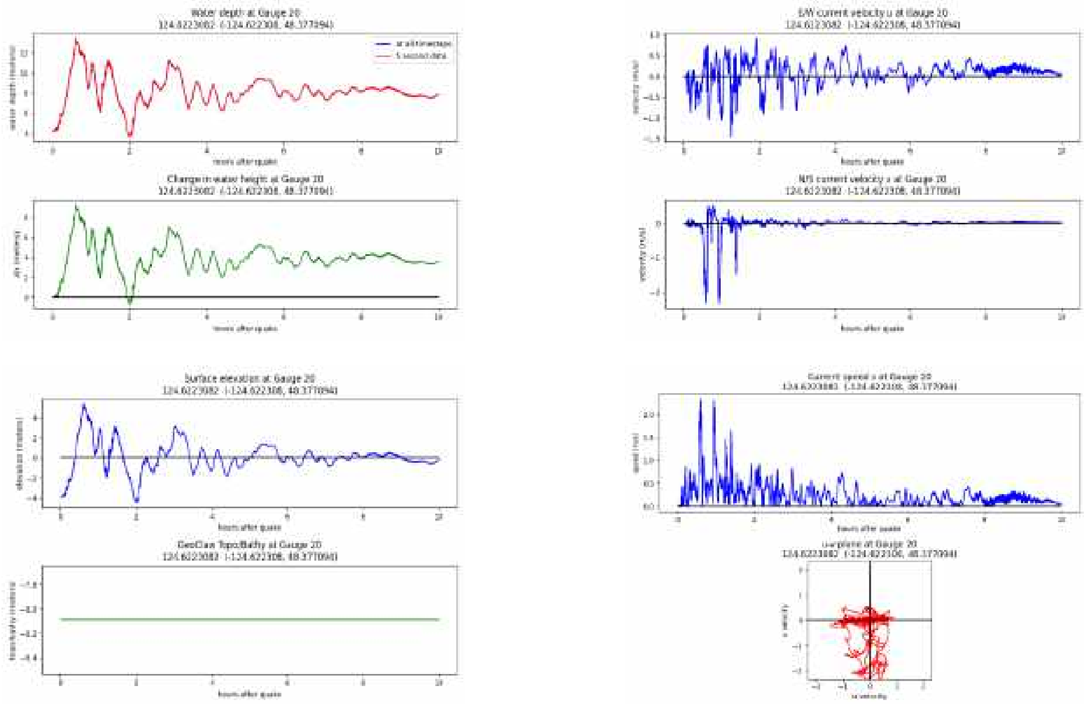



## Alaska-Aleutian subduction zone scenario, MLW:

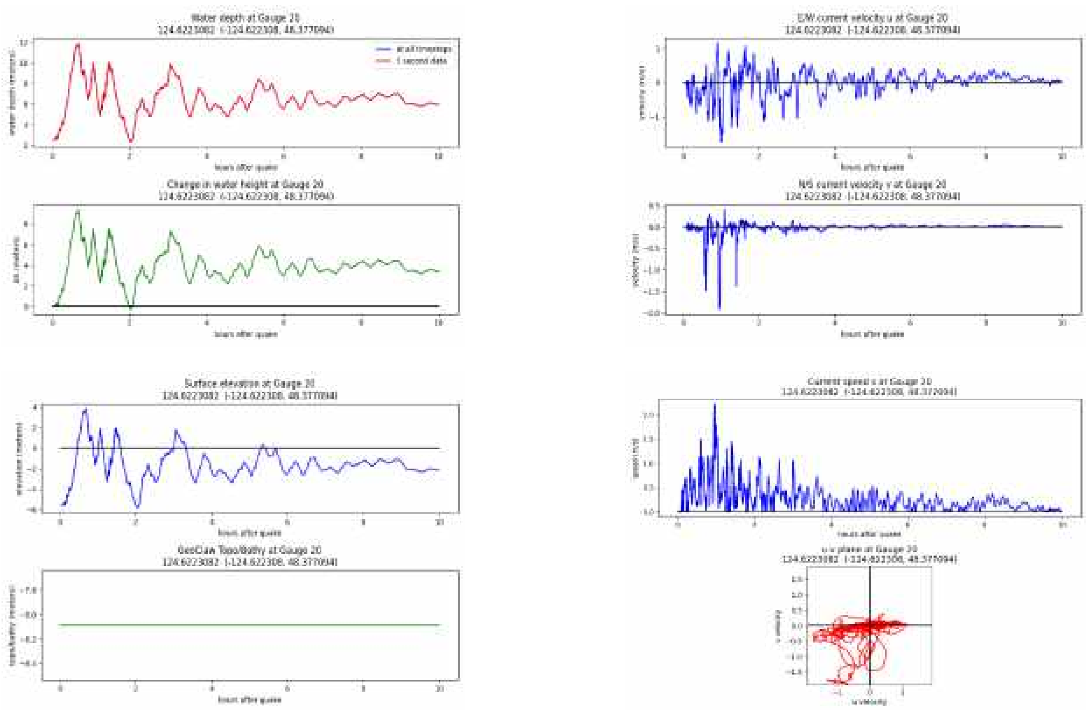


## Gauge 20: Neah Bay Scenic Viewpoint, south

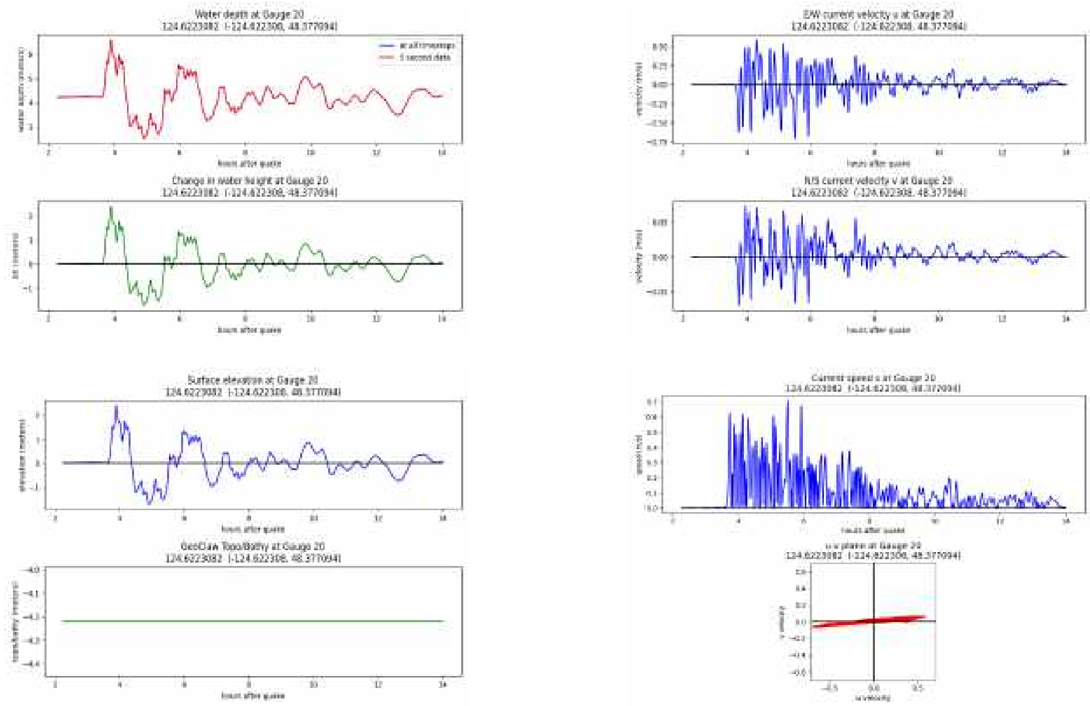
### Cascadia subduction zone scenario, MHW:



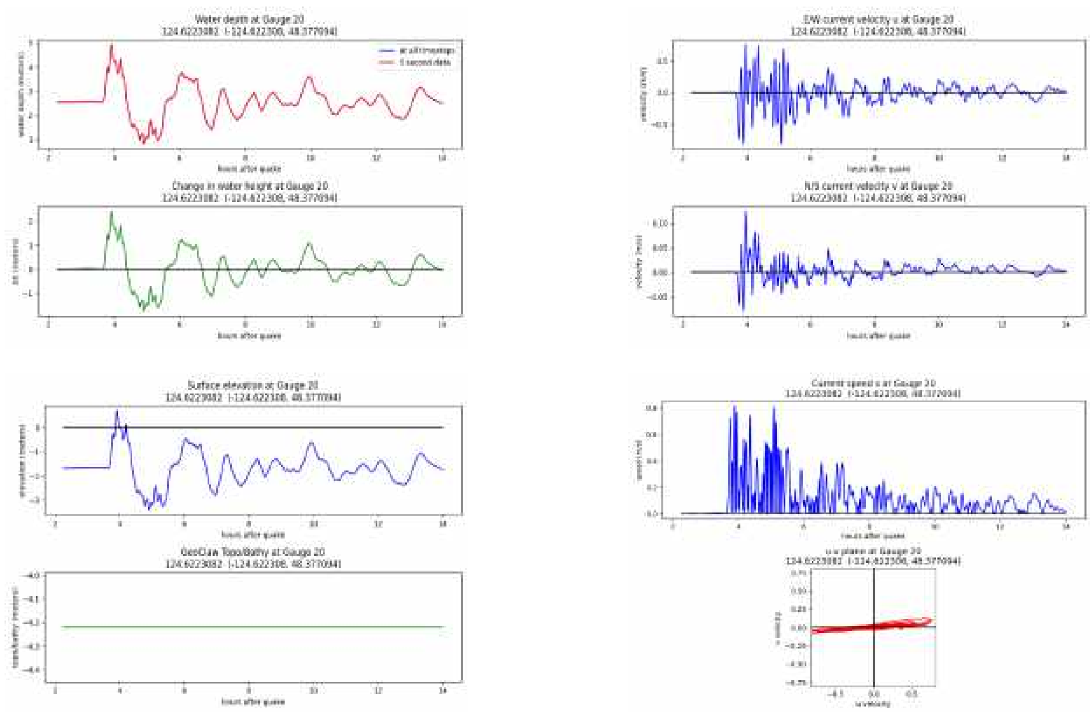

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

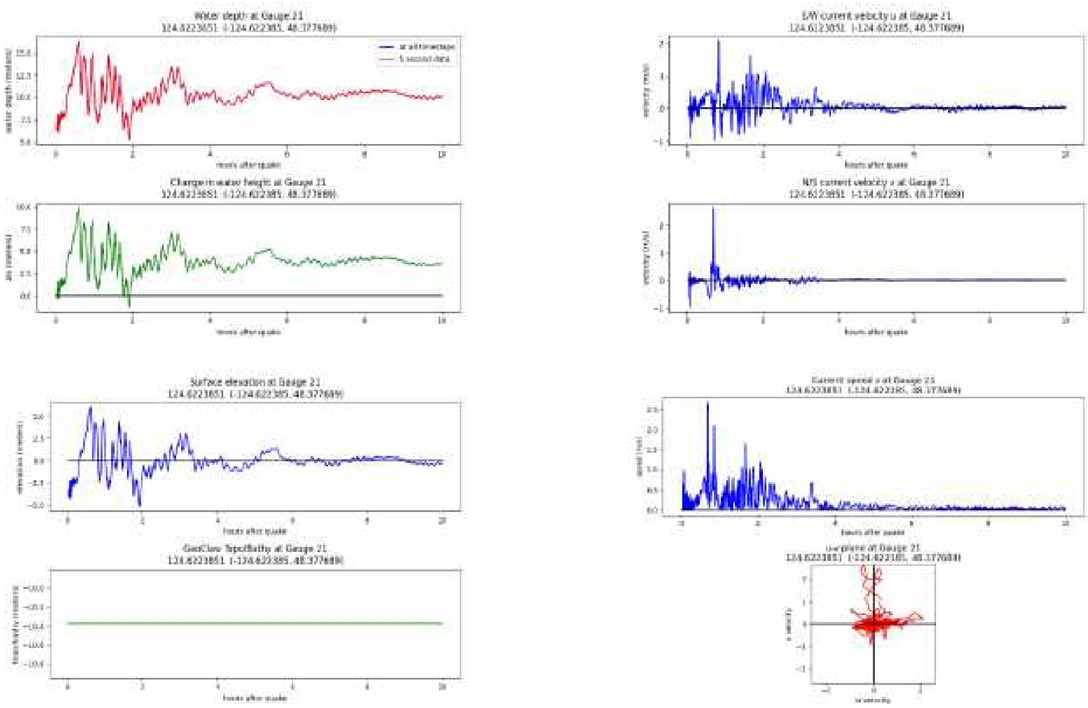



## Alaska-Aleutian subduction zone scenario, MLW:

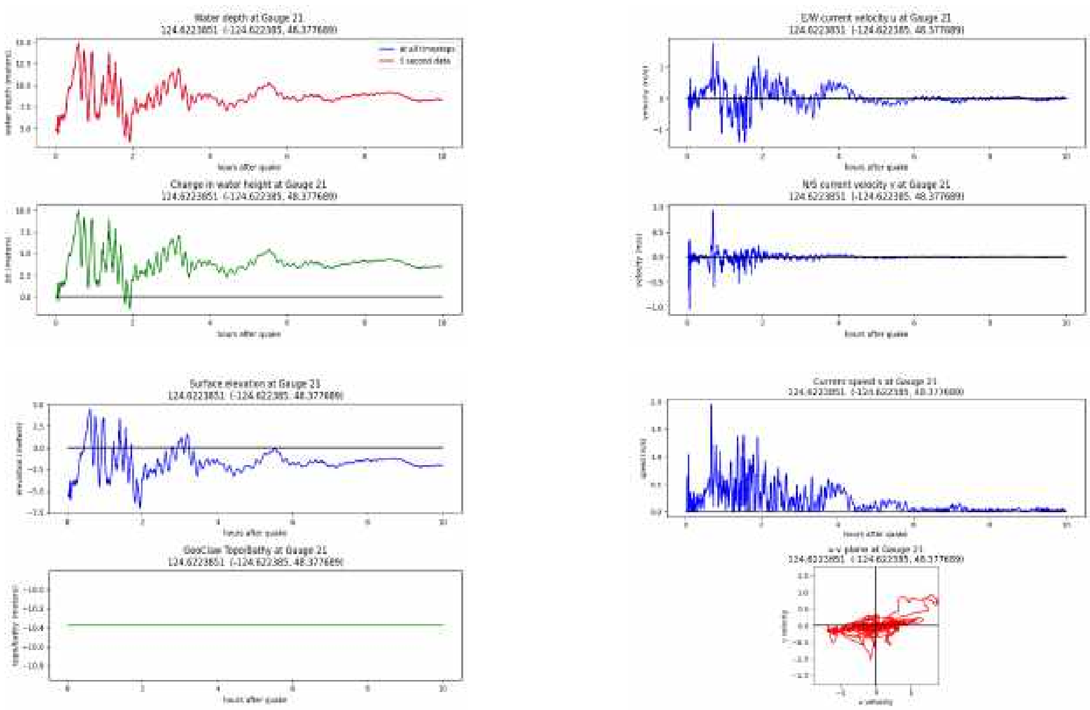


## Gauge 21: Neah Bay Scenic Viewpoint, north

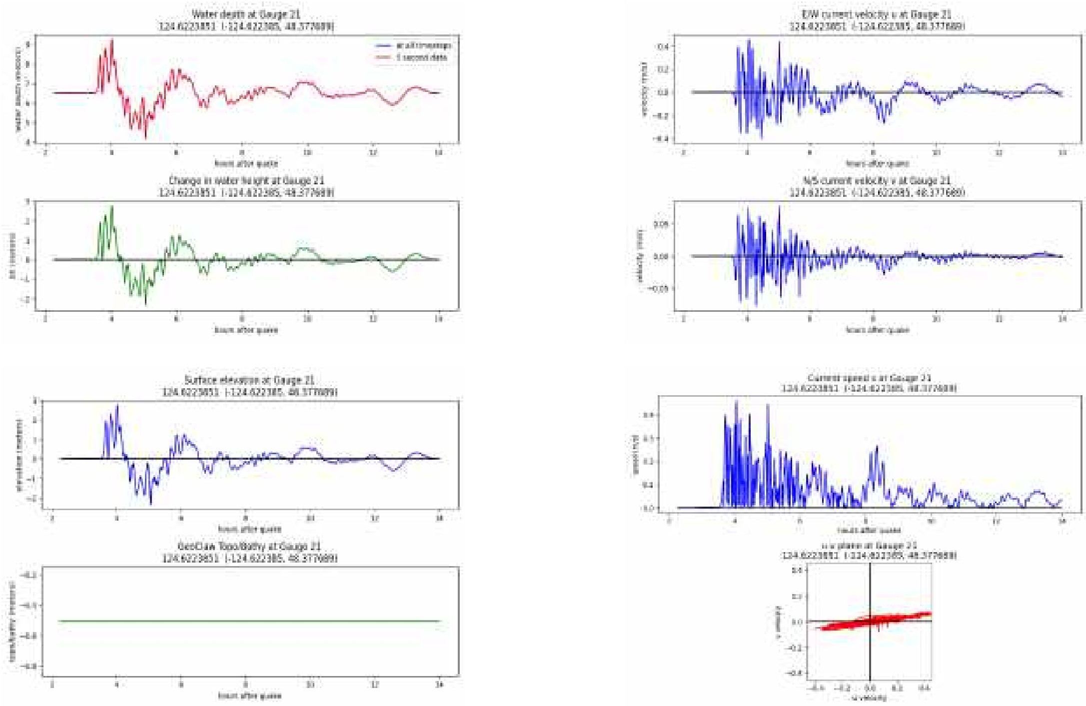
### Cascadia subduction zone scenario, MHW:



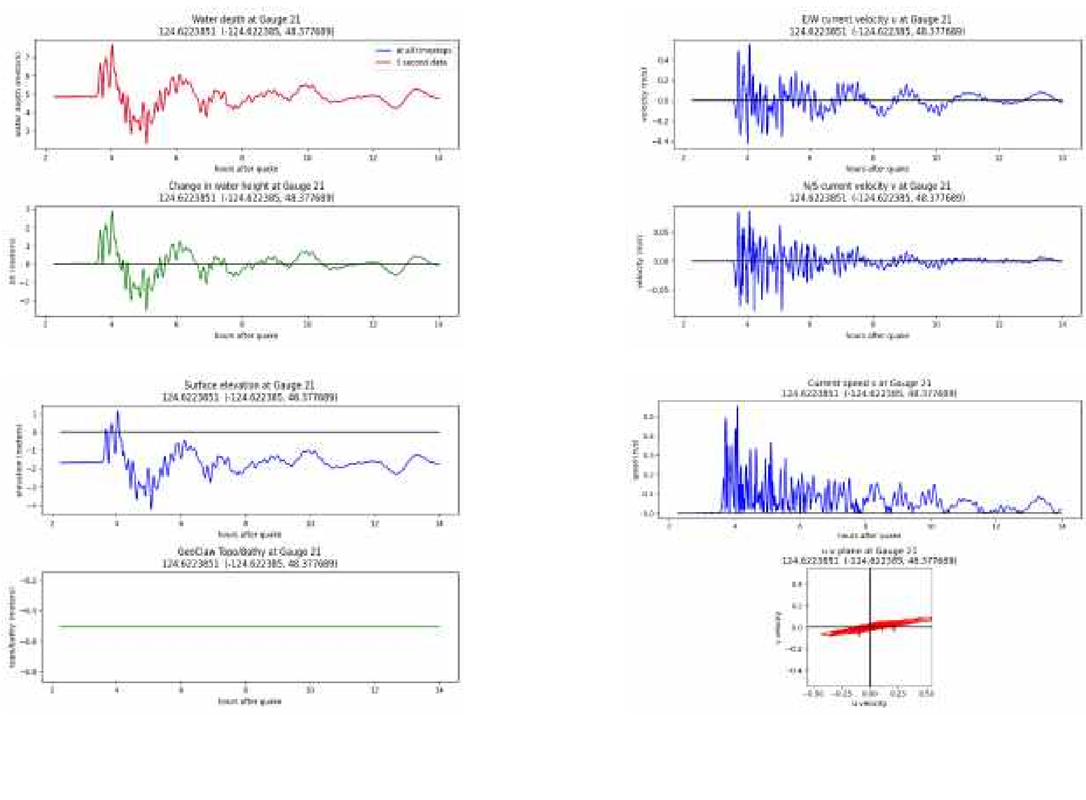

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

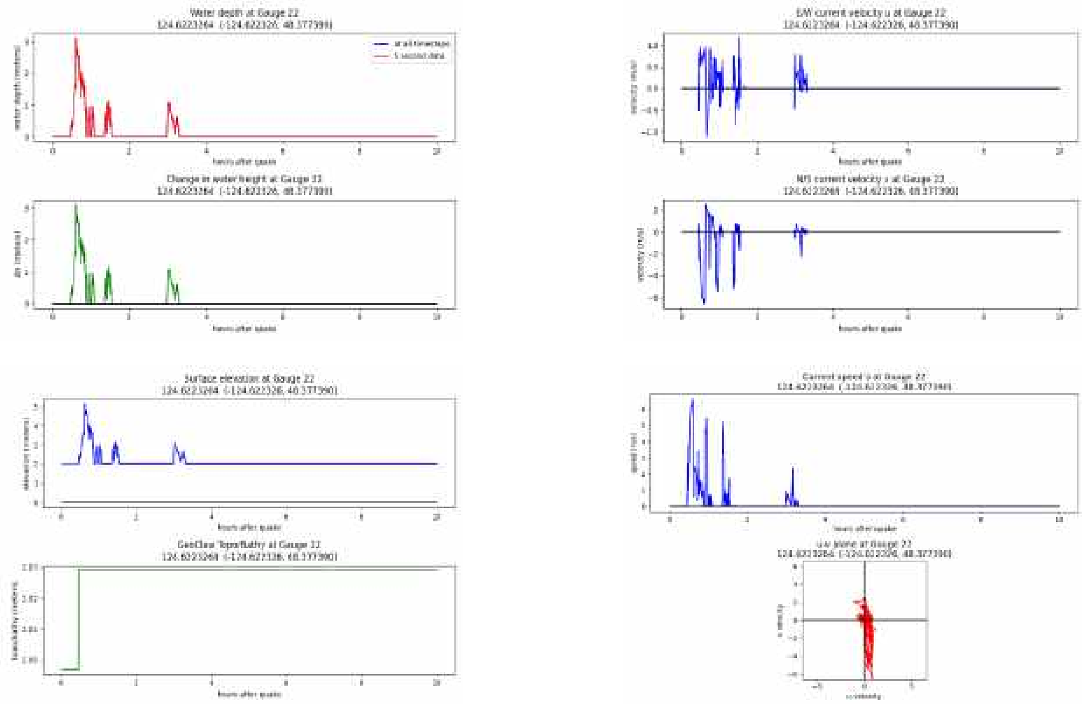



## Alaska-Aleutian subduction zone scenario, MLW:

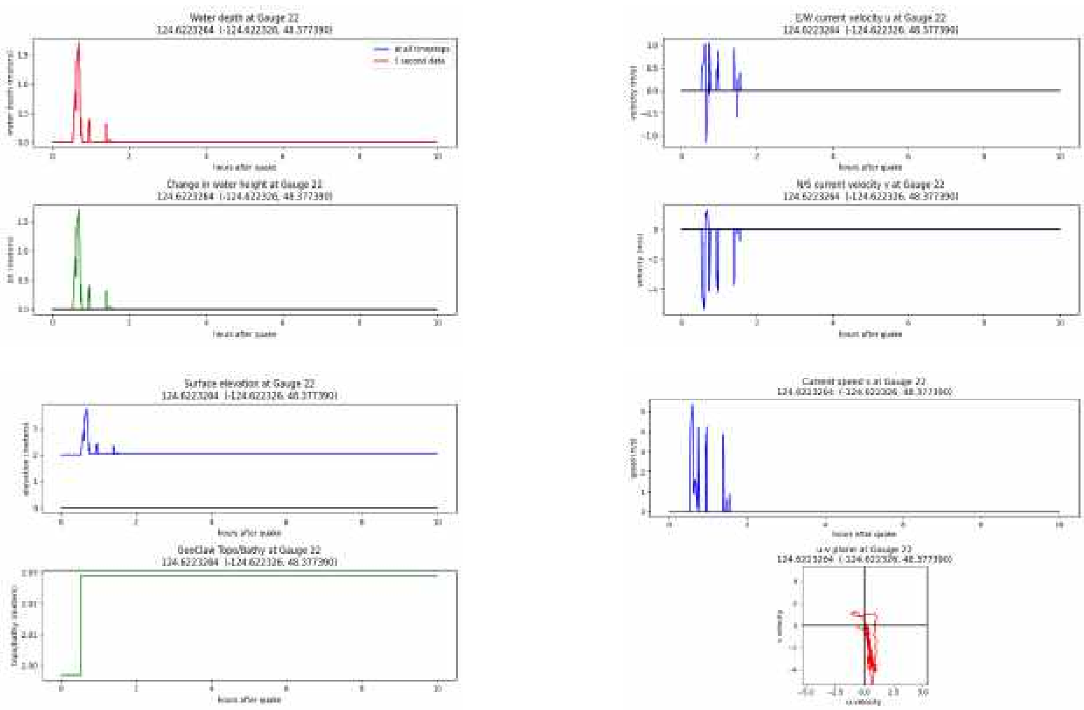


## Gauge 22: Neah Bay Scenic Viewpoint

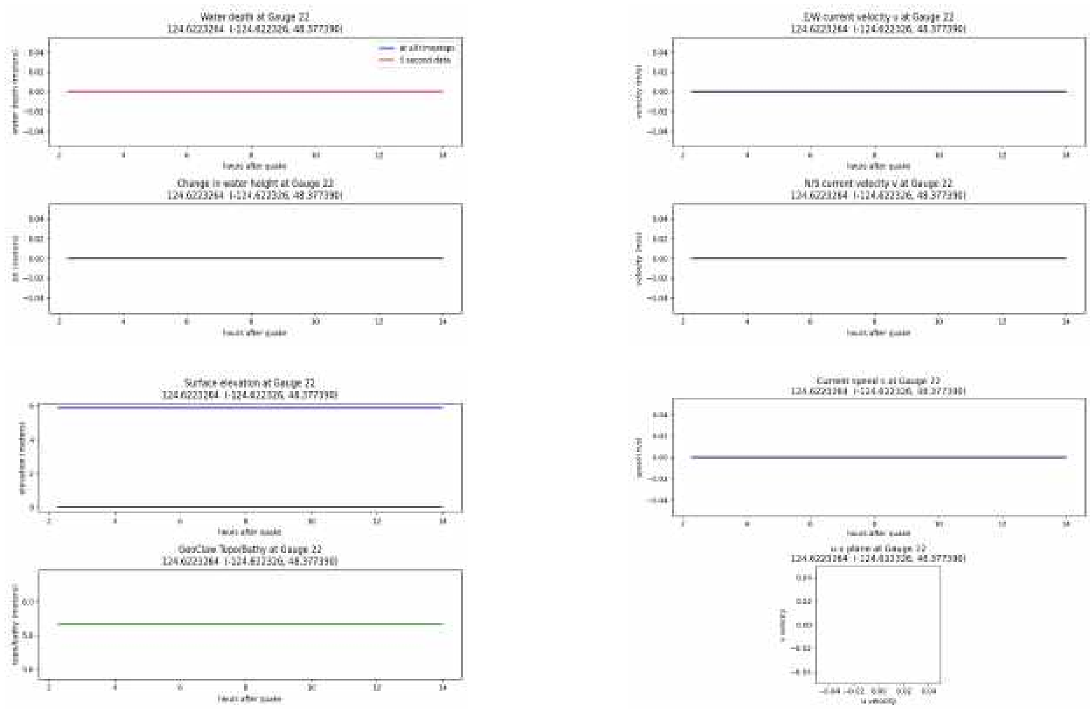
### Cascadia subduction zone scenario, MHW:



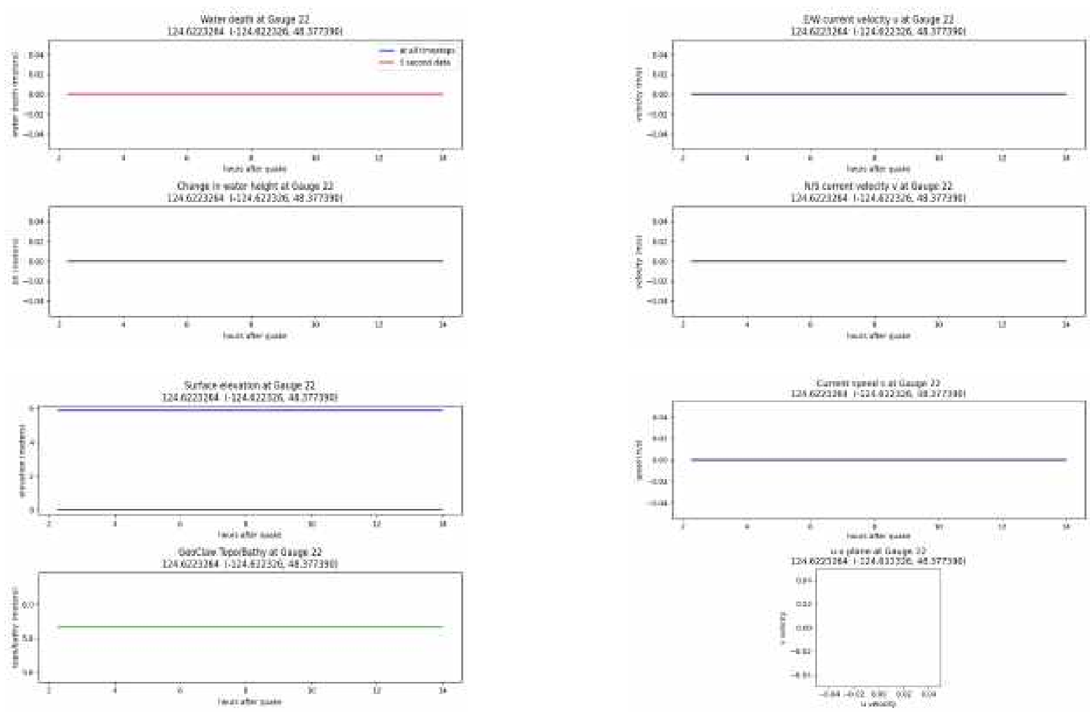

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

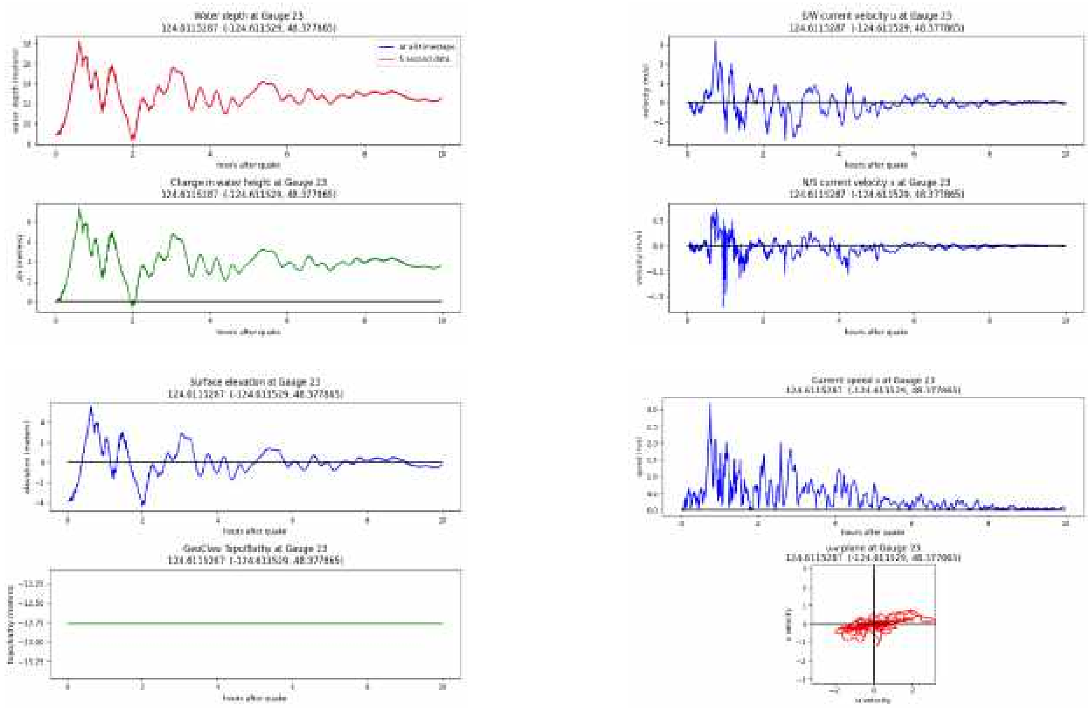


## Alaska-Aleutian subduction zone scenario, MLW:

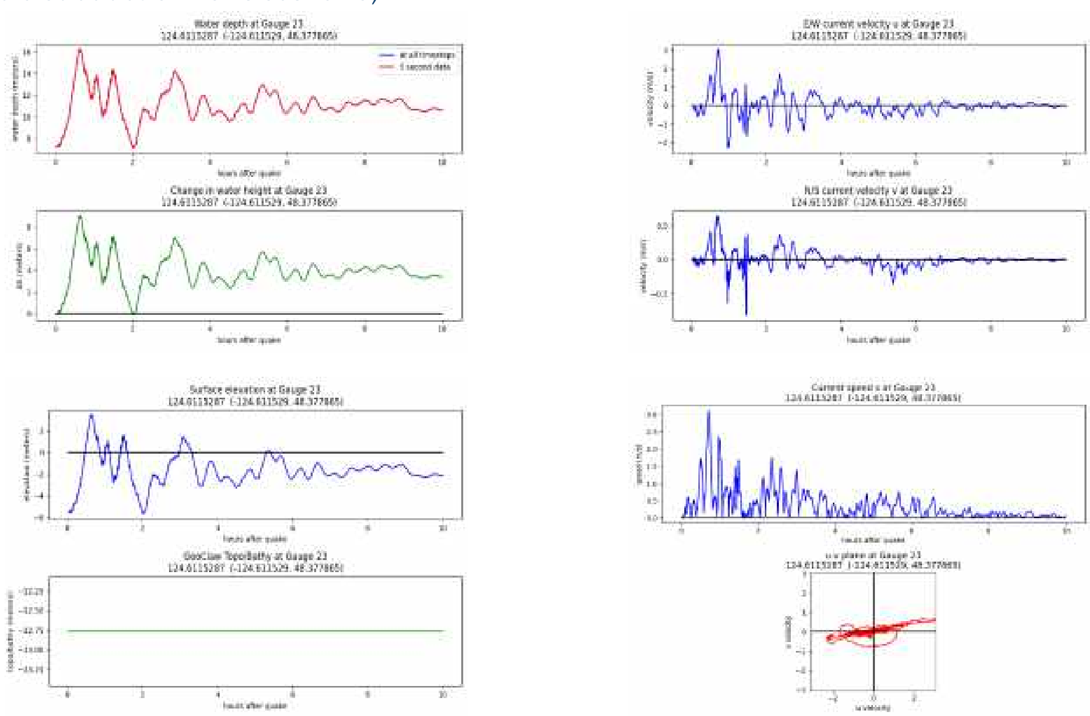


## Gauge 23: South of Jetty, center

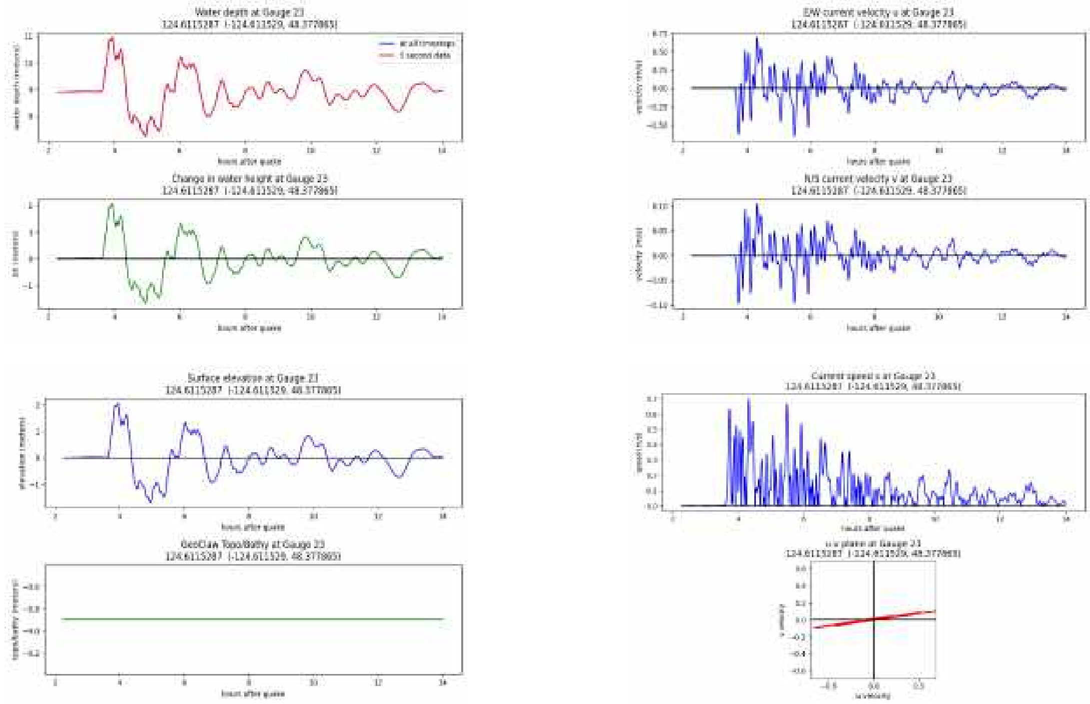
### Cascadia subduction zone scenario, MHW:



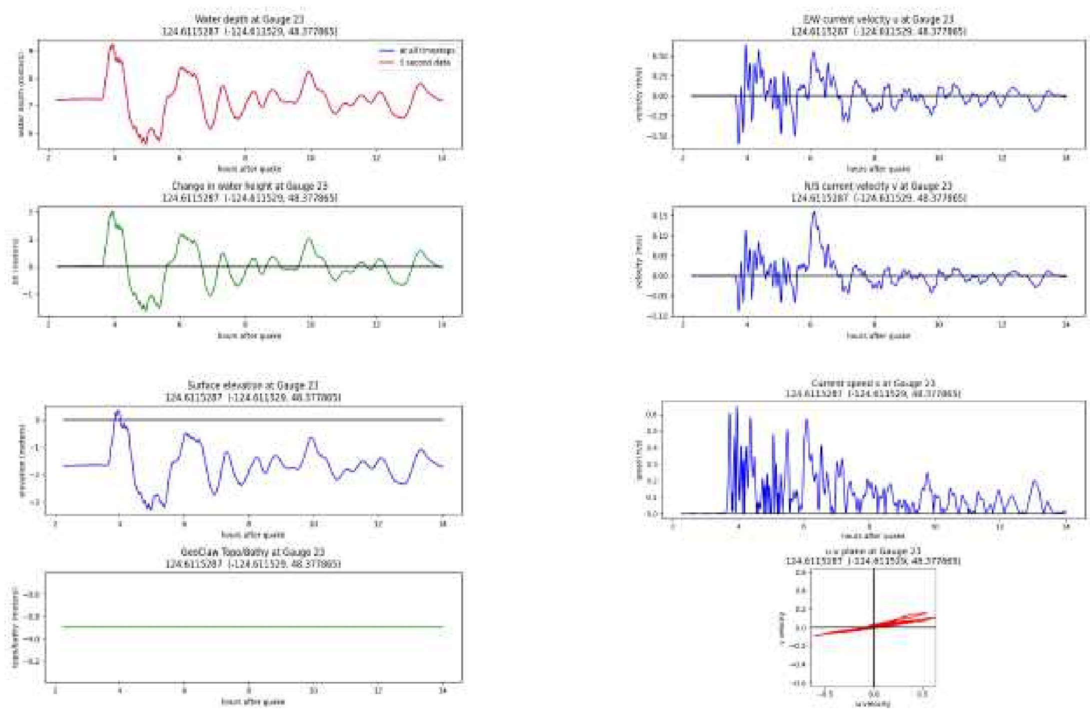

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

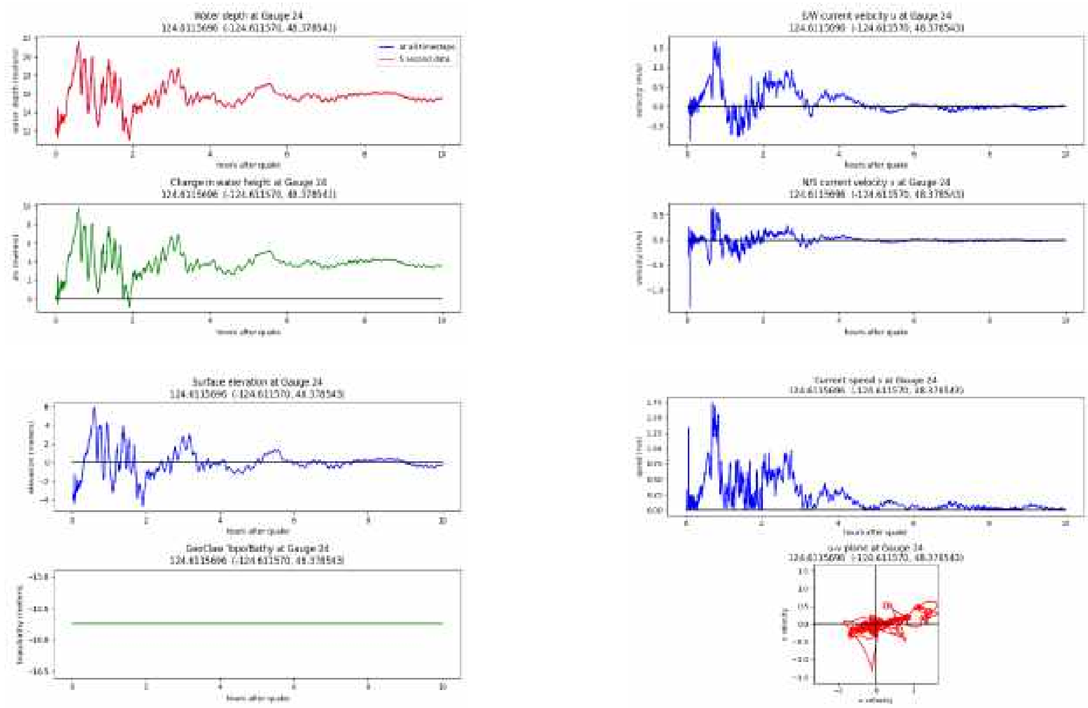



## Alaska-Aleutian subduction zone scenario, MLW:

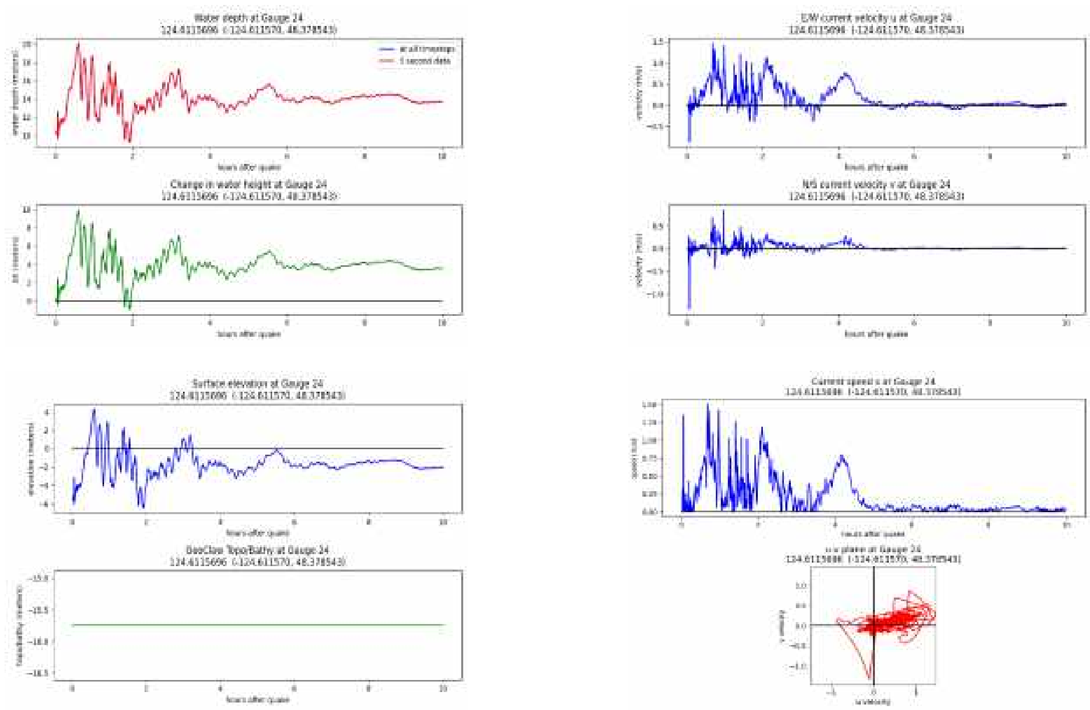


## Gauge 24: North of jetty, center

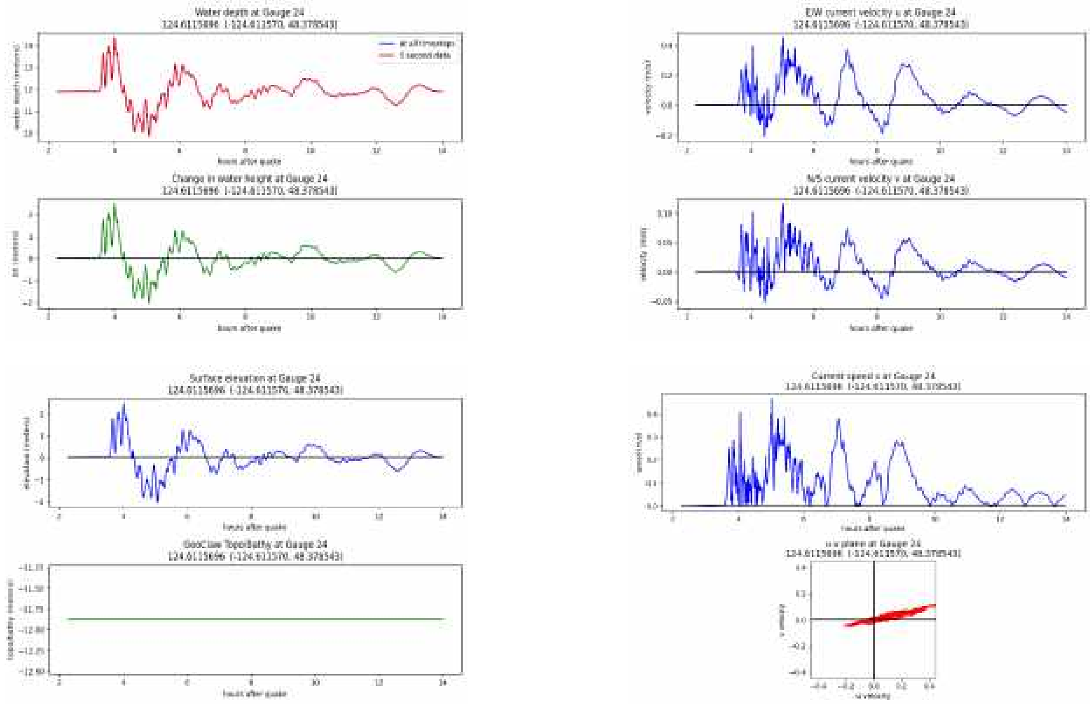
### Cascadia subduction zone scenario, MHW:



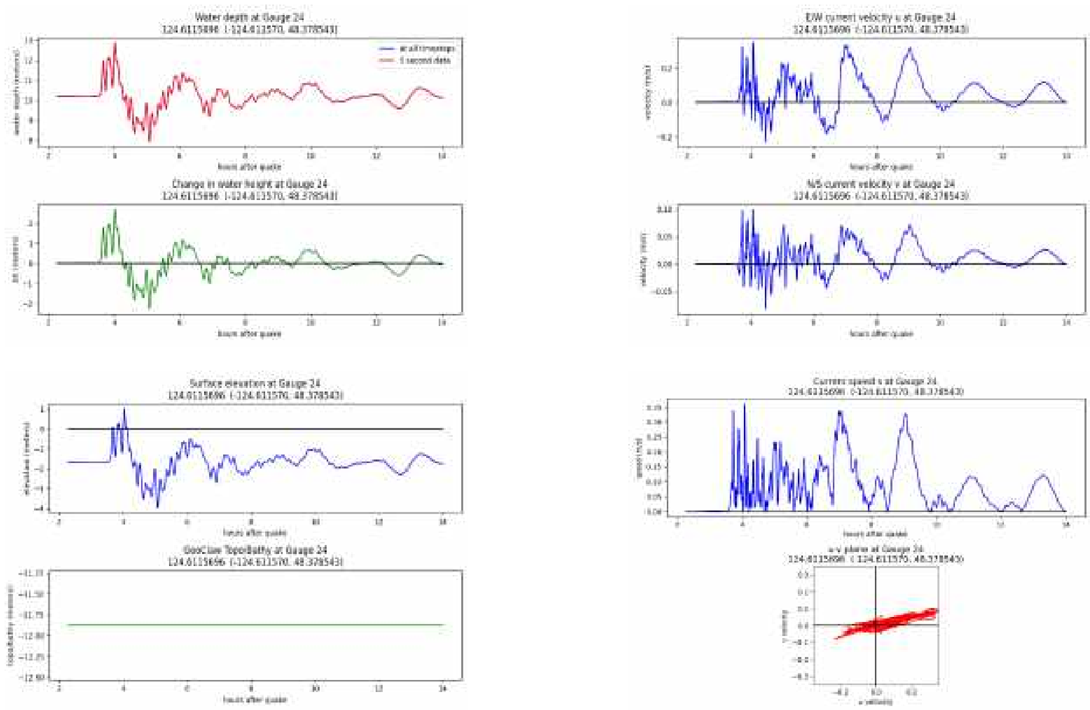
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

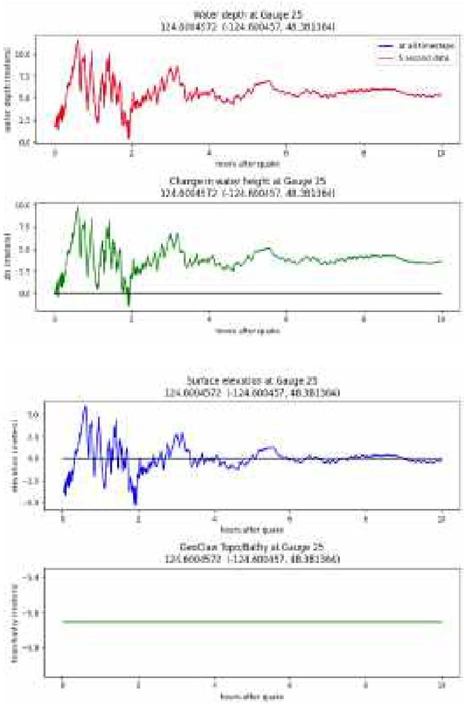


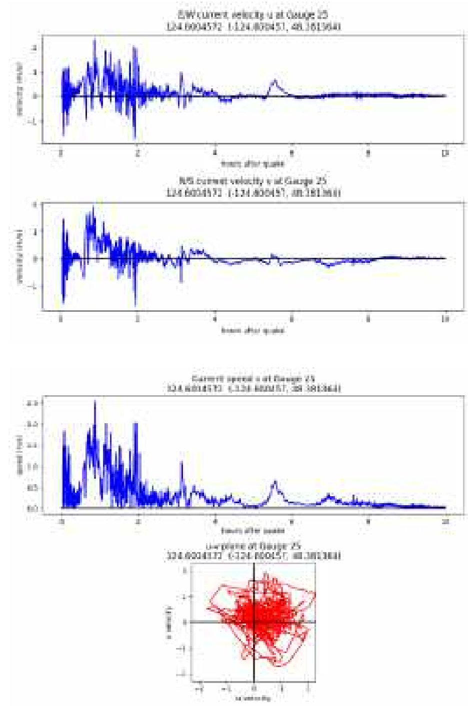
## Alaska-Aleutian subduction zone scenario, MLW:



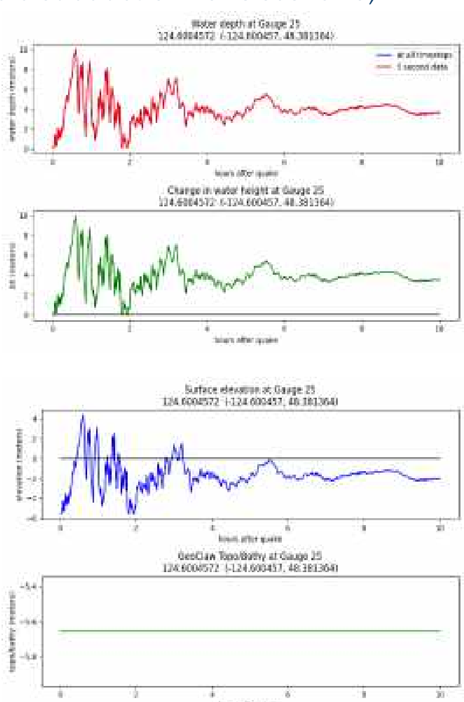
## Gauge 25: North of Jetty, Waadah Island

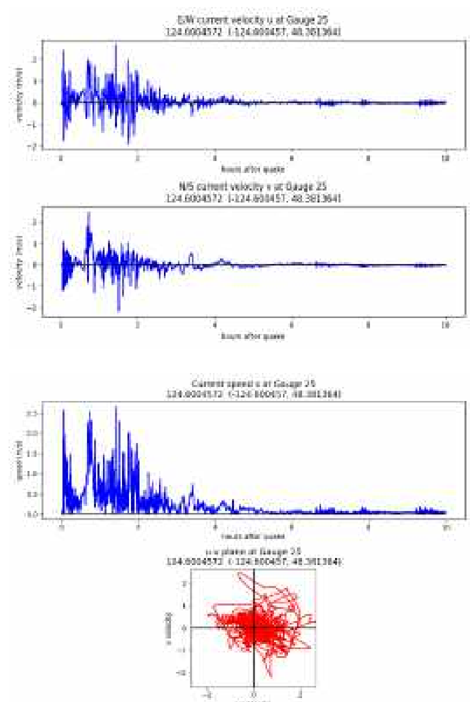
### Cascadia subduction zone scenario, MHW:



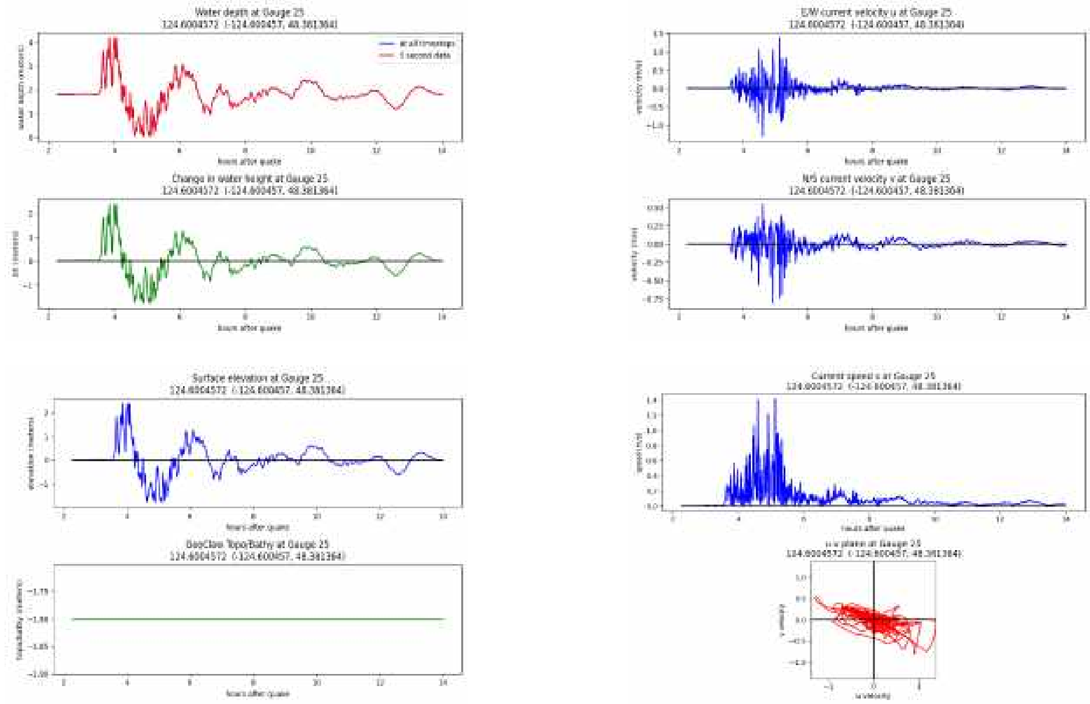


### Cascadia subduction zone scenario, MLW:

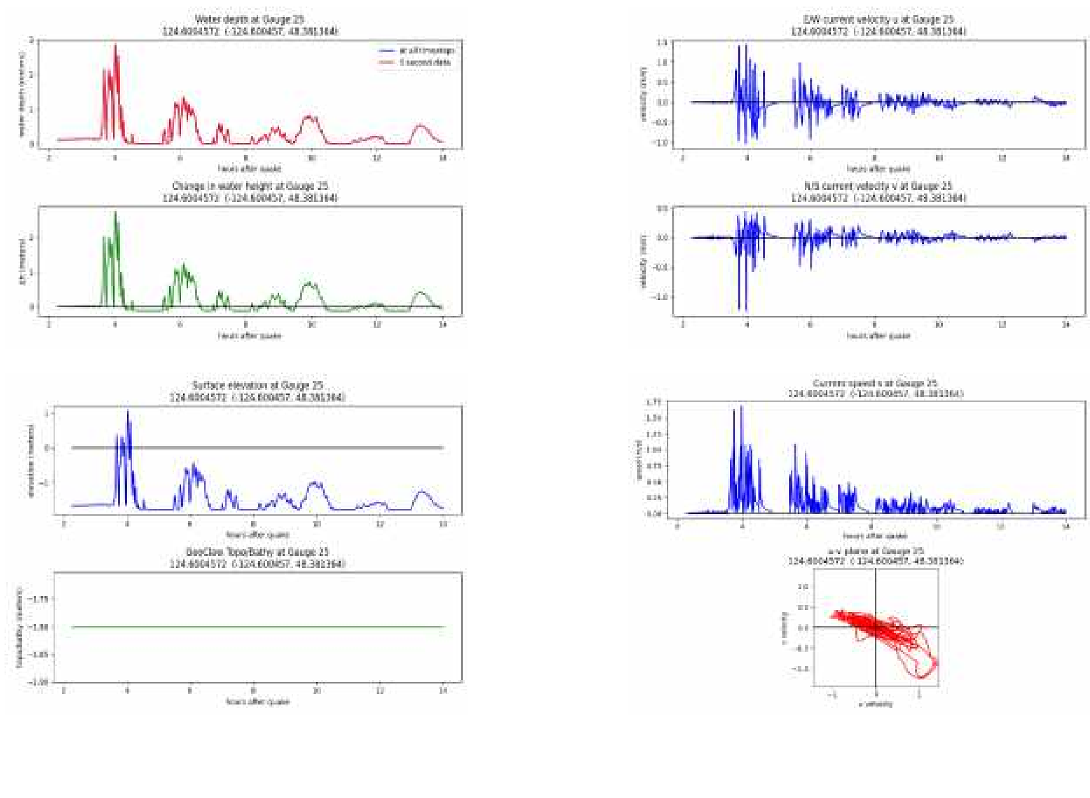




## Alaska-Aleutian subduction zone scenario, MHW:

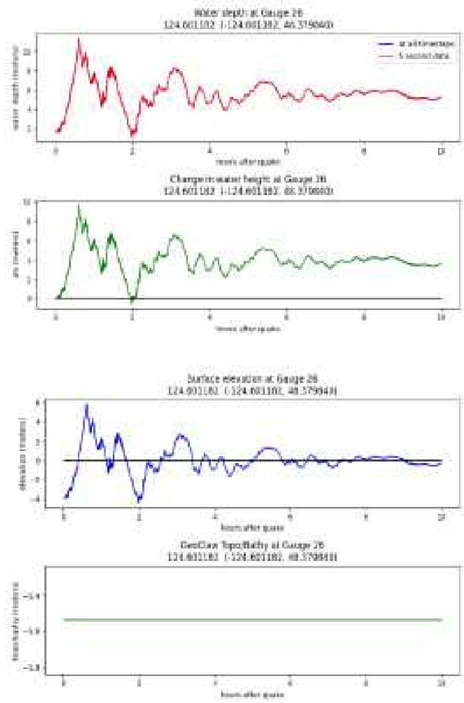


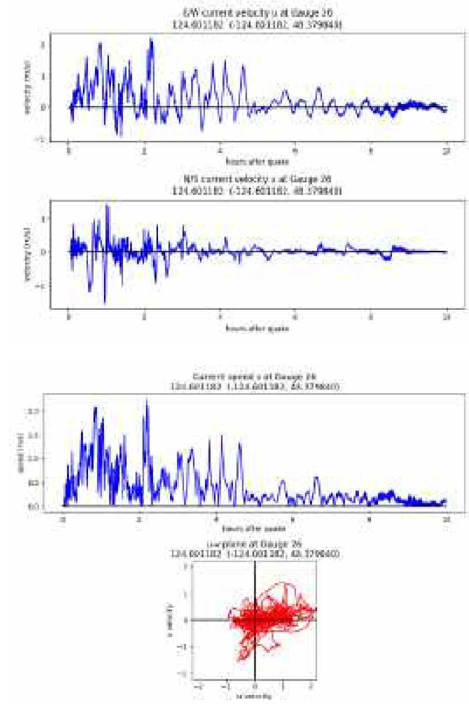

## Alaska-Aleutian subduction zone scenario, MLW:



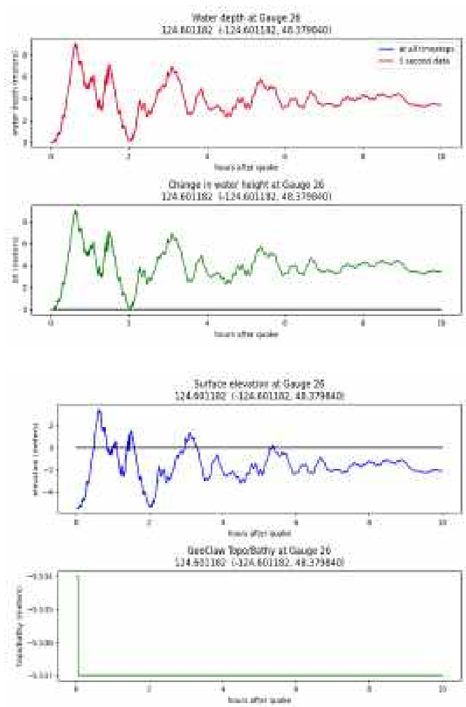
## Gauge 26: South of Jetty, Waadah Island

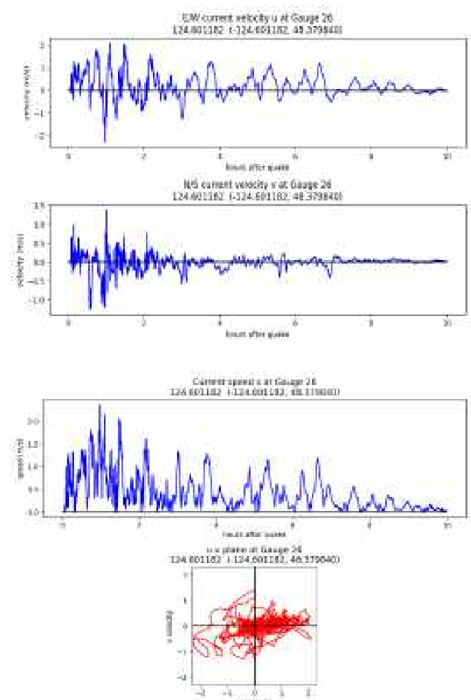
### Cascadia subduction zone scenario, MHW:



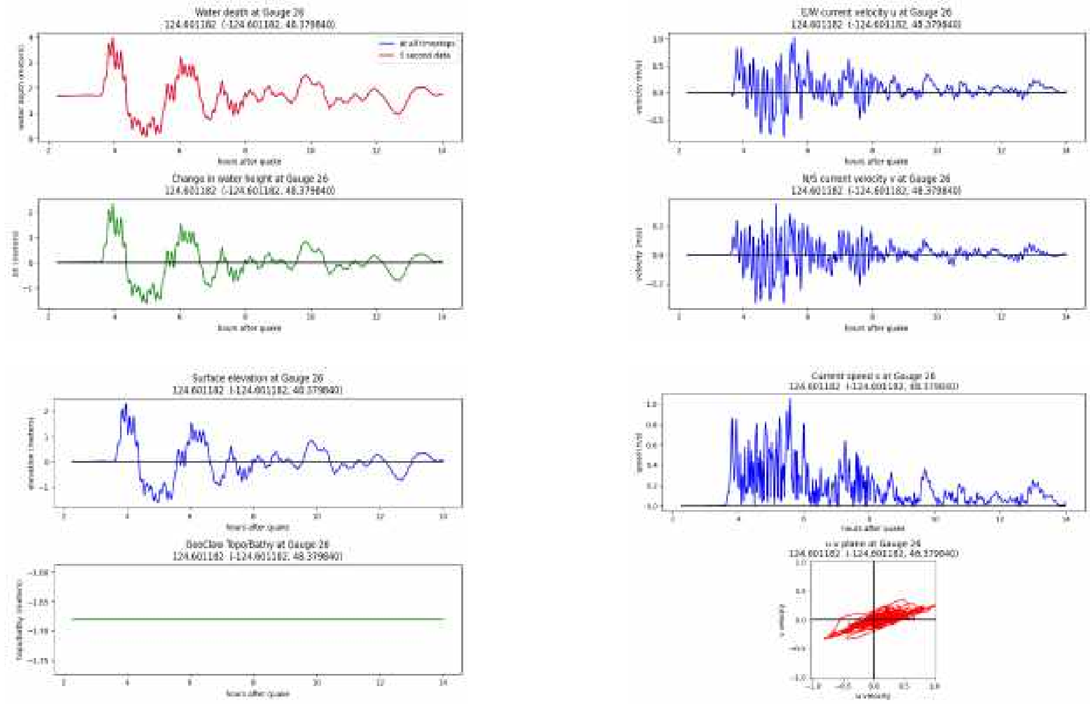


### Cascadia subduction zone scenario, MLW:

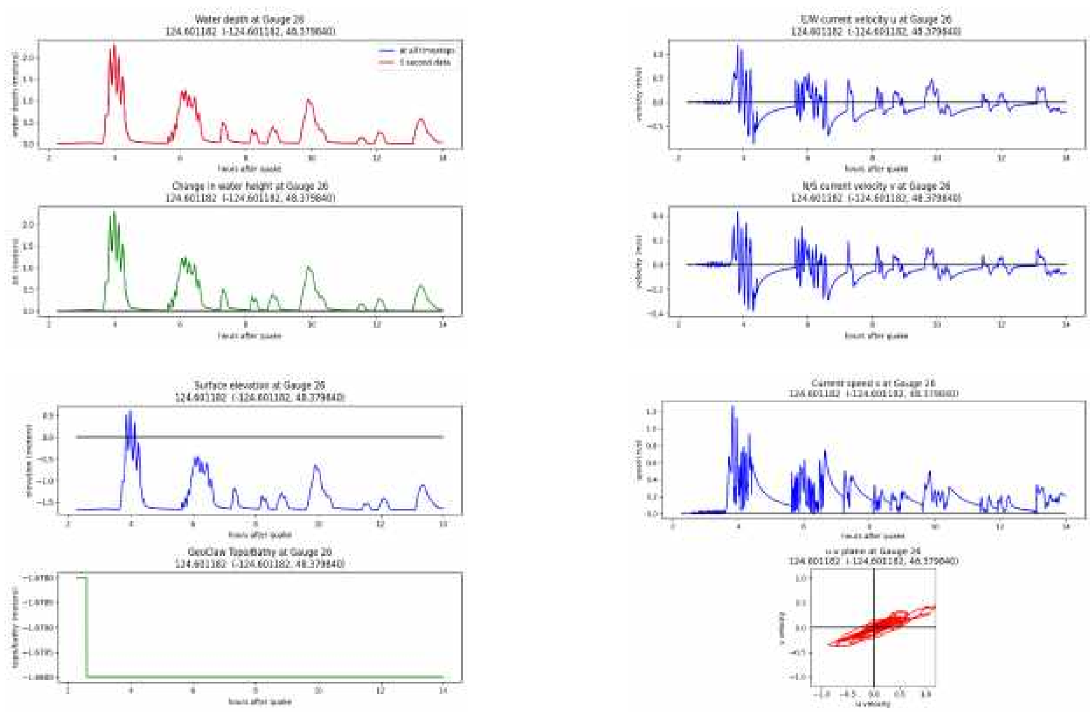




Alaska-Aleutian subduction zone scenario, MHW:

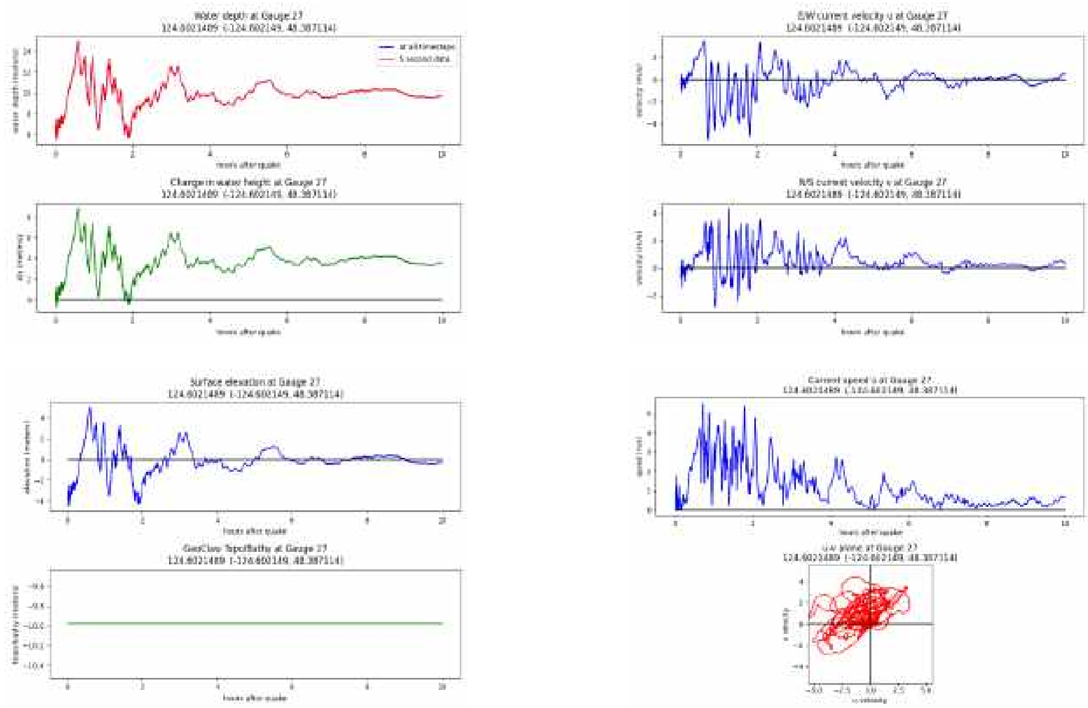



Alaska-Aleutian subduction zone scenario, MLW:

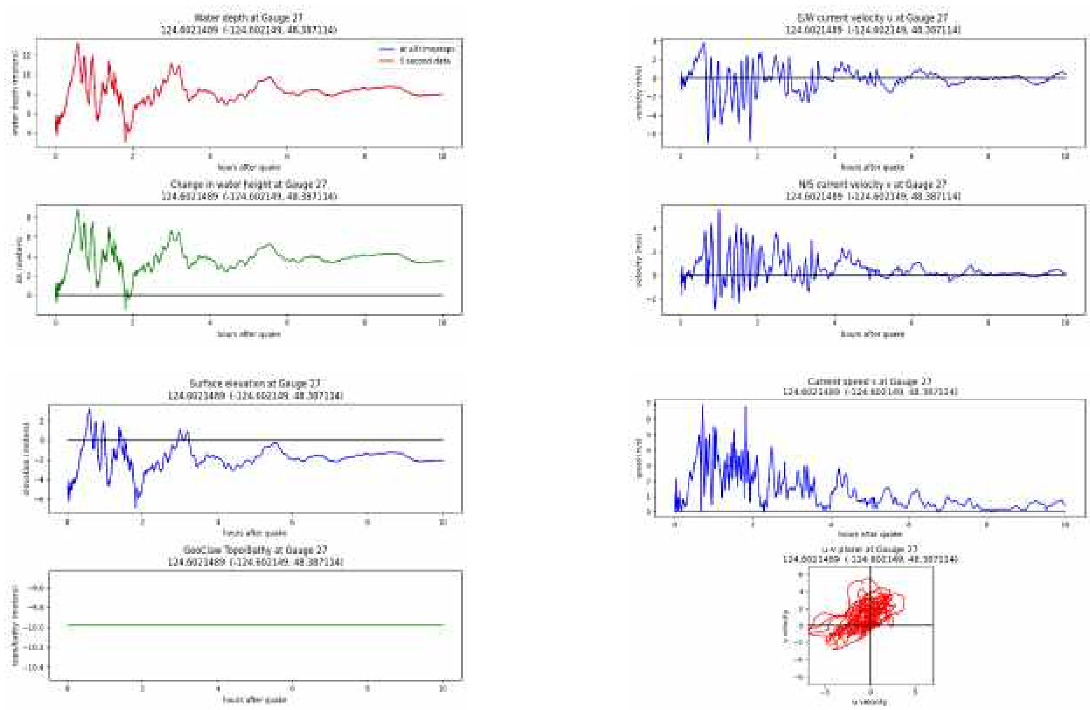


## Gauge 27: Waadah Point

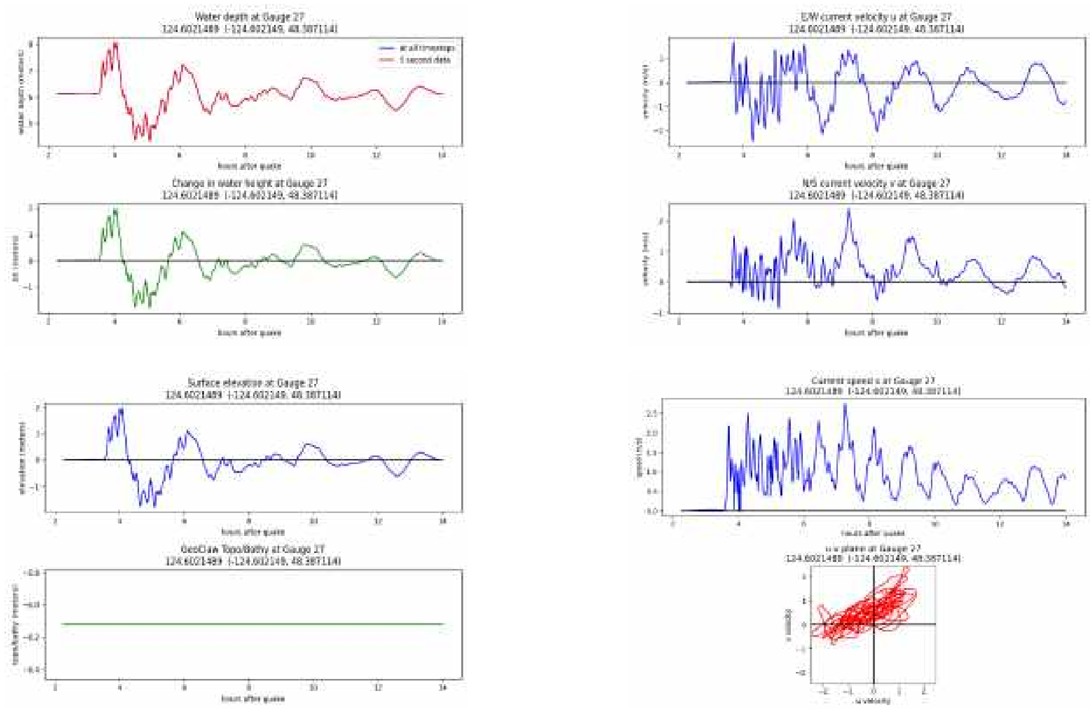
### Cascadia subduction zone scenario, MHW:



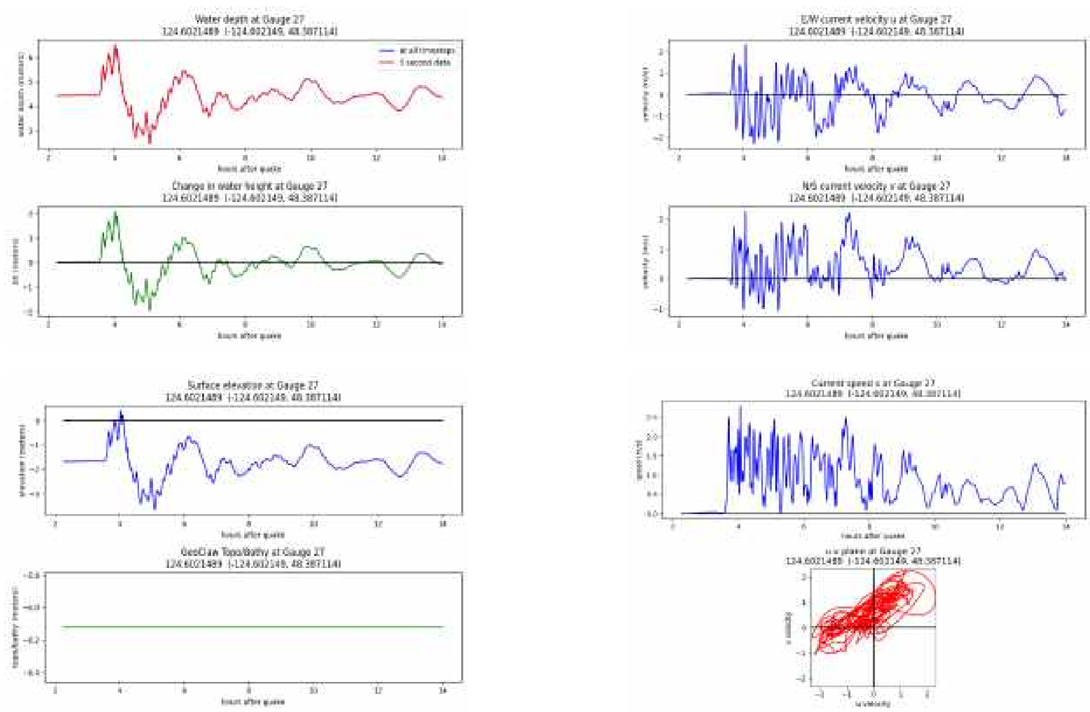
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

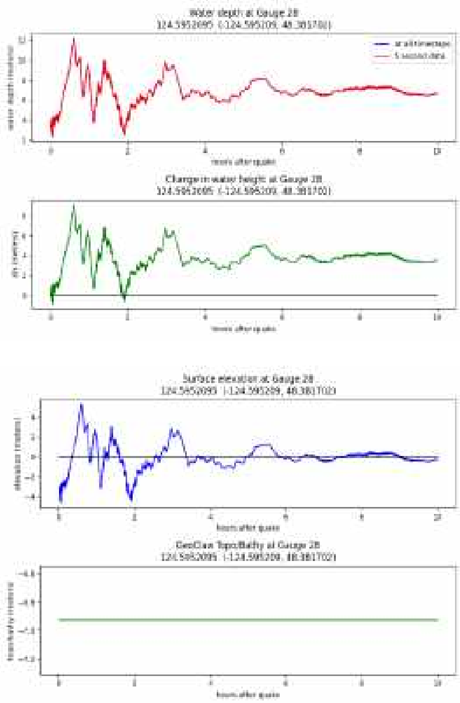


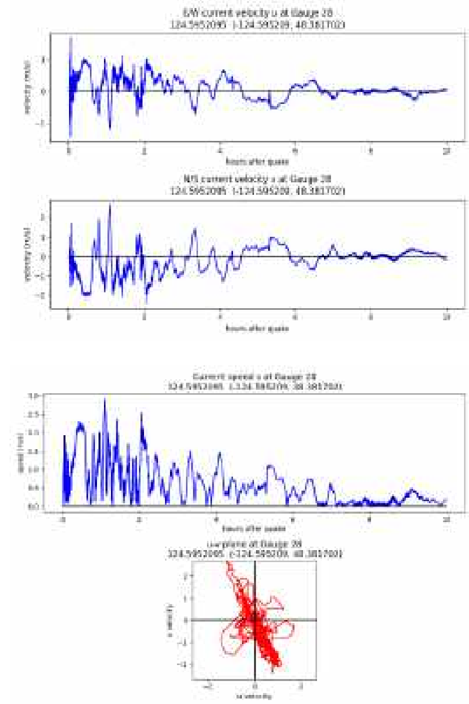

Alaska-Aleutian subduction zone scenario, MLW:



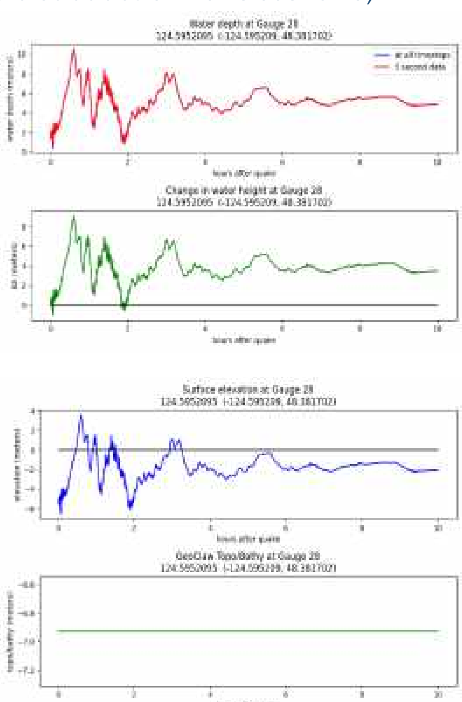
## Gauge 28: West of Waadah Island

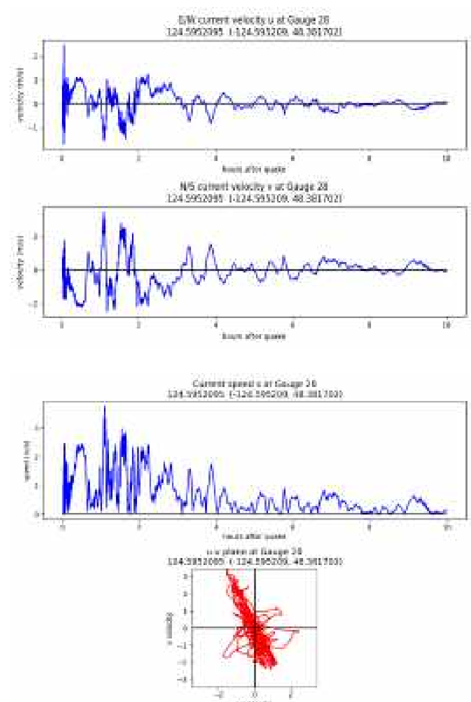
### Cascadia subduction zone scenario, MHW:



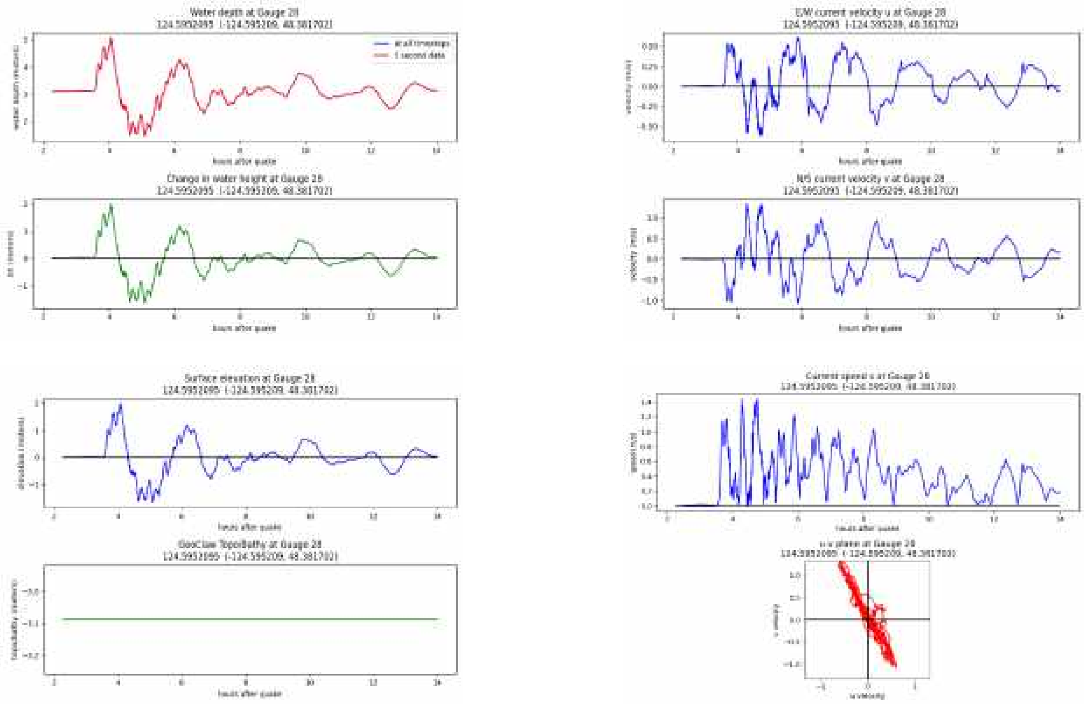


### Cascadia subduction zone scenario, MLW:

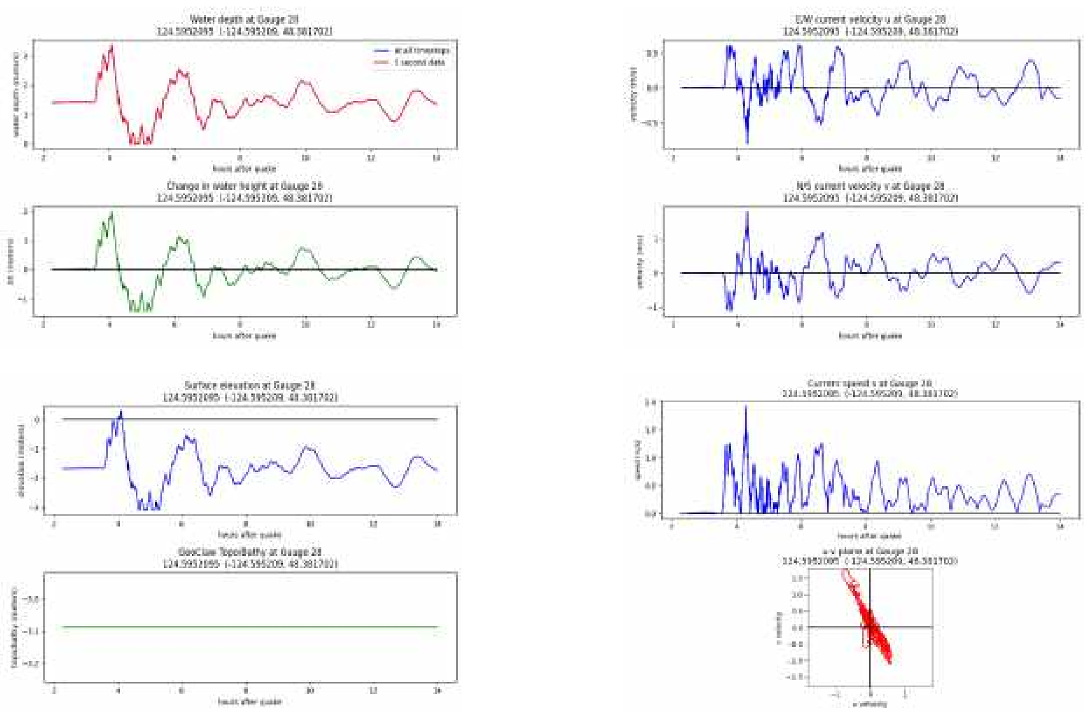




## Alaska-Aleutian subduction zone scenario, MHW:

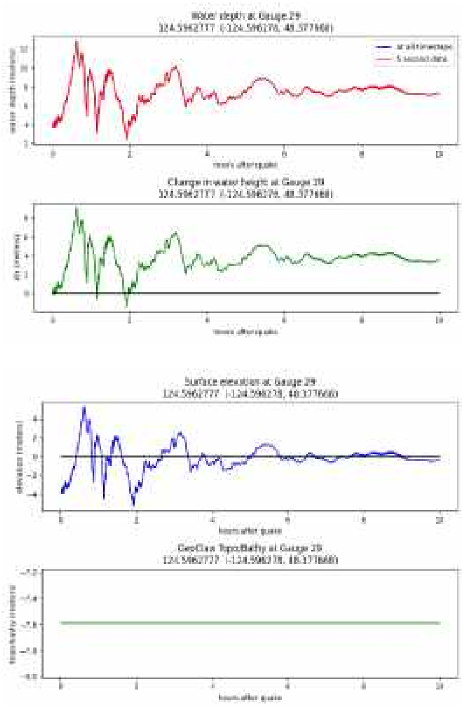


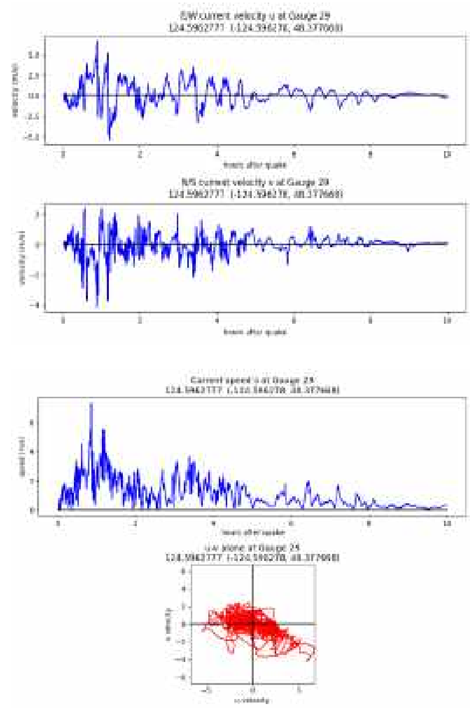
## Alaska-Aleutian subduction zone scenario, MLW:



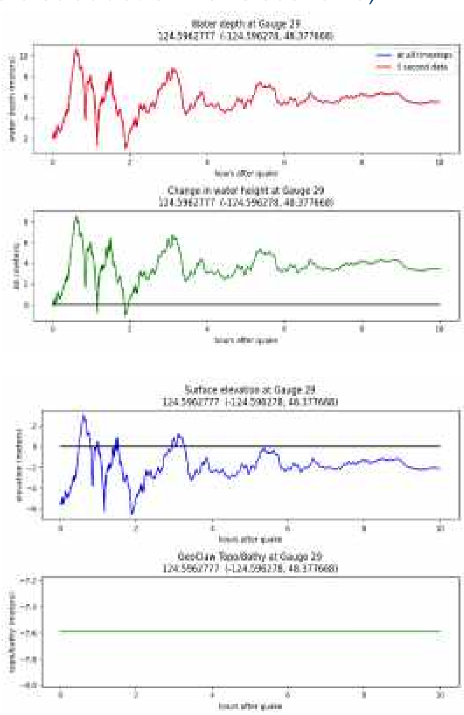
## Gauge 29: South of Waadah Island

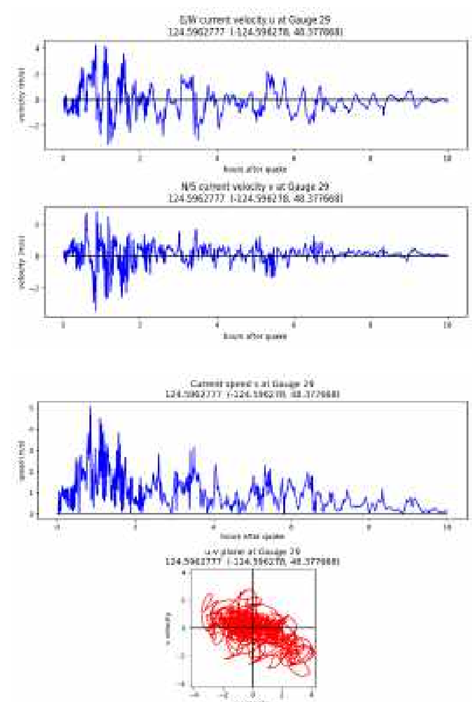
### Cascadia subduction zone scenario, MHW:



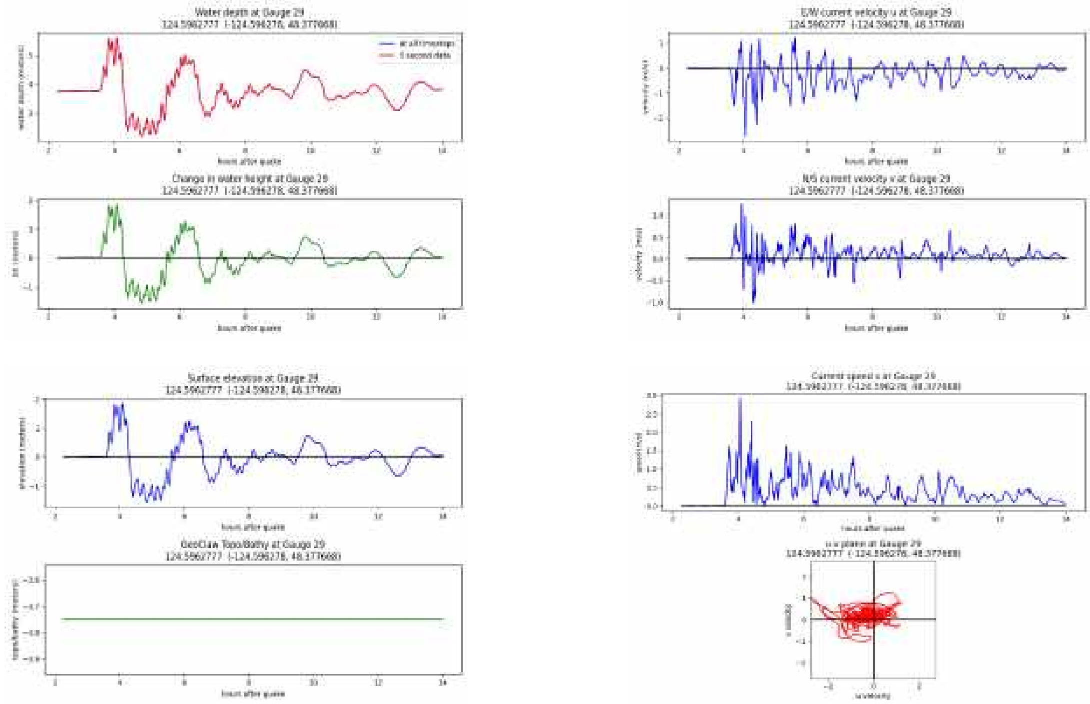


### Cascadia subduction zone scenario, MLW:

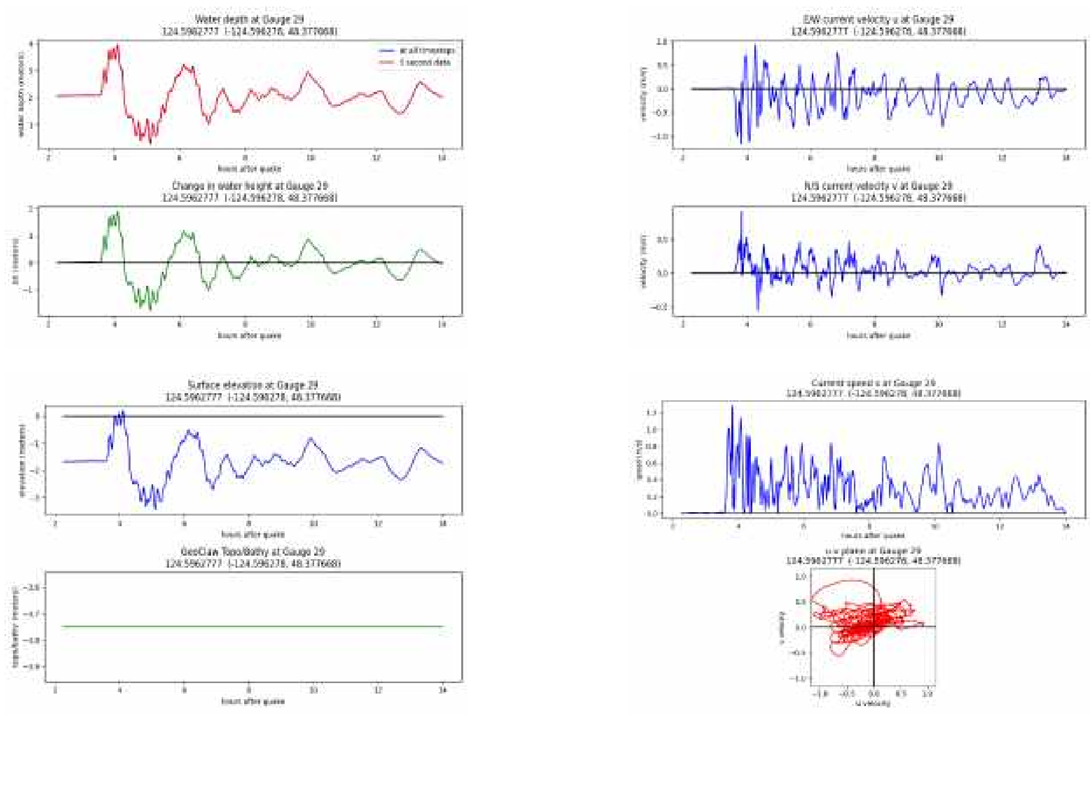




## Alaska-Aleutian subduction zone scenario, MHW:

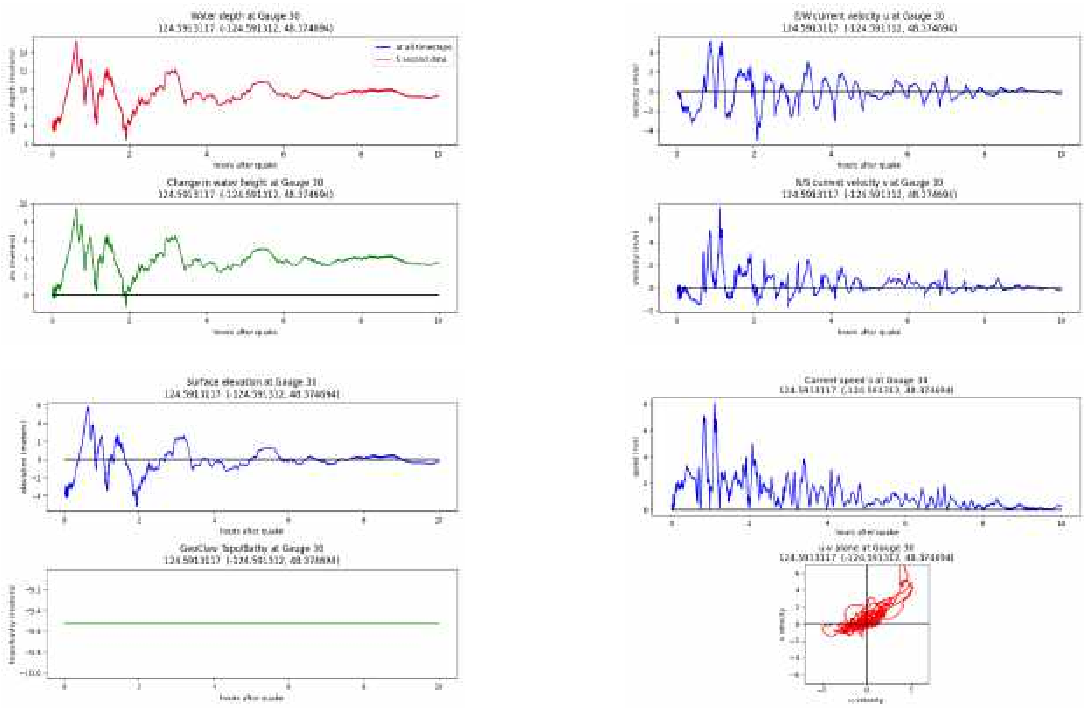



## Alaska-Aleutian subduction zone scenario, MLW:

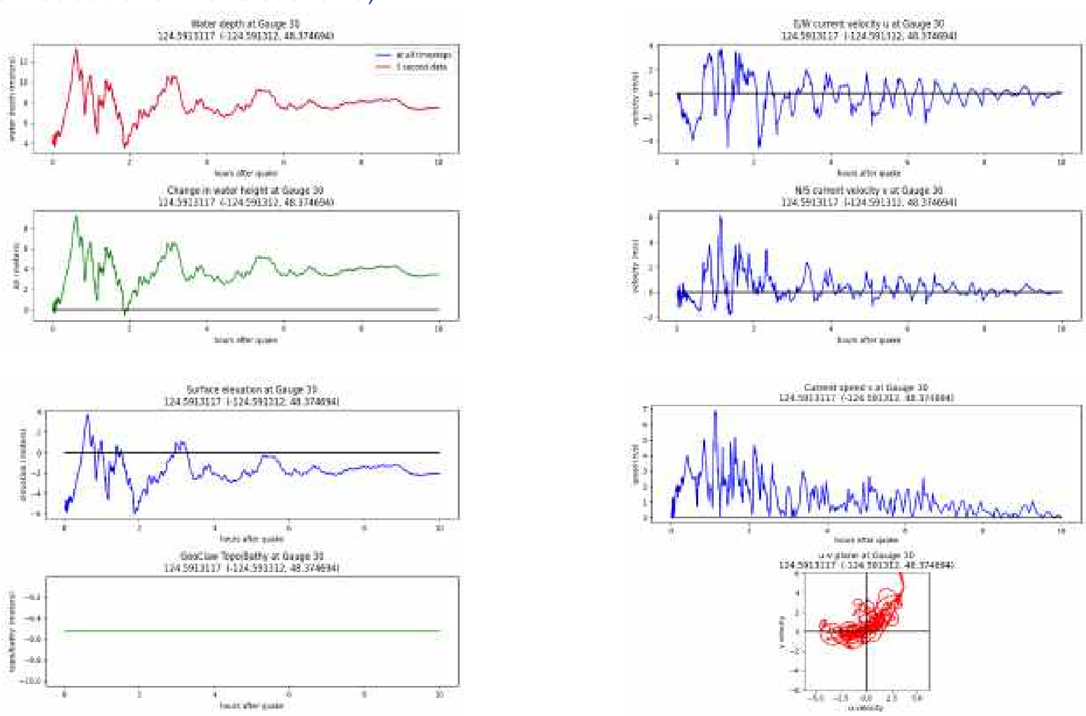


## Gauge 30: Baada Point

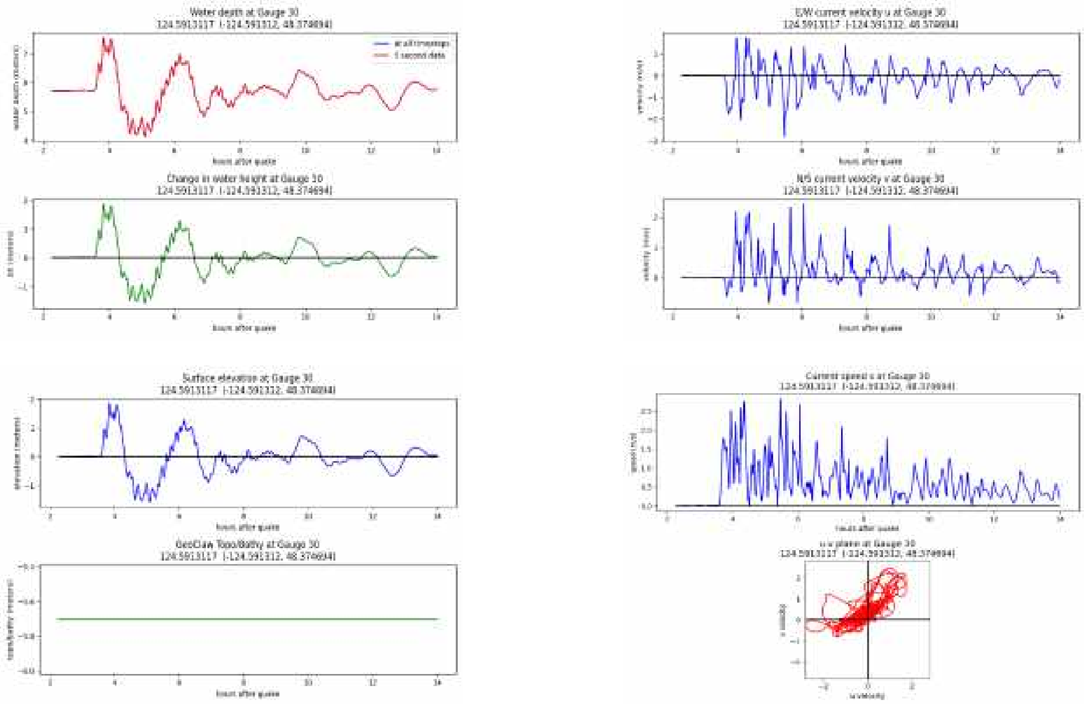
### Cascadia subduction zone scenario, MHW:



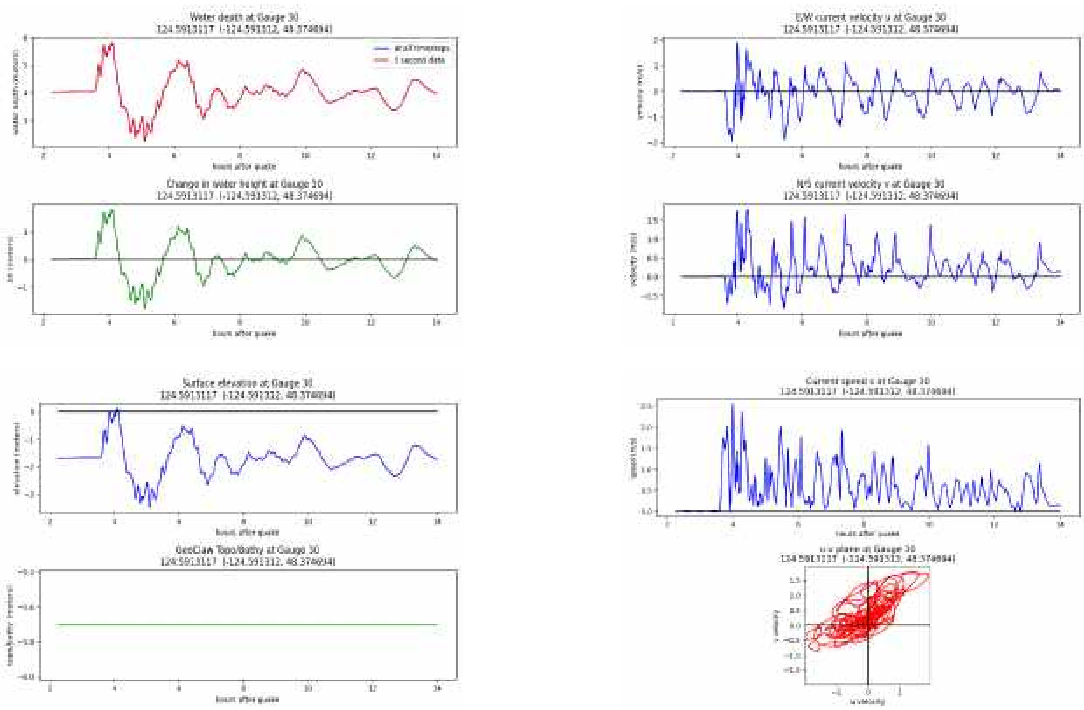
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

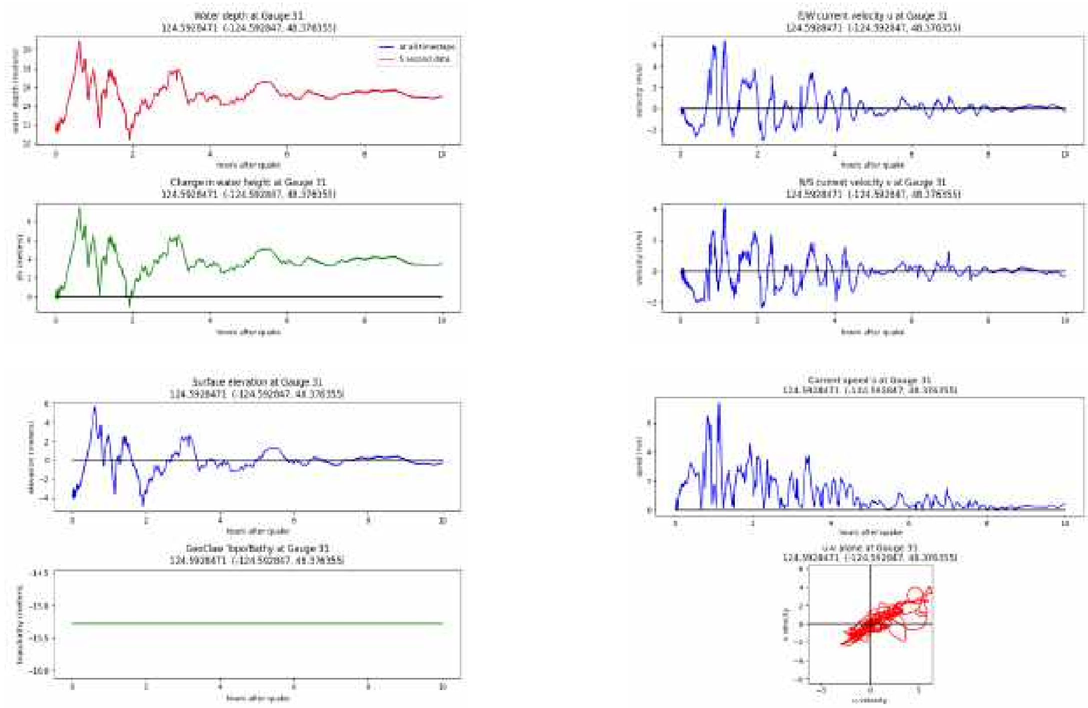



Alaska-Aleutian subduction zone scenario, MLW:

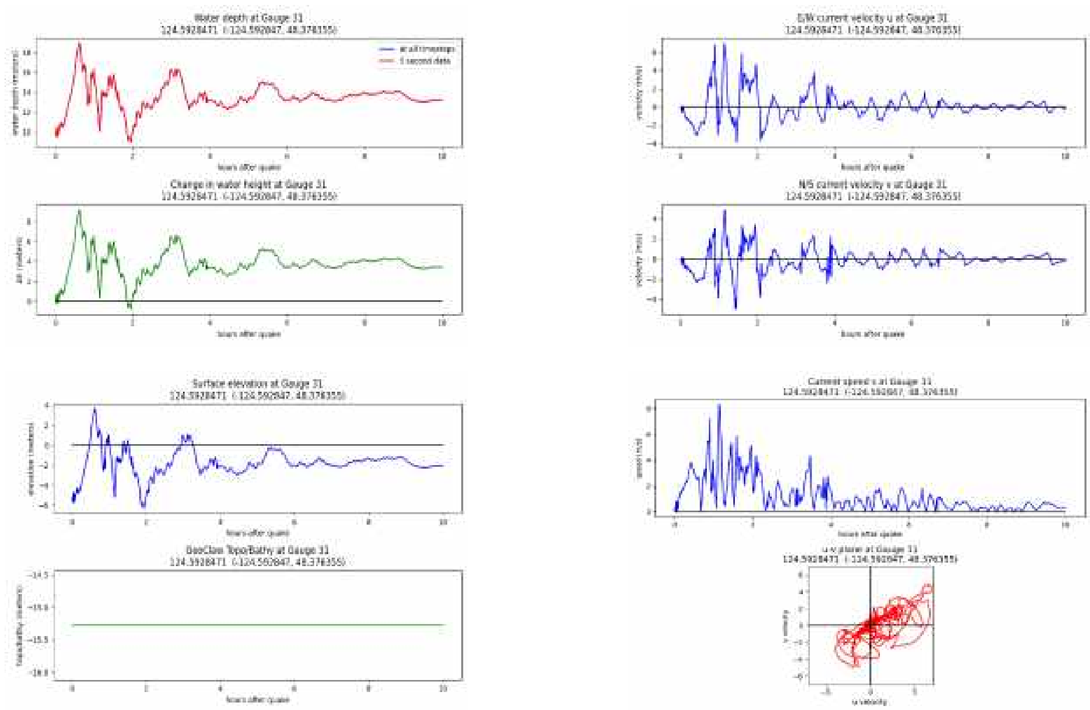


## Gauge 31: Neah Bay, entrance

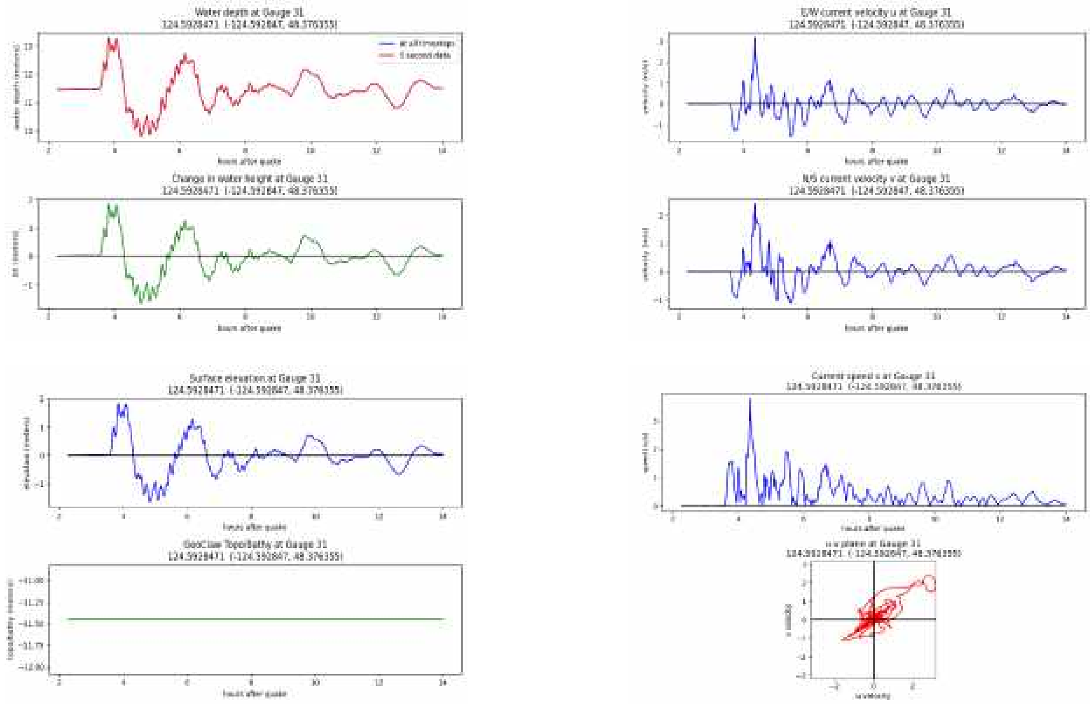
### Cascadia subduction zone scenario, MHW:



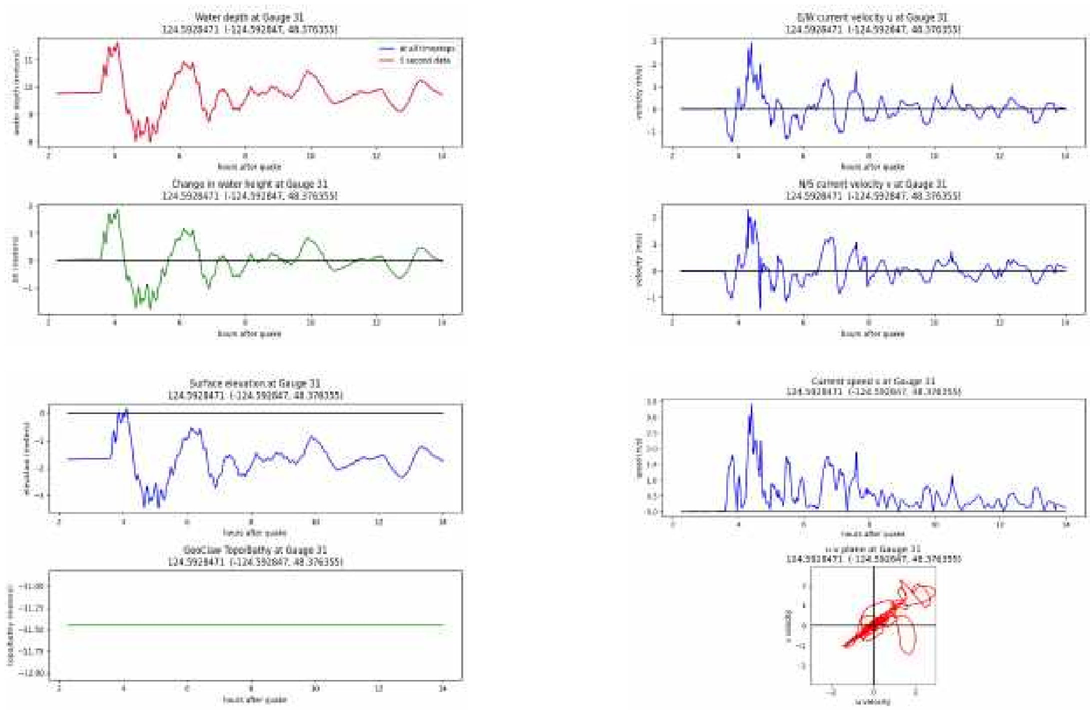
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

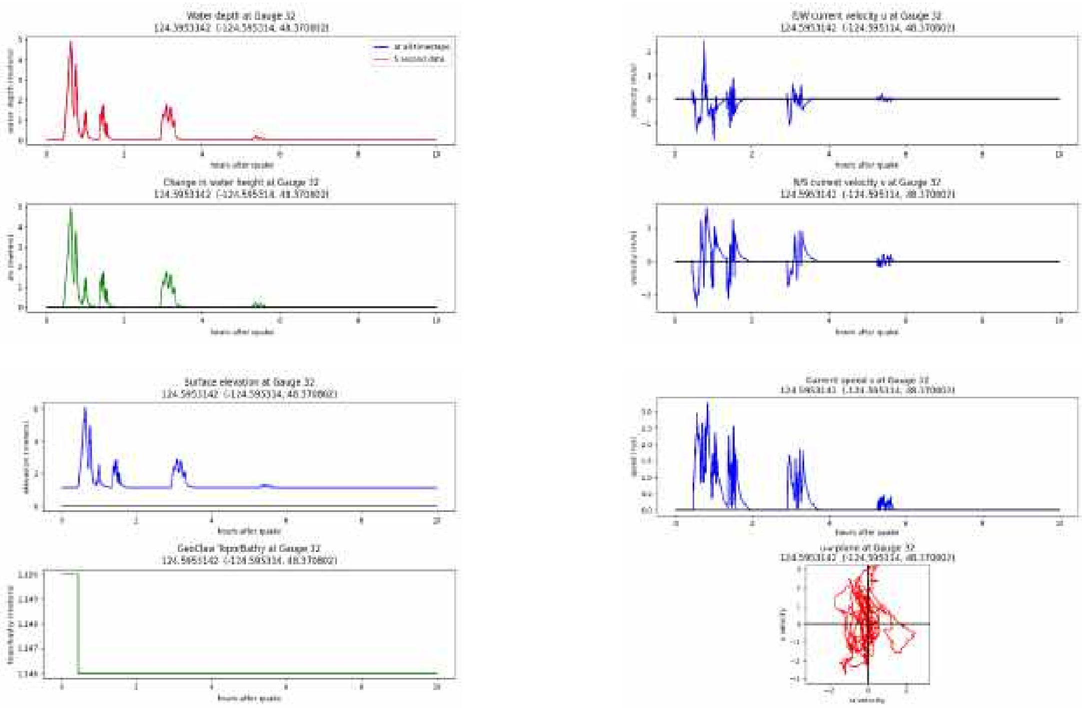



Alaska-Aleutian subduction zone scenario, MLW:

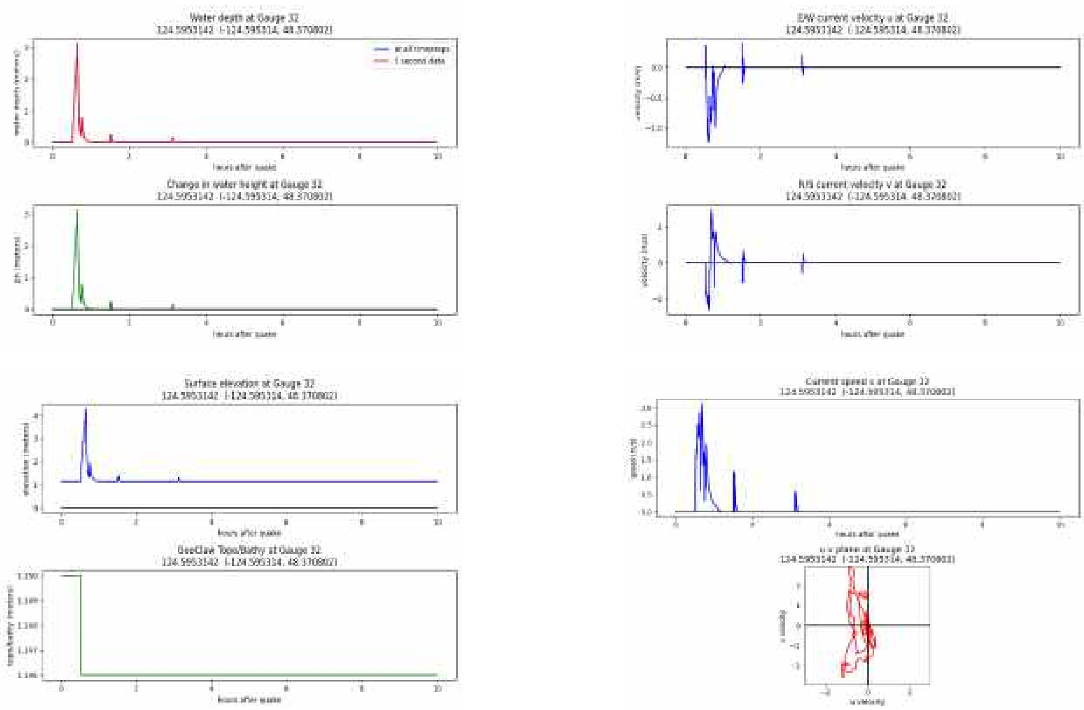


## Gauge 32: Makah Tribal Police

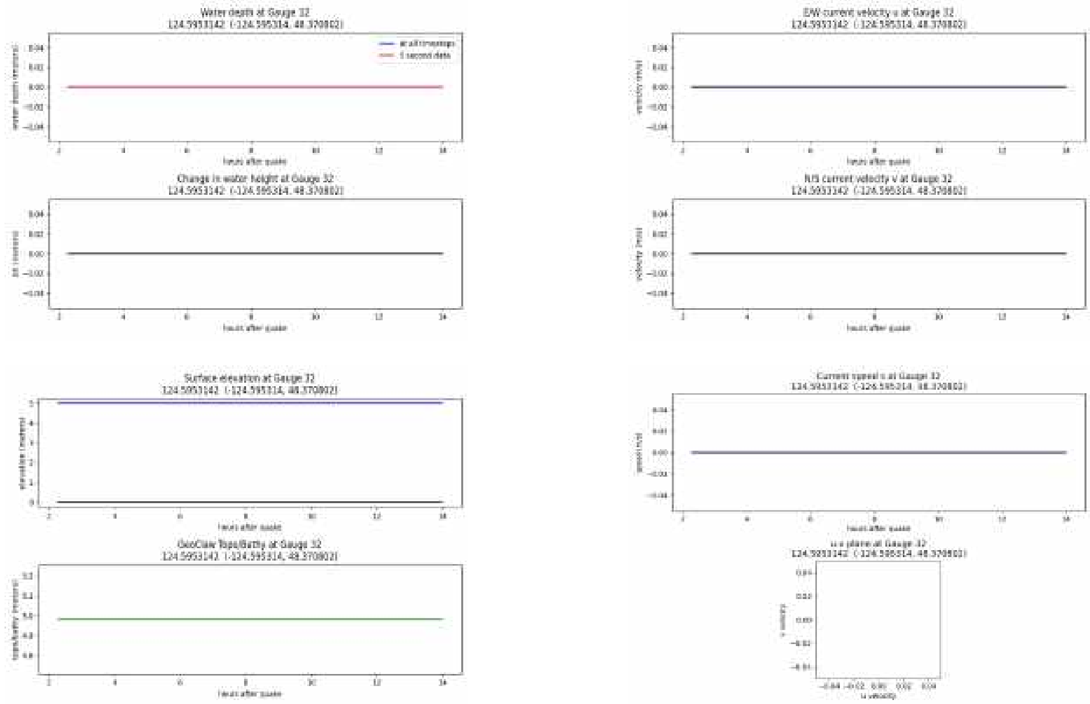
### Cascadia subduction zone scenario, MHW:



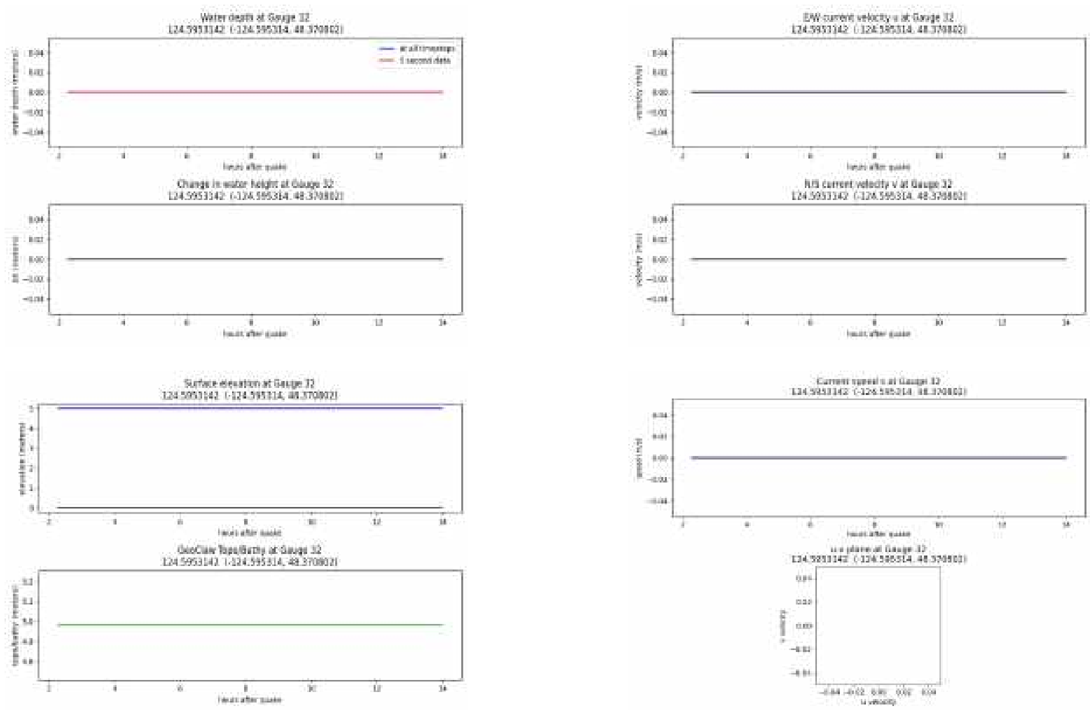

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

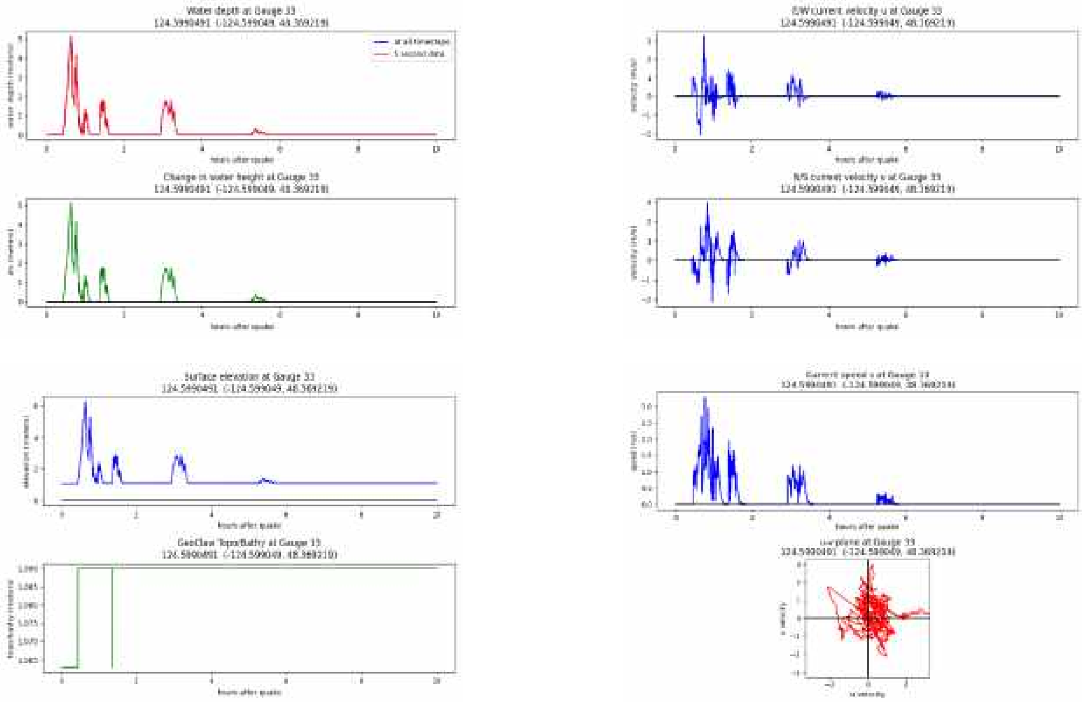


## Alaska-Aleutian subduction zone scenario, MLW:

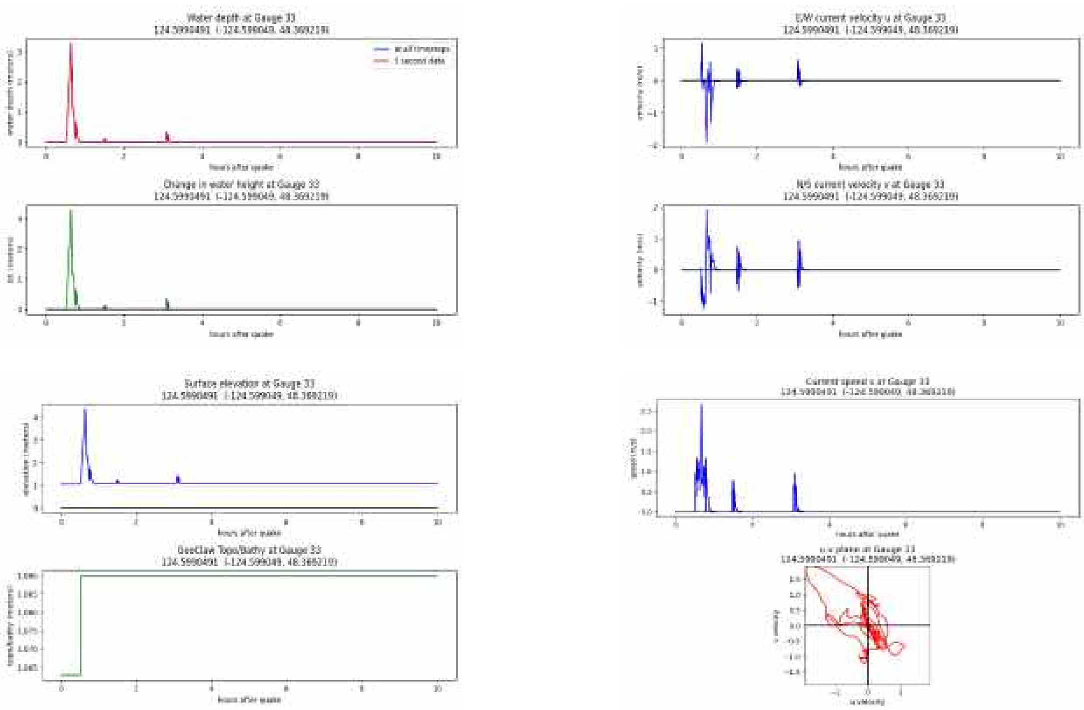


## Gauge 33: US Coast Guard Station Neah Bay

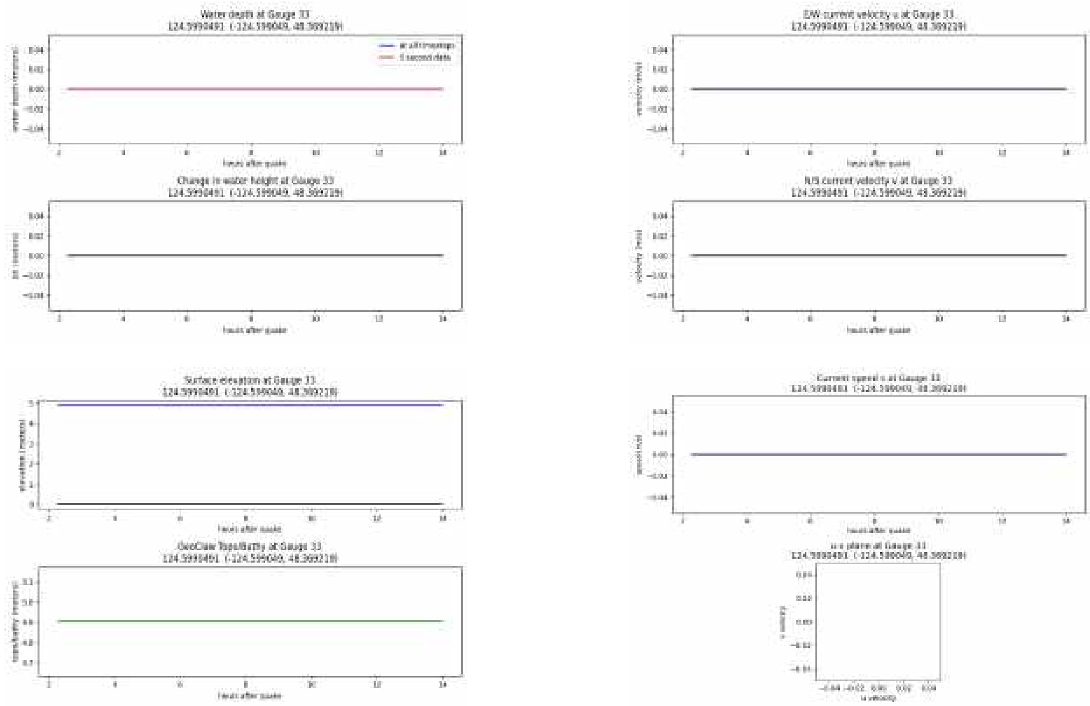
### Cascadia subduction zone scenario, MHW:



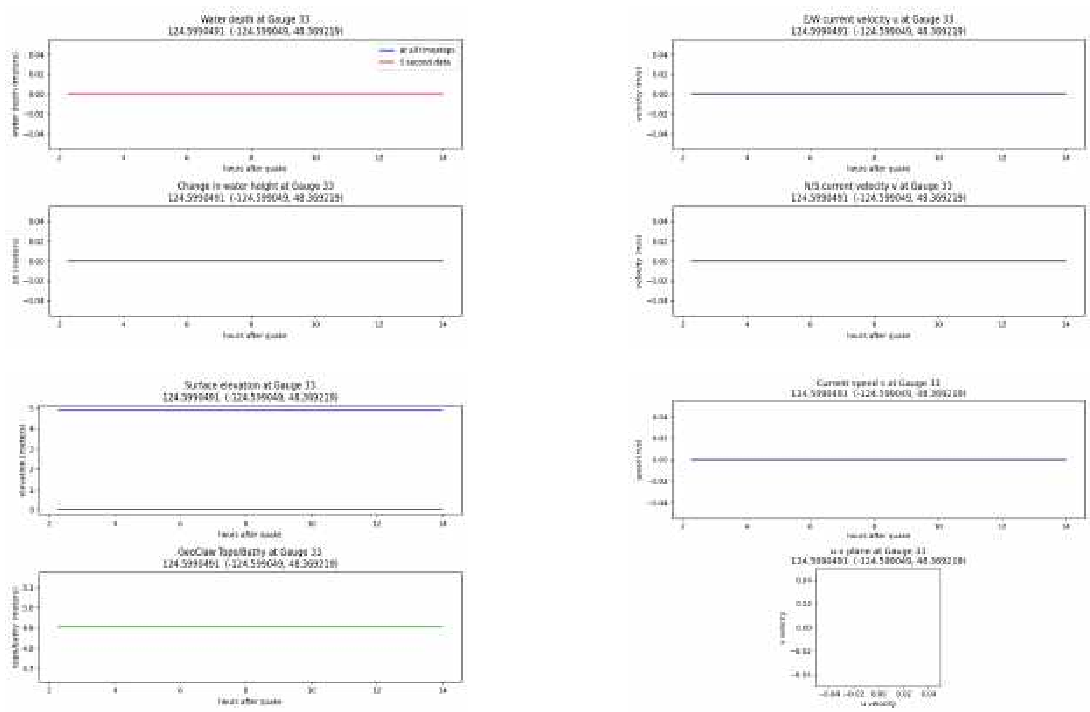
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

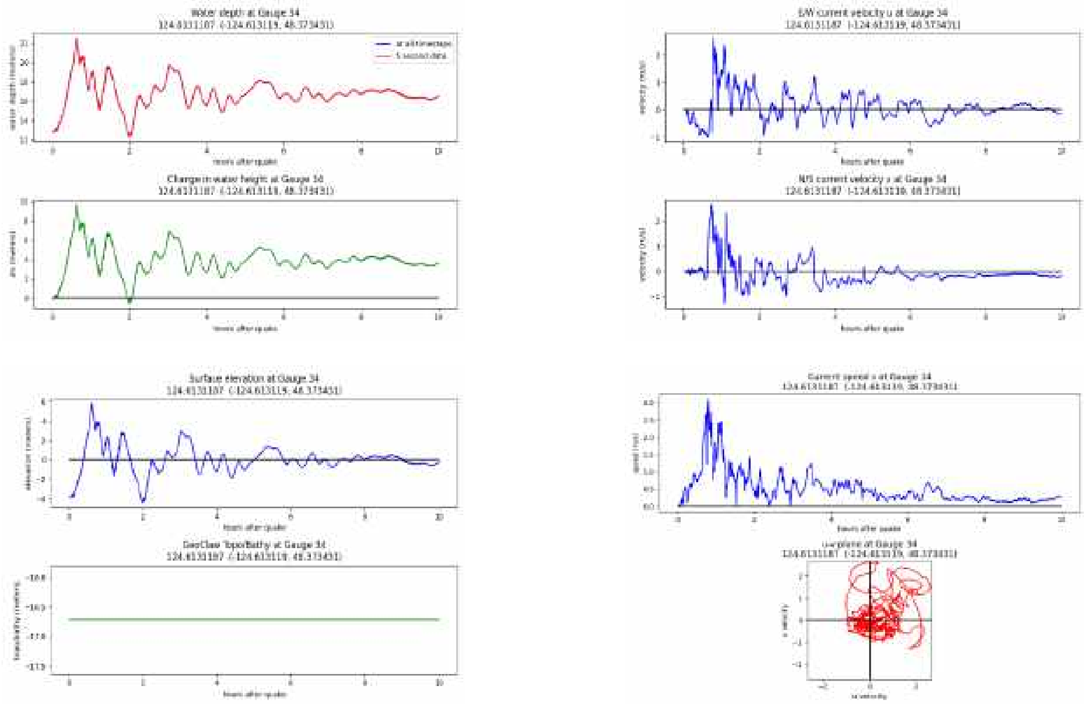


## Alaska-Aleutian subduction zone scenario, MLW:

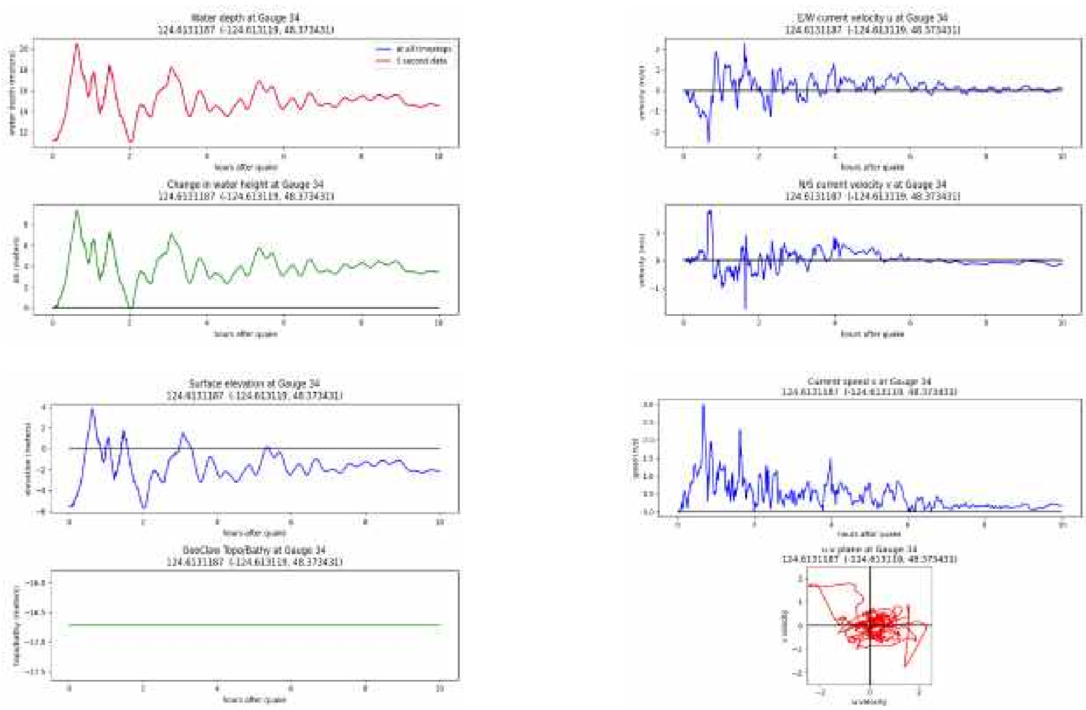


## Gauge 34: Neah Bay, center

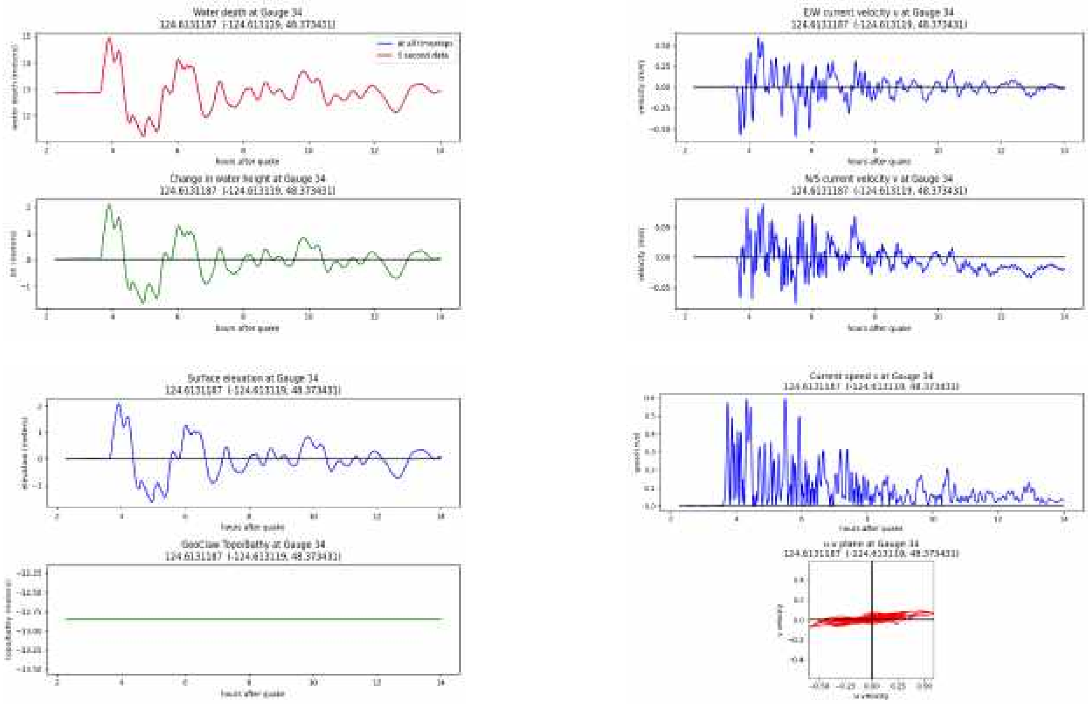
### Cascadia subduction zone scenario, MHW:



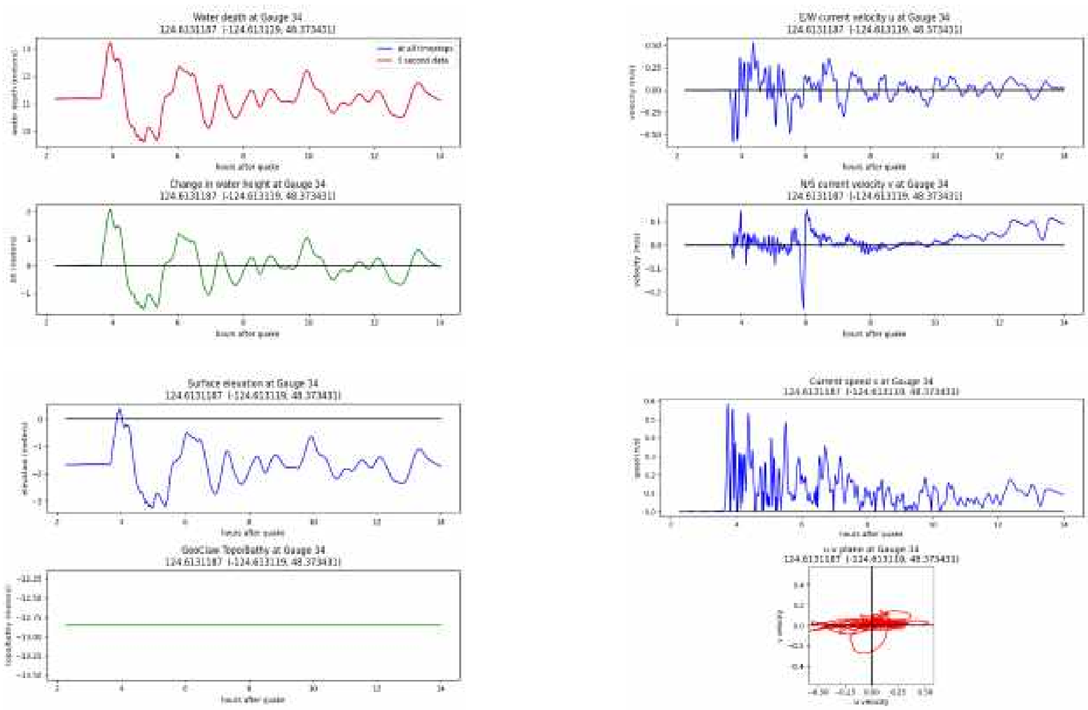

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

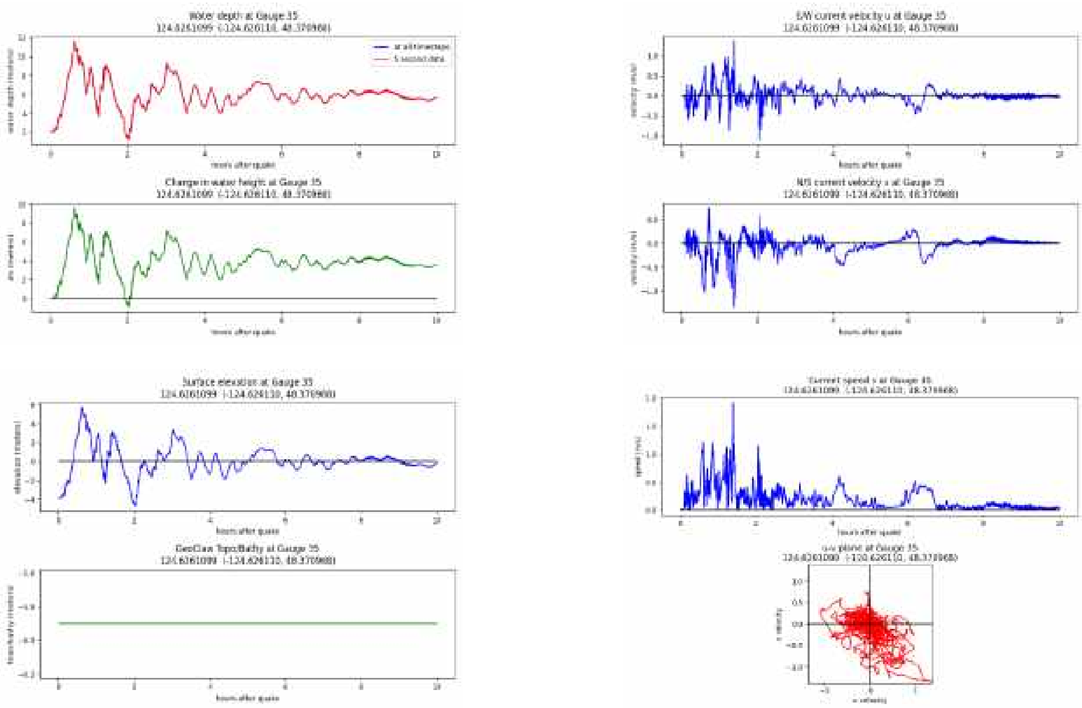


## Alaska-Aleutian subduction zone scenario, MLW:

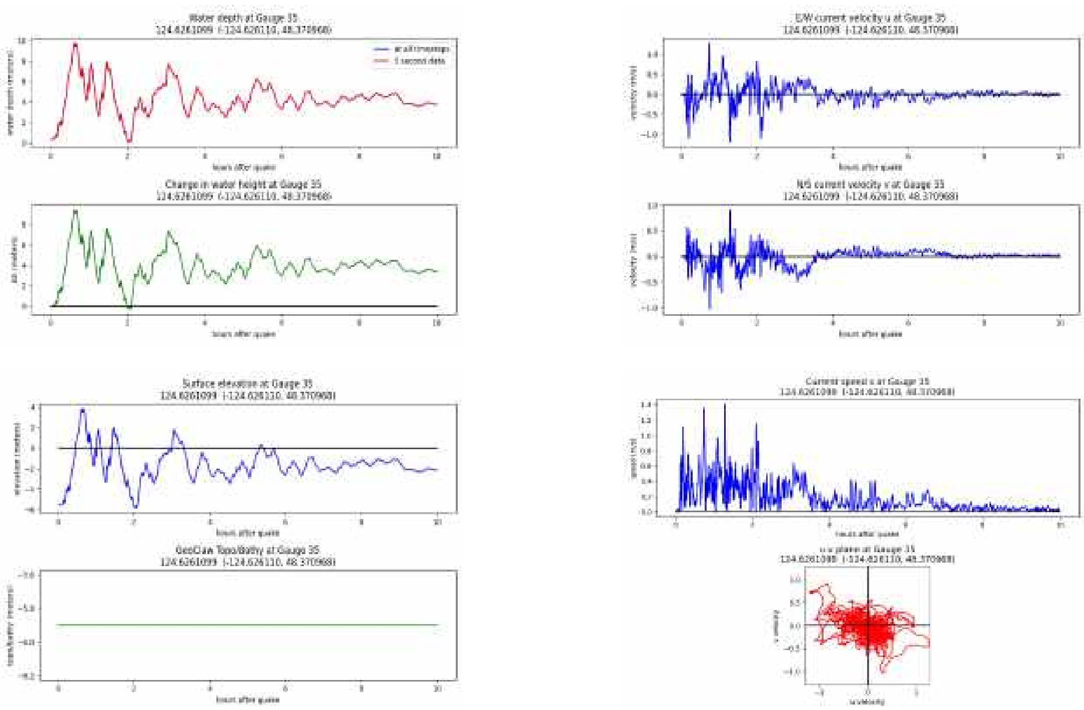


## Gauge 35: Neah Bay, west

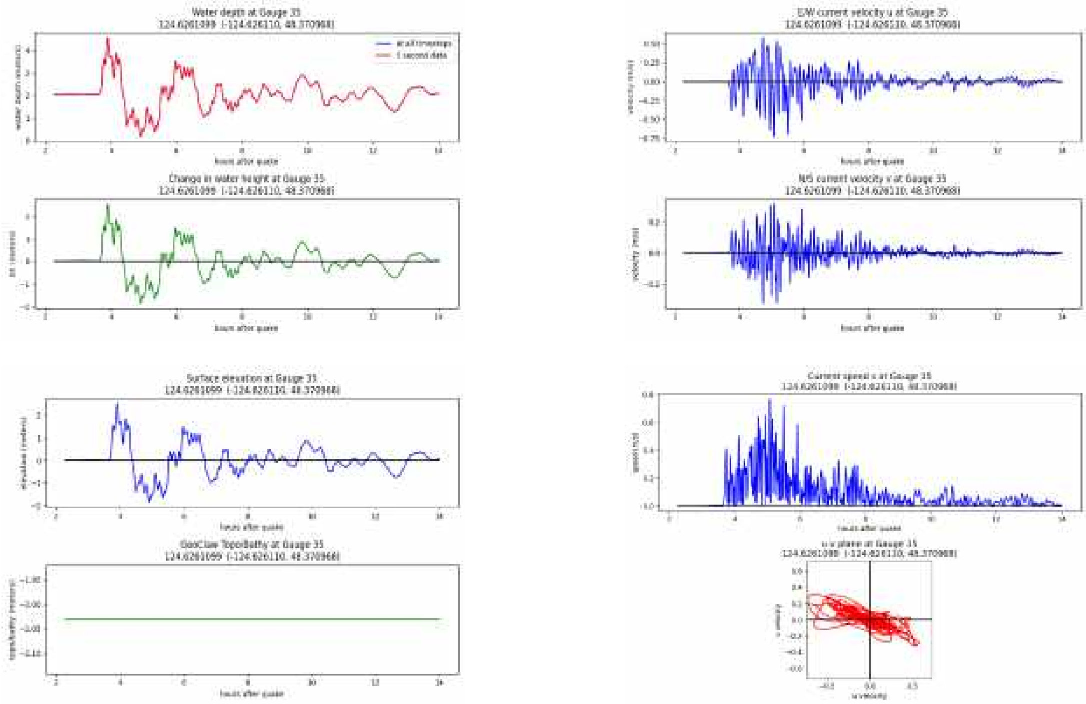
### Cascadia subduction zone scenario, MHW:



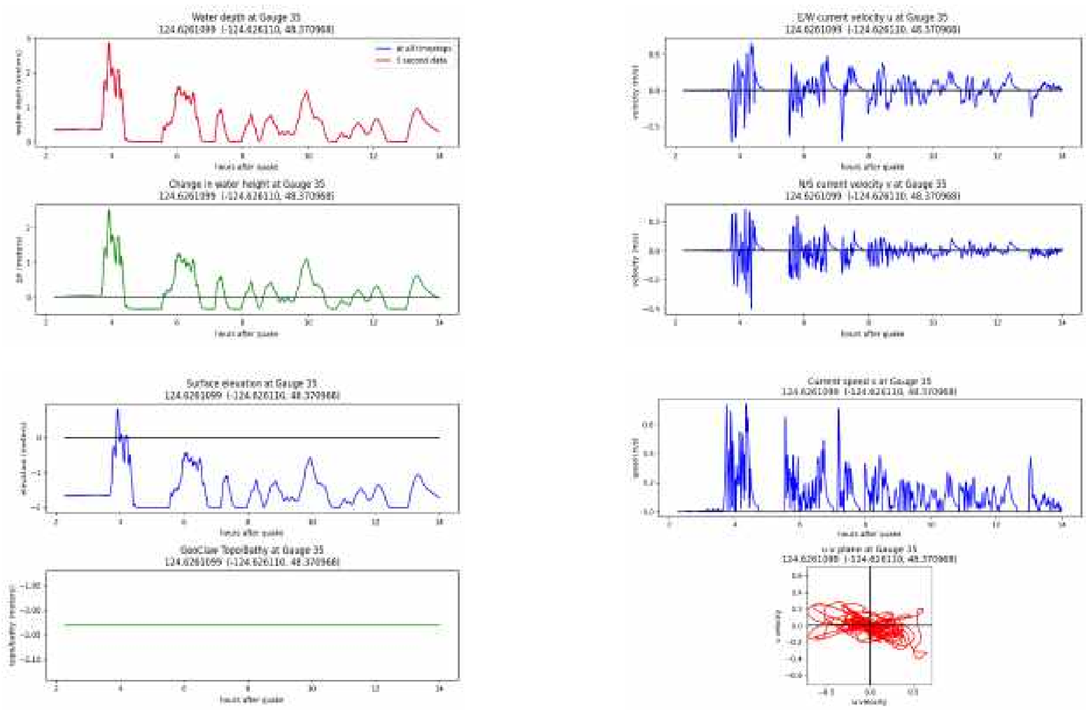
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

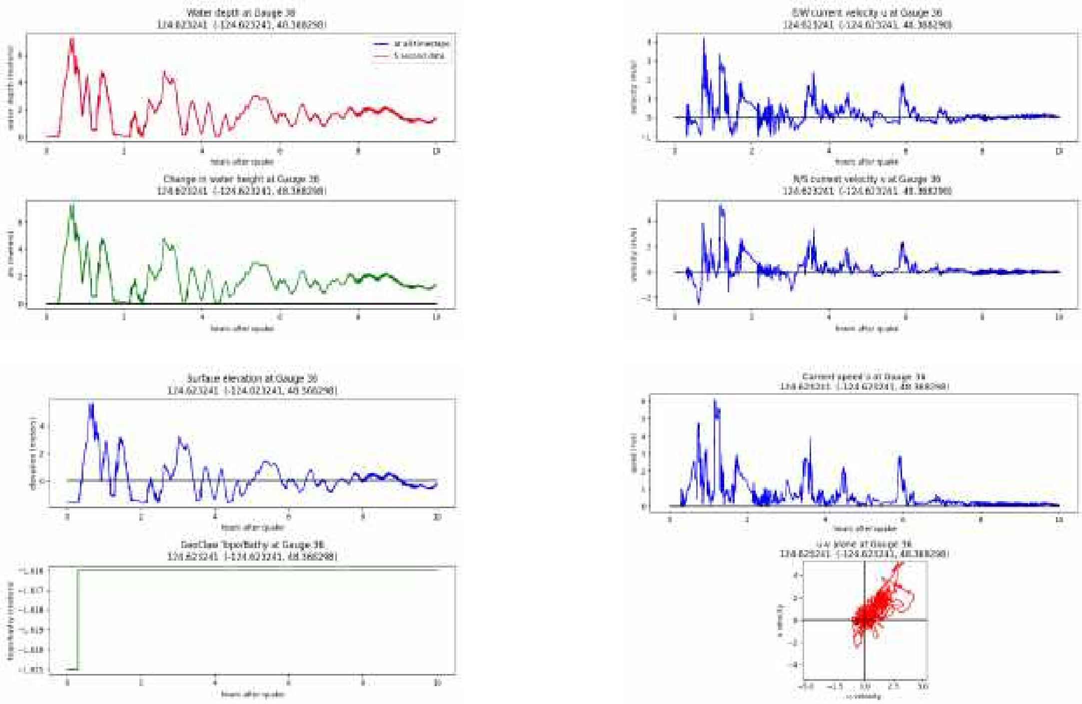



## Alaska-Aleutian subduction zone scenario, MLW:

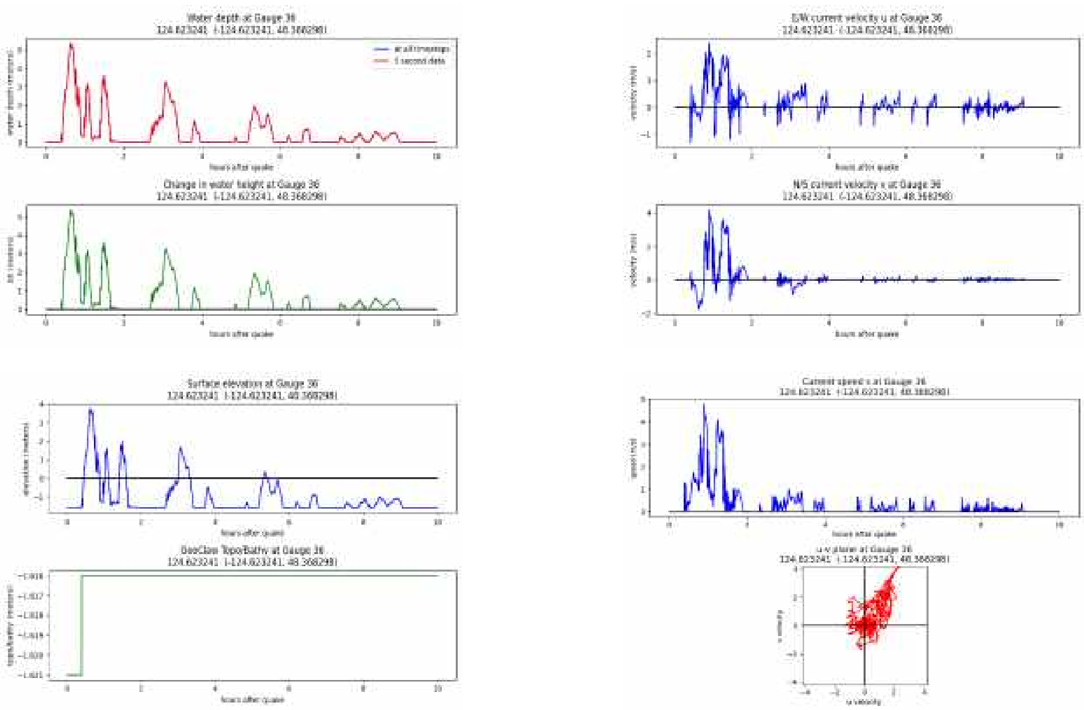


## Gauge 36: Makah Tribal Council Senior Citizen Center

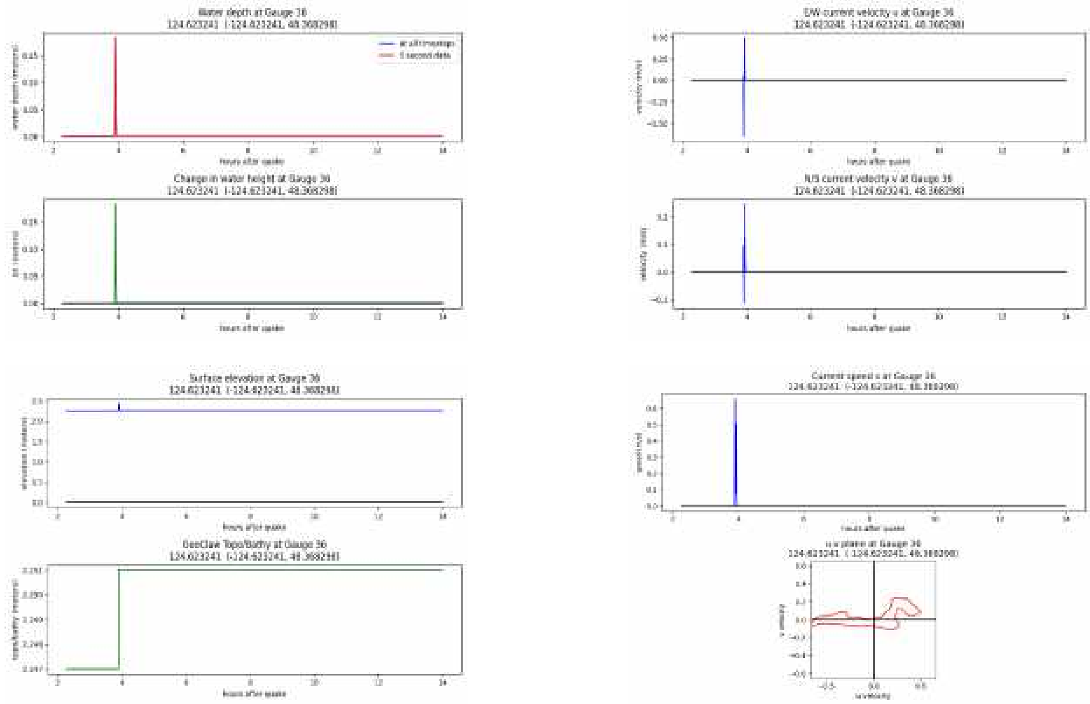
### Cascadia subduction zone scenario, MHW:



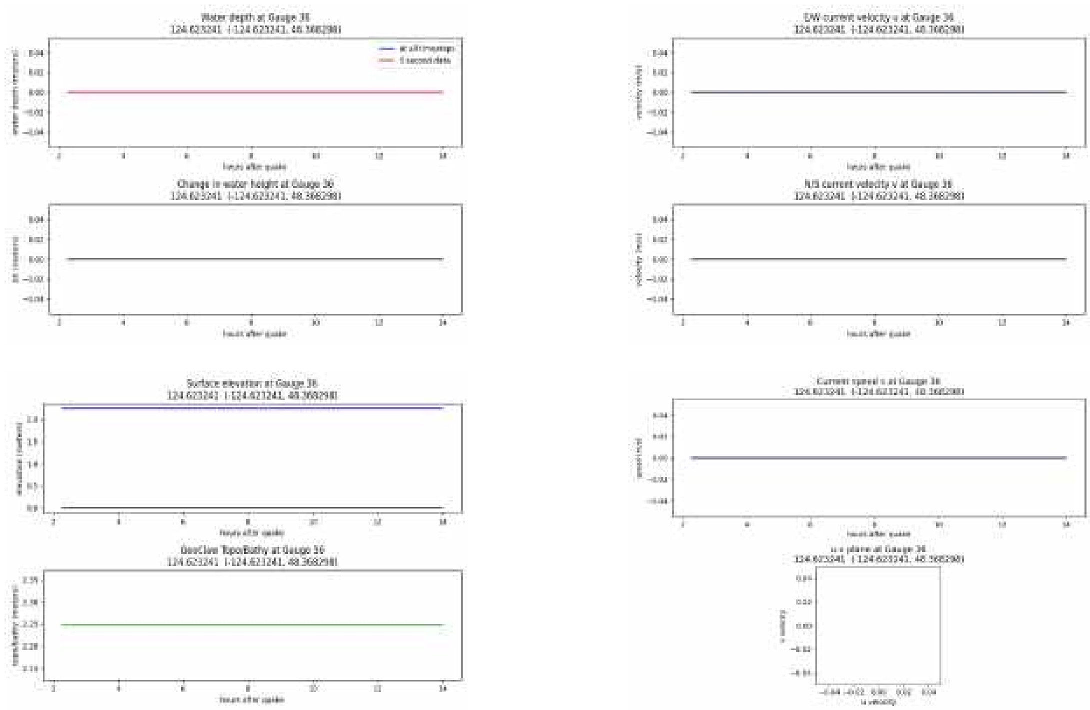
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

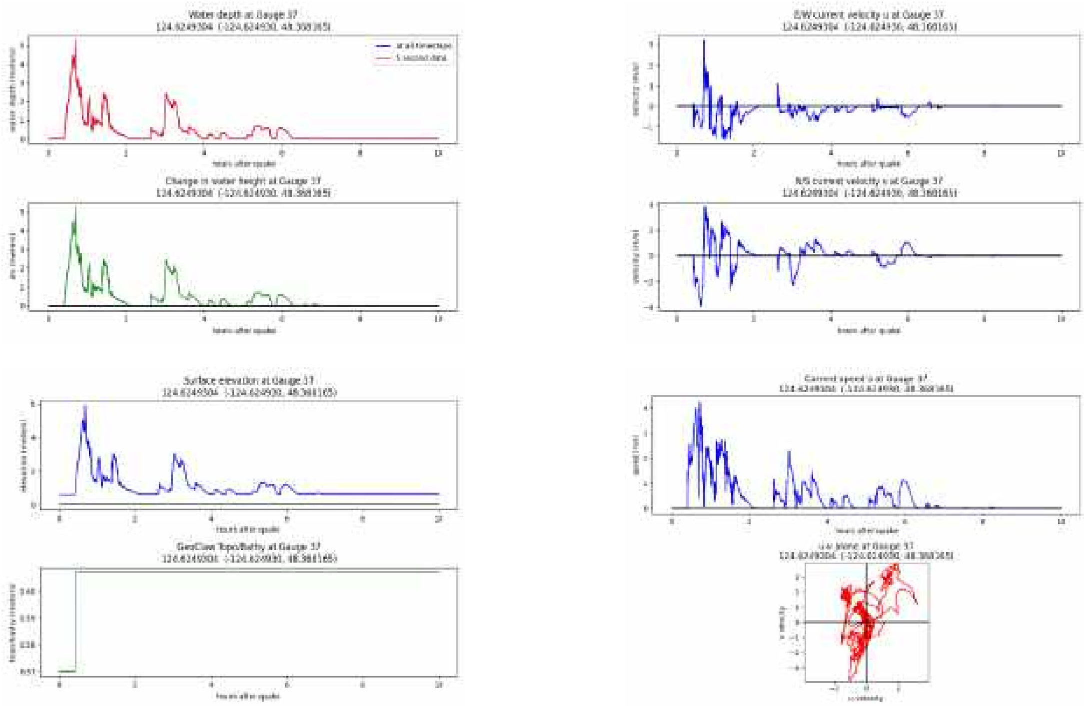



Alaska-Aleutian subduction zone scenario, MLW:

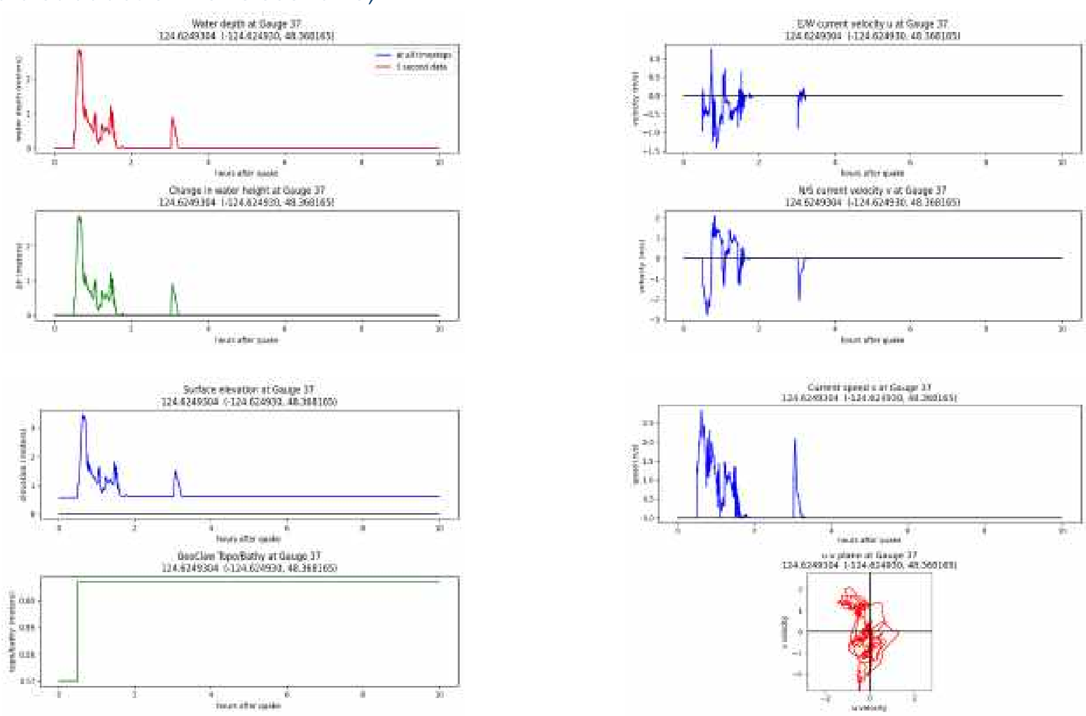


## Gauge 37: Makah Tribal Social Health Services

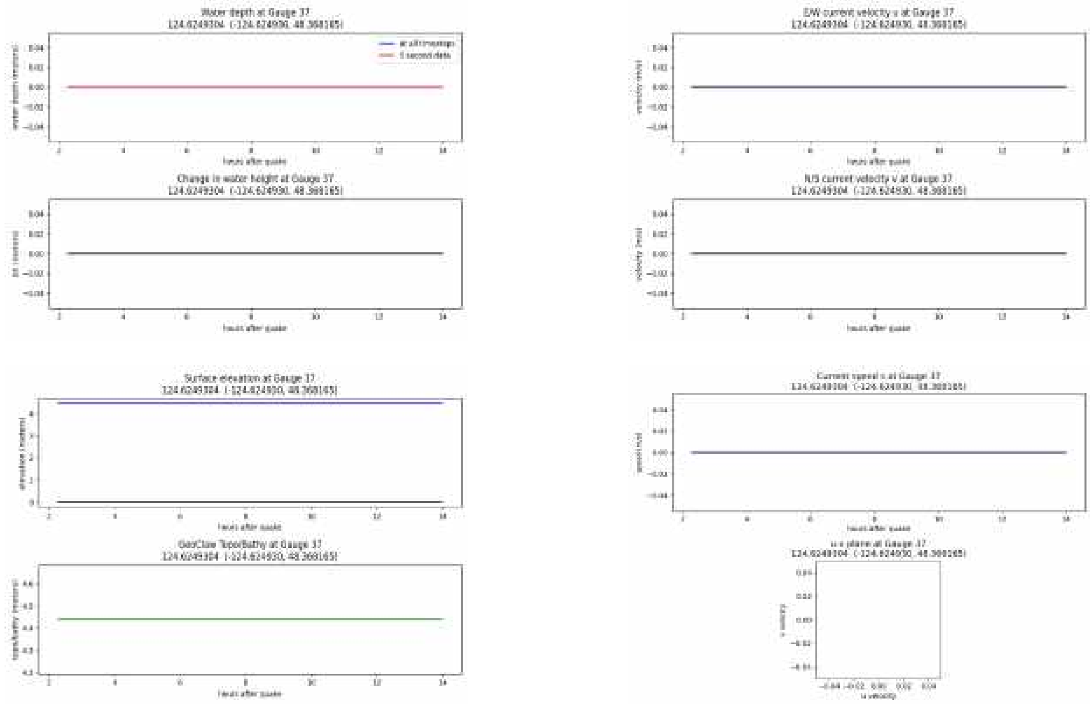
### Cascadia subduction zone scenario, MHW:



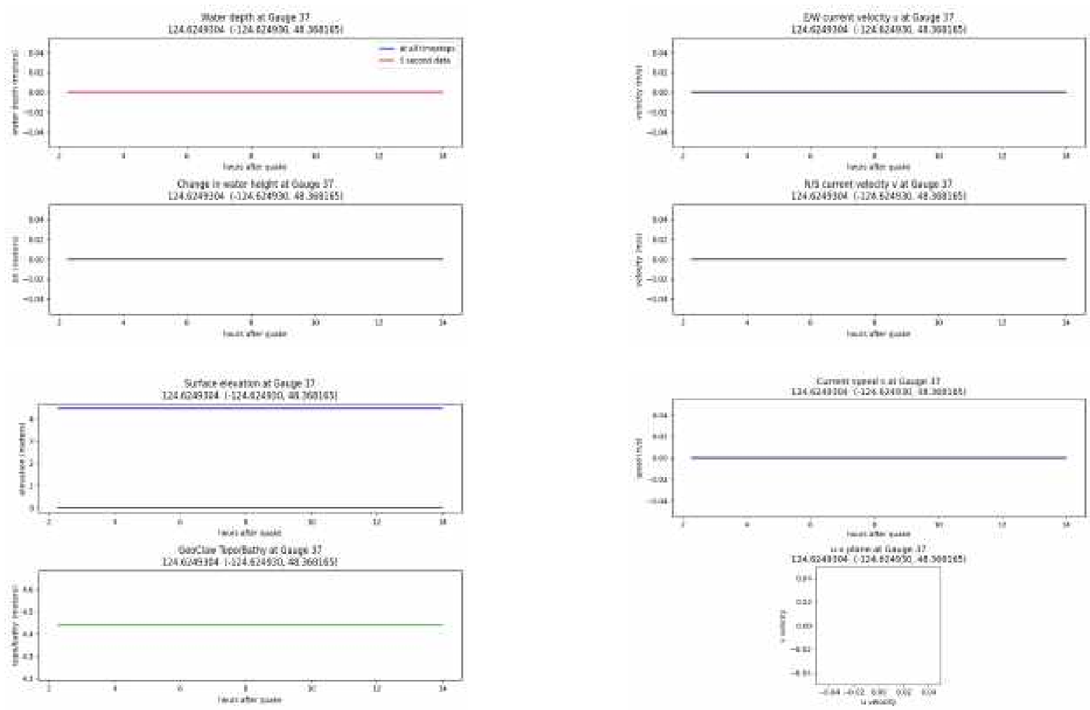
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

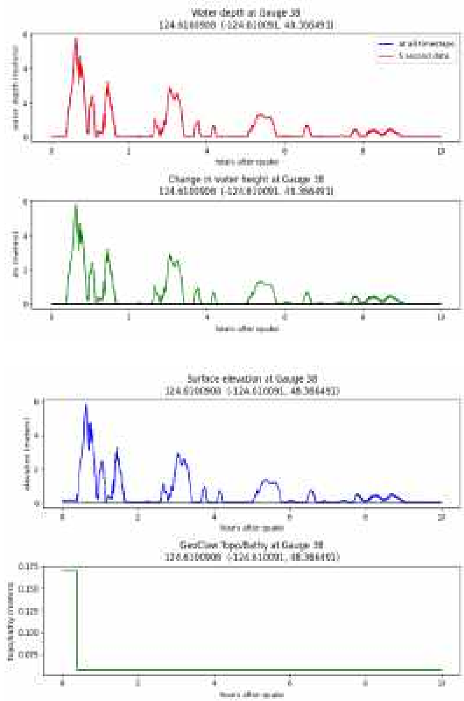


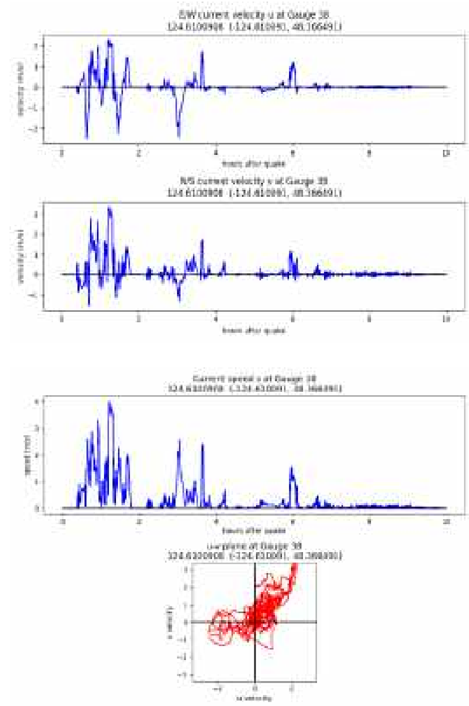

Alaska-Aleutian subduction zone scenario, MLW:



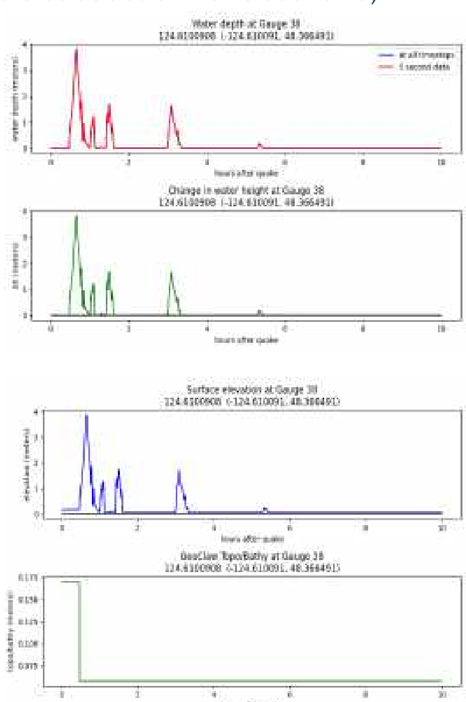
## Gauge 38: Makah Tribal Marina

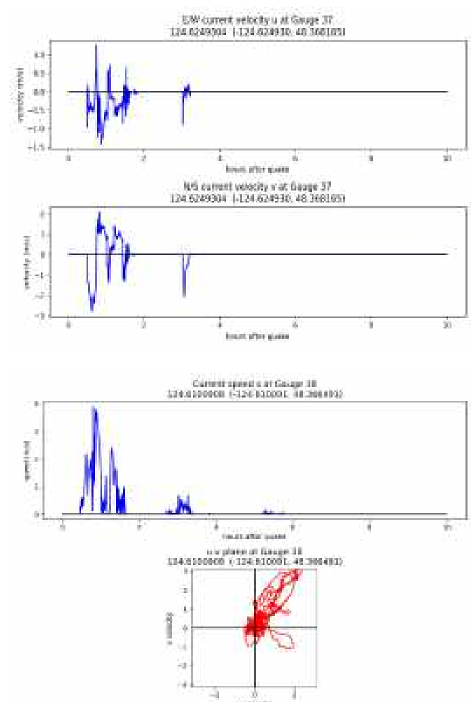
### Cascadia subduction zone scenario, MHW:



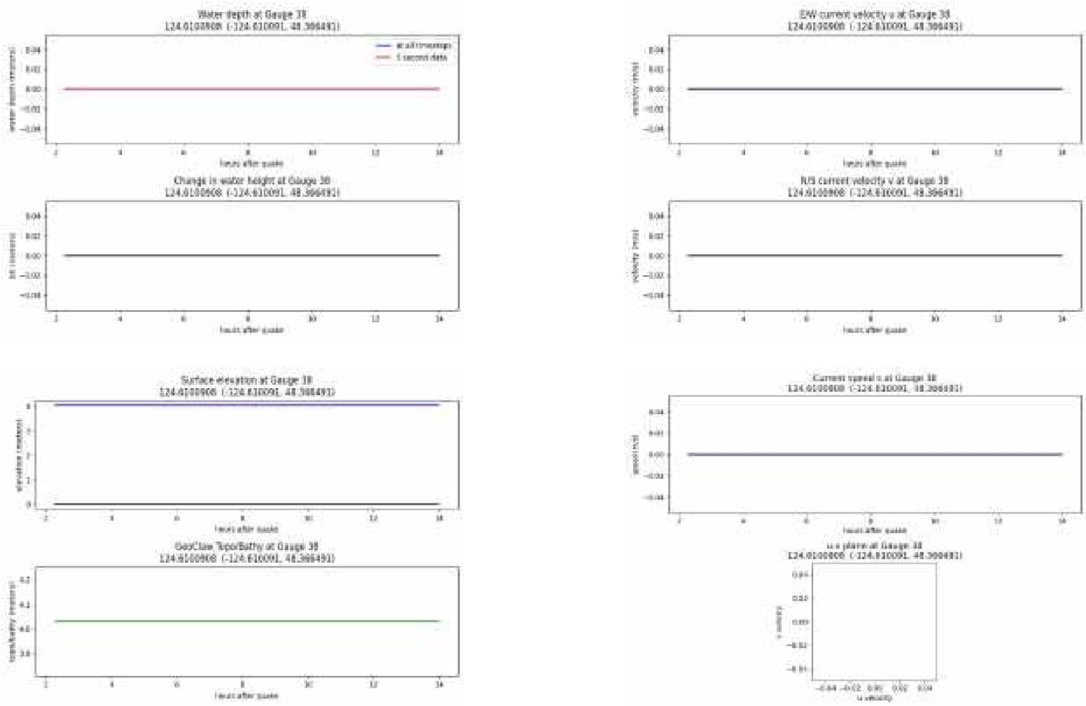




### Cascadia subduction zone scenario, MLW:

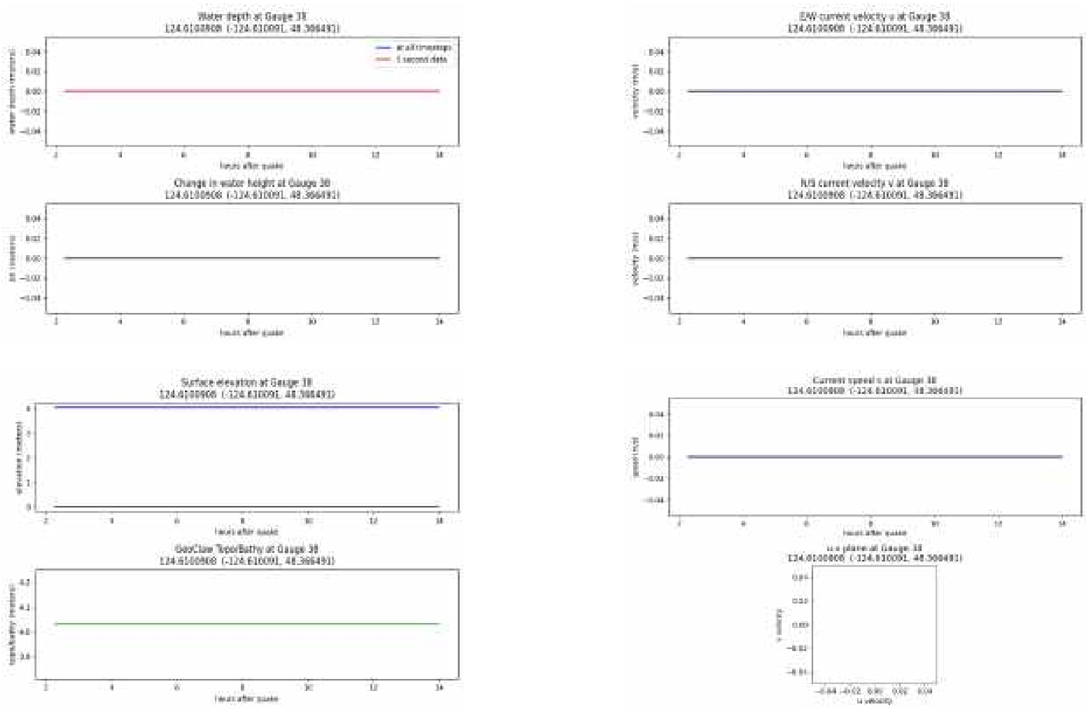


## Alaska-Aleutian subduction zone scenario, MHW:

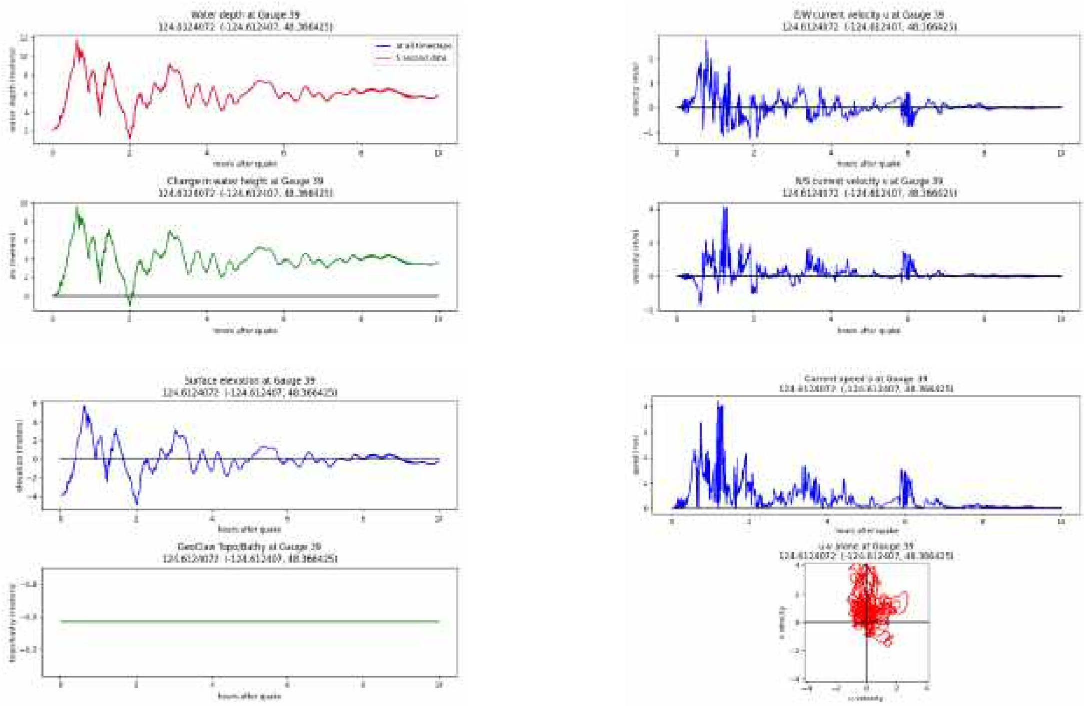



## Alaska-Aleutian subduction zone scenario, MLW:

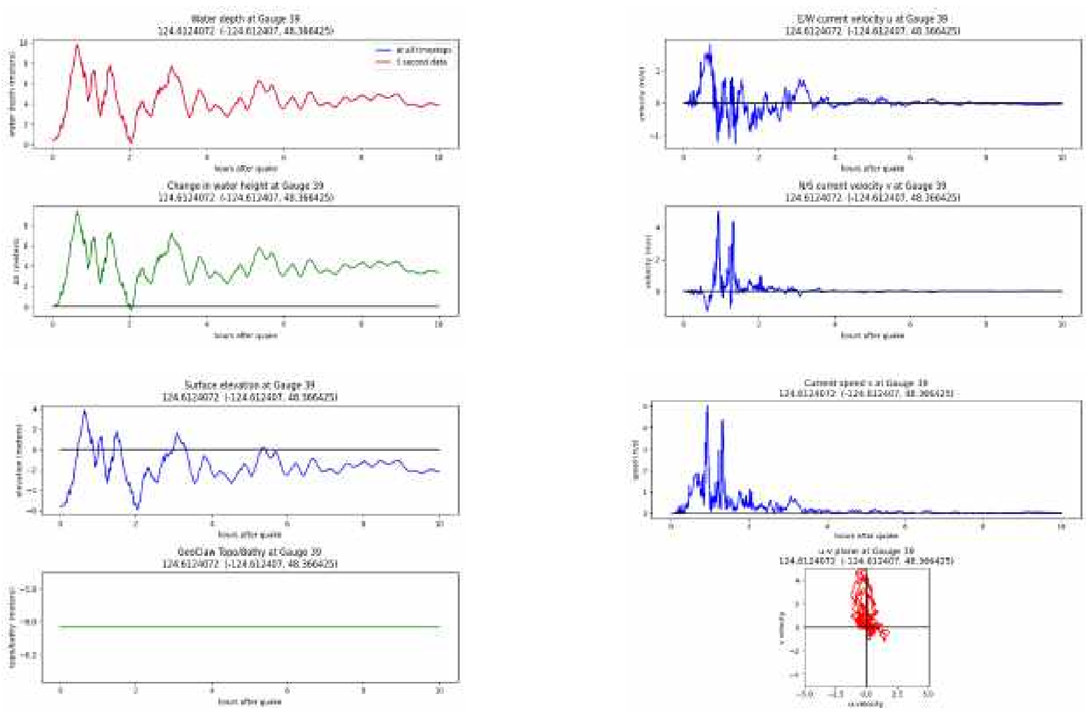


## Gauge 39: Makah Tribal Marina Boat Ramp

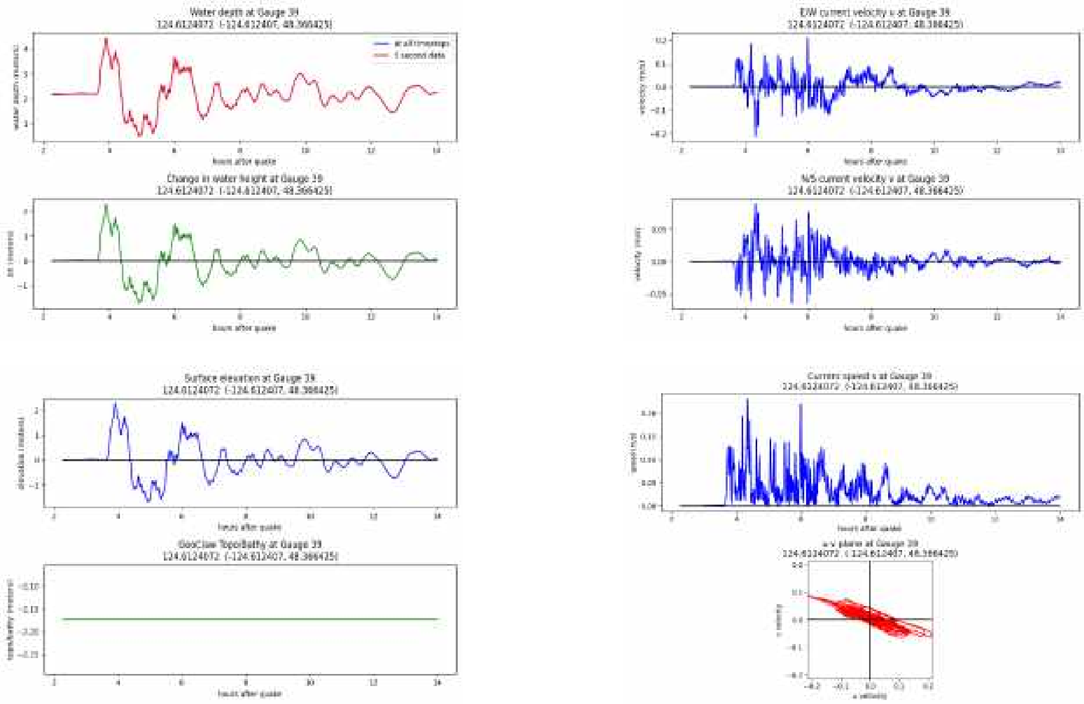
### Cascadia subduction zone scenario, MHW:



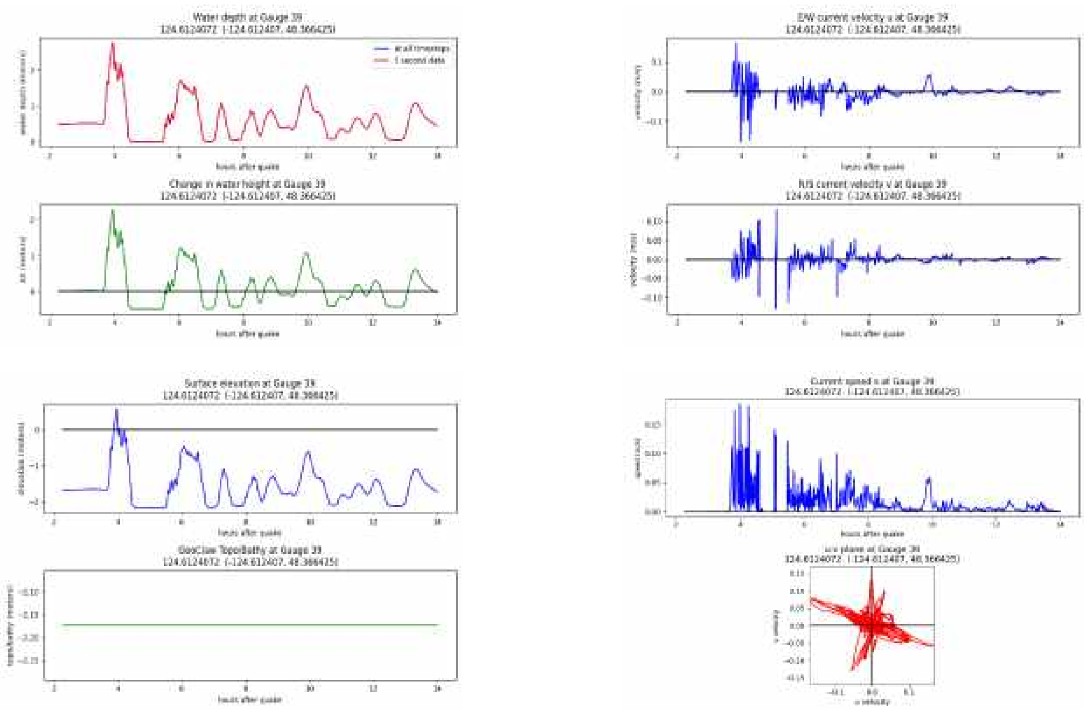
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

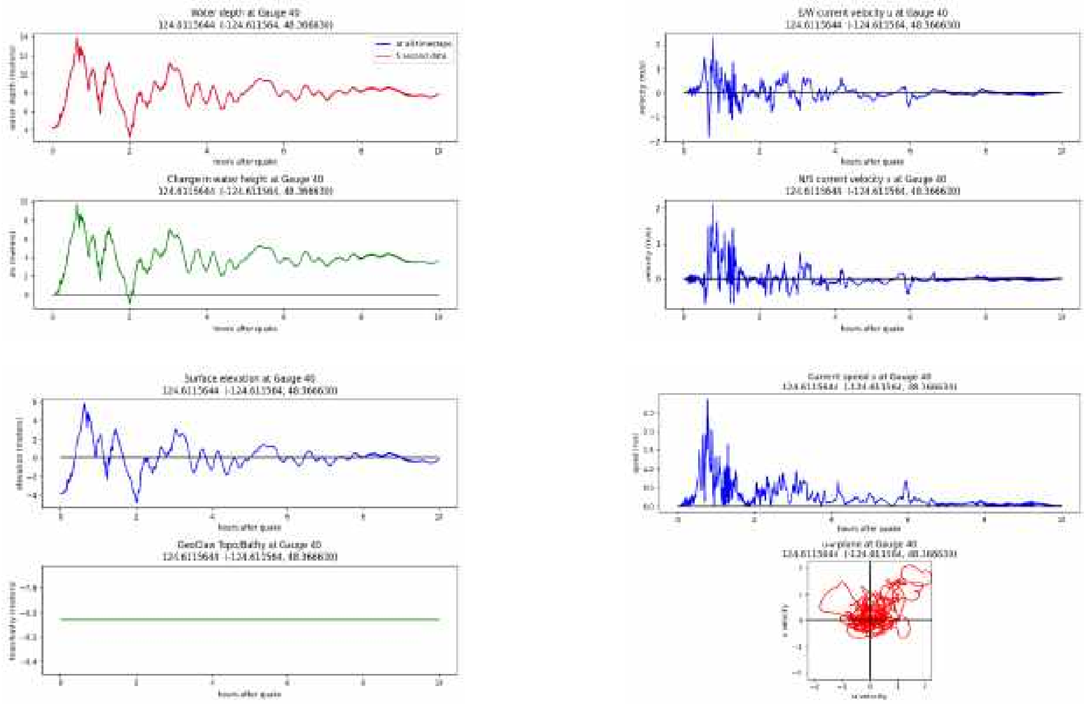


## Alaska-Aleutian subduction zone scenario, MLW:

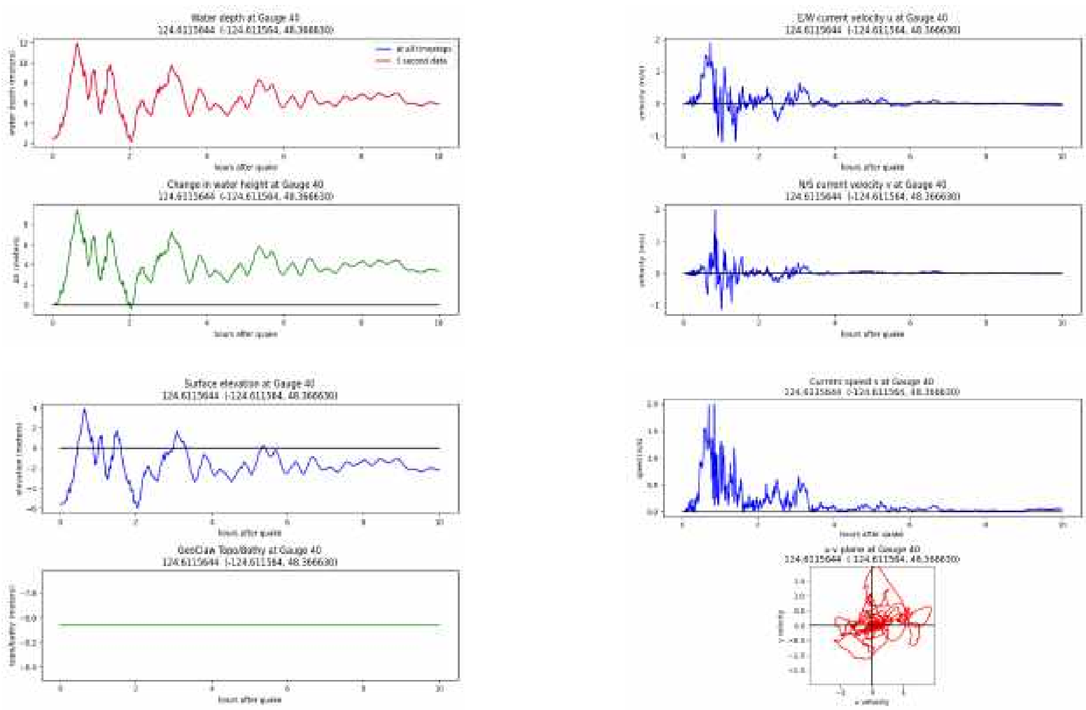


## Gauge 40: Makah Tribal Marina, south

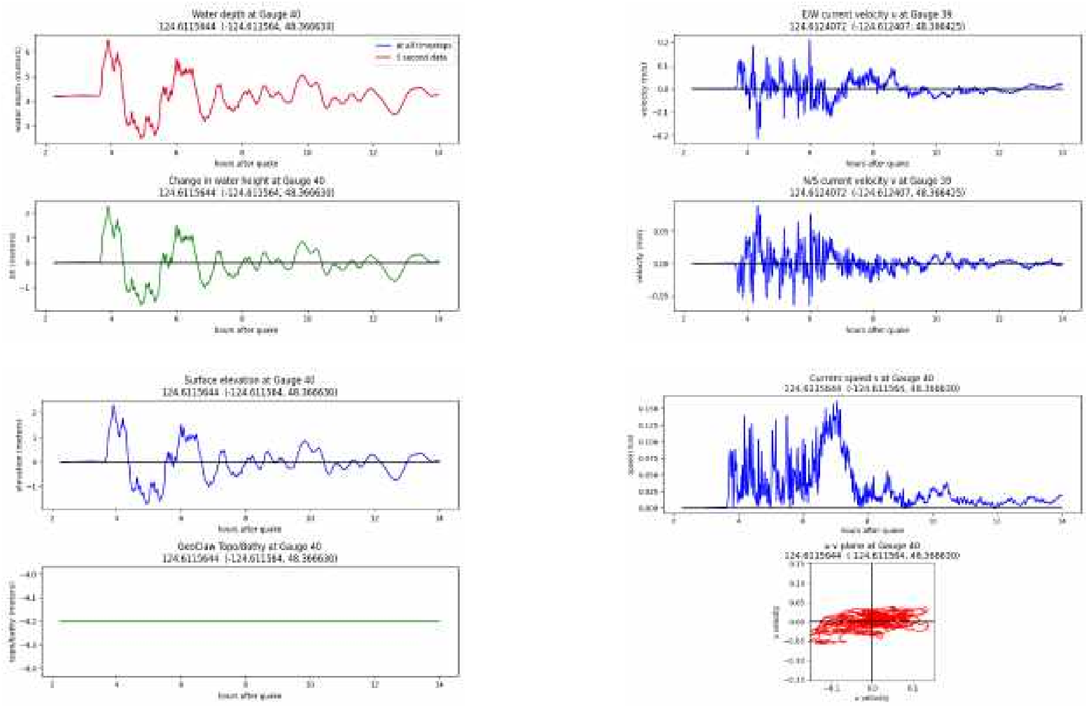
### Cascadia subduction zone scenario, MHW:



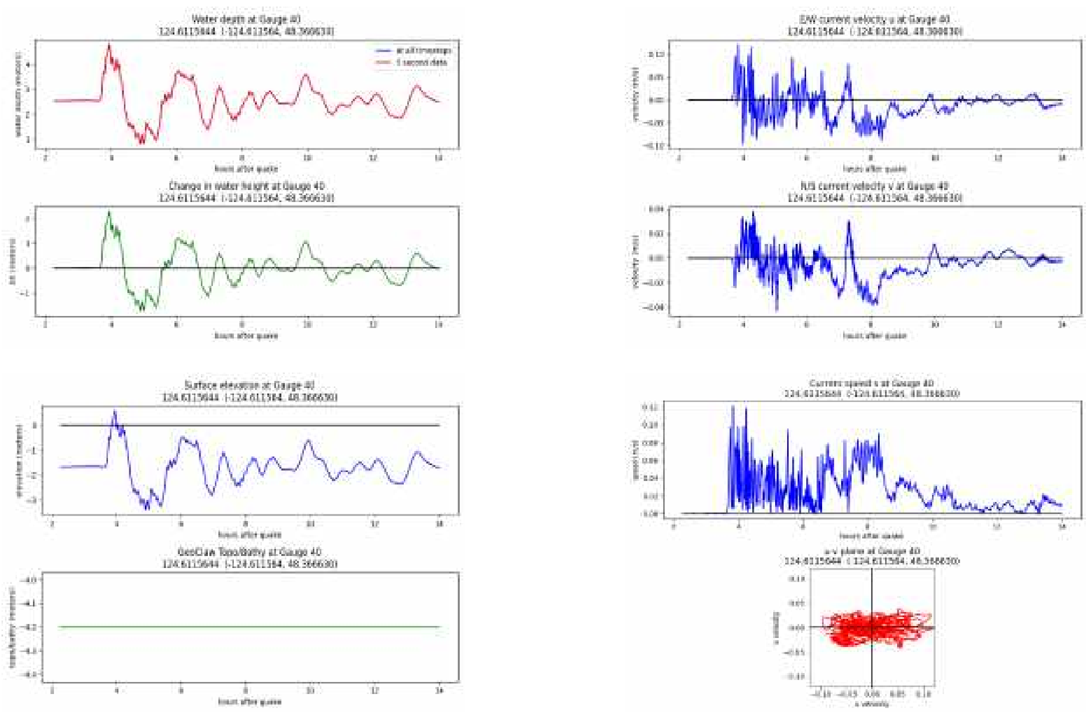
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

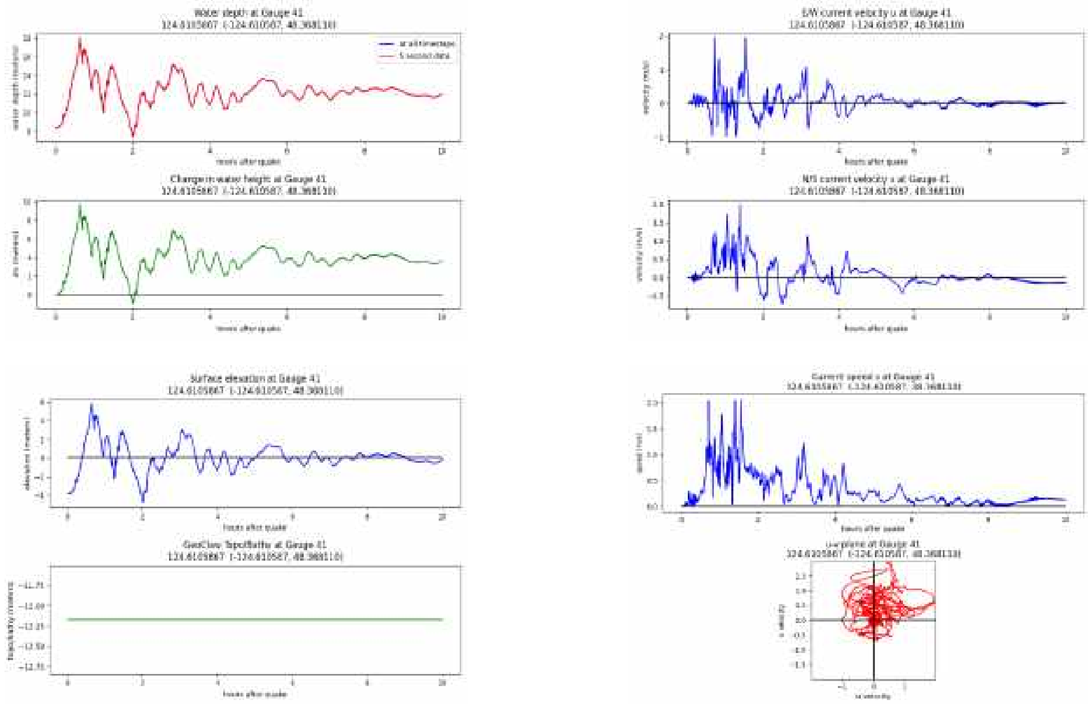



## Alaska-Aleutian subduction zone scenario, MLW:

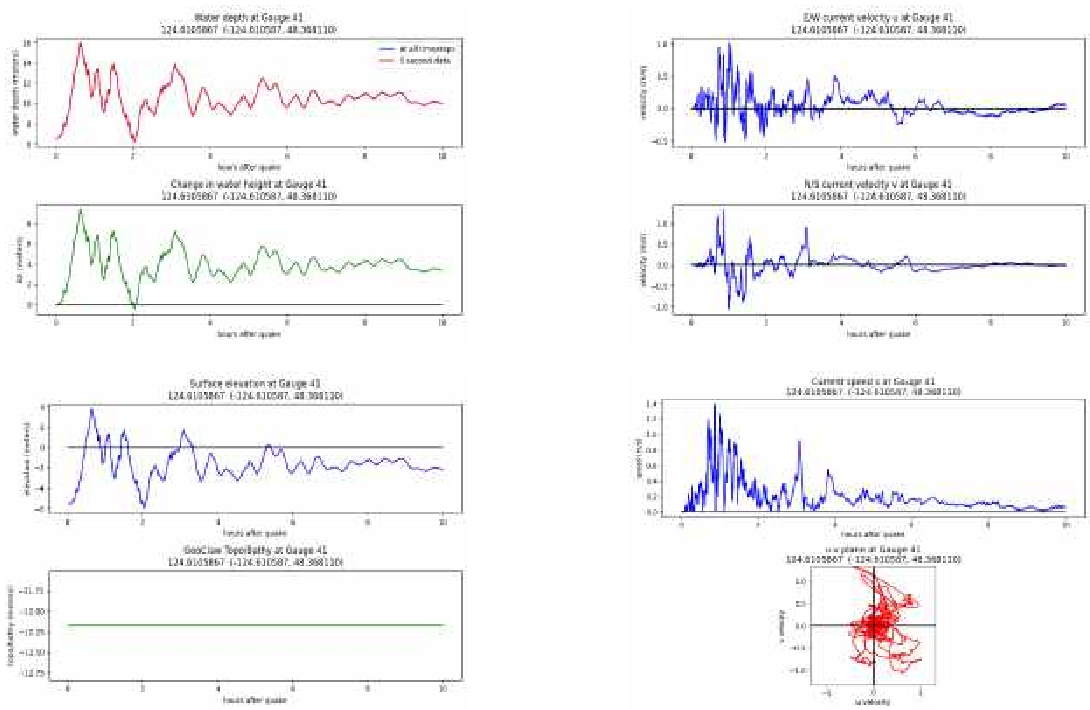


## Gauge 41: Makah Tribal Marina, center

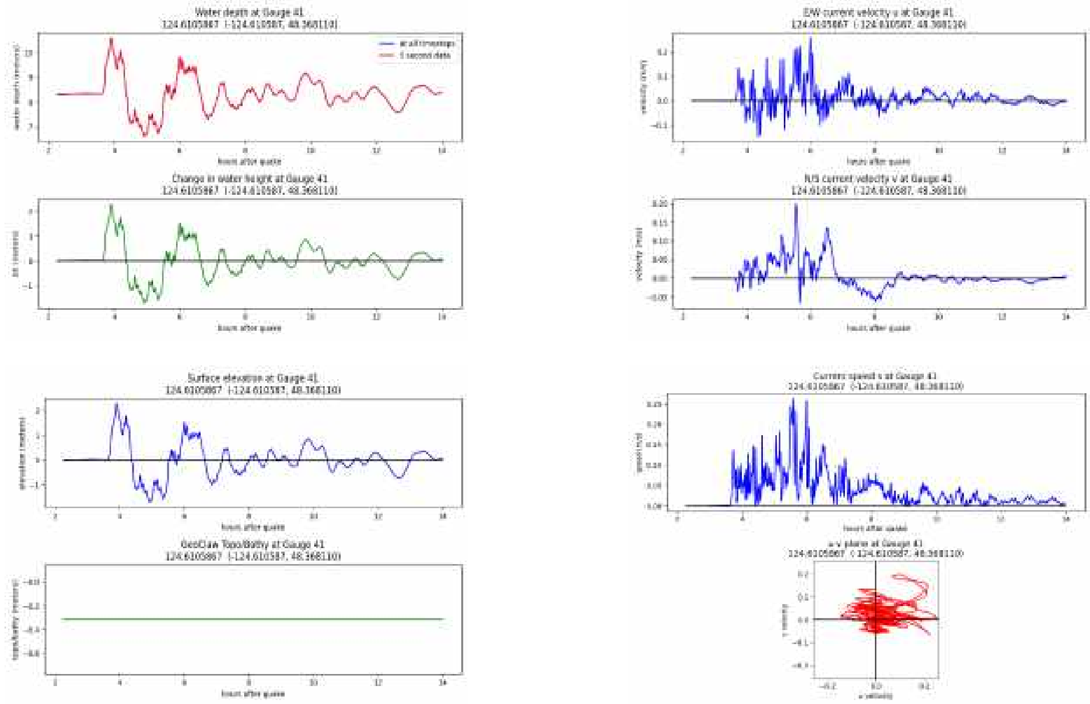
### Cascadia subduction zone scenario, MHW:



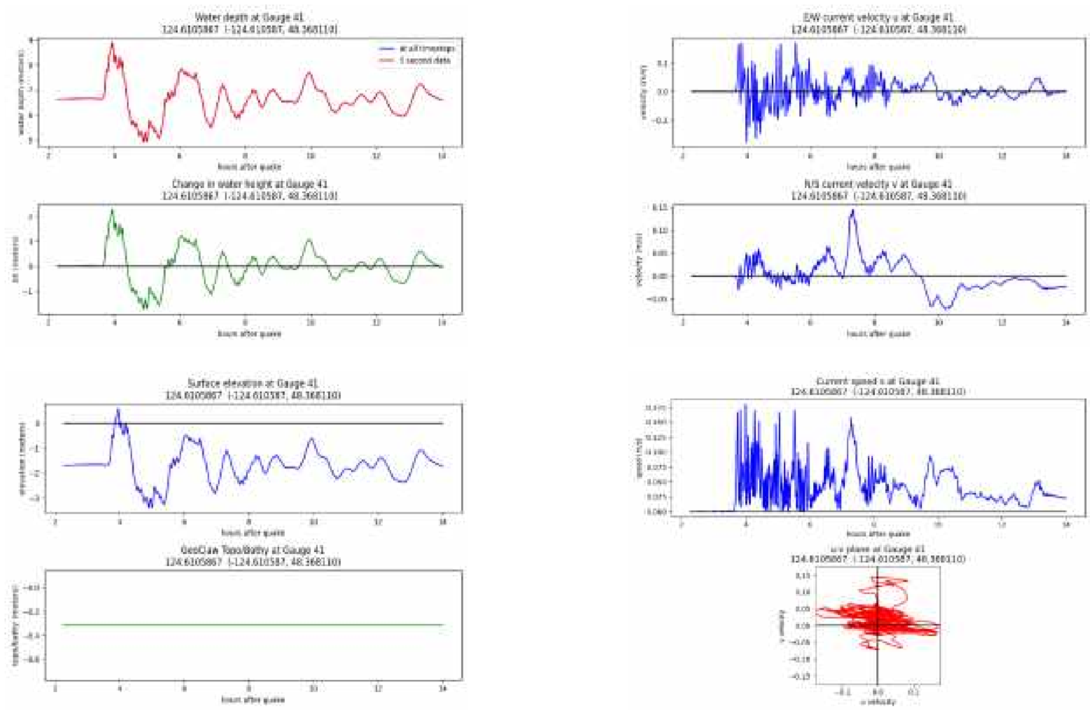
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

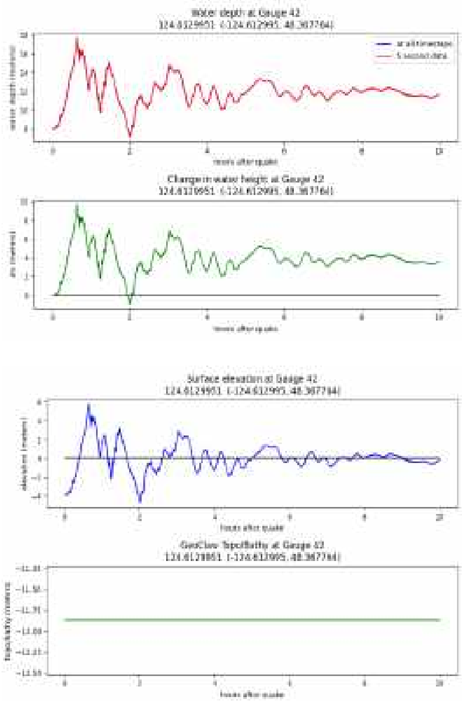


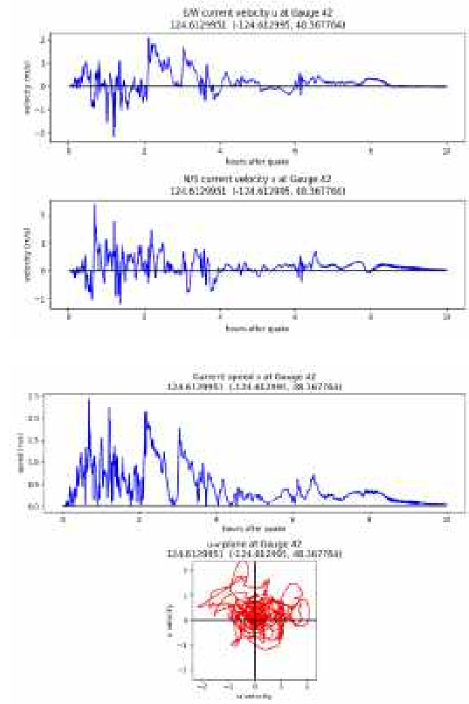

## Alaska-Aleutian subduction zone scenario, MLW:



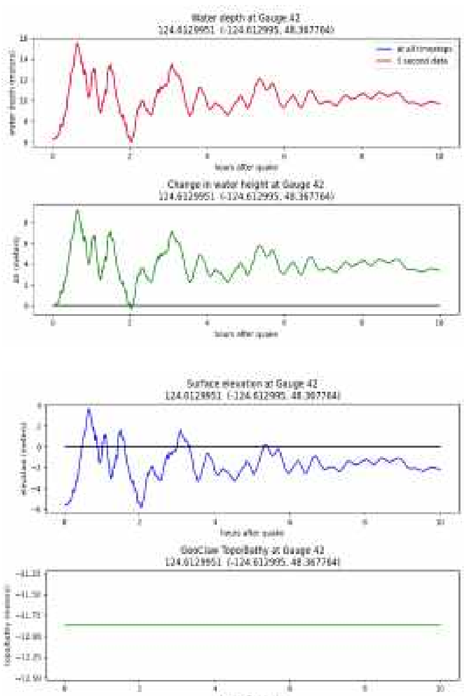
## Gauge 42: Makah Tribal Marina, west

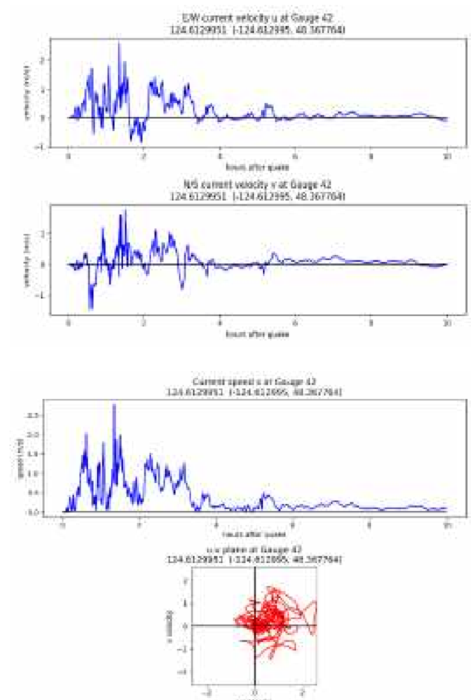
### Cascadia subduction zone scenario, MHW:



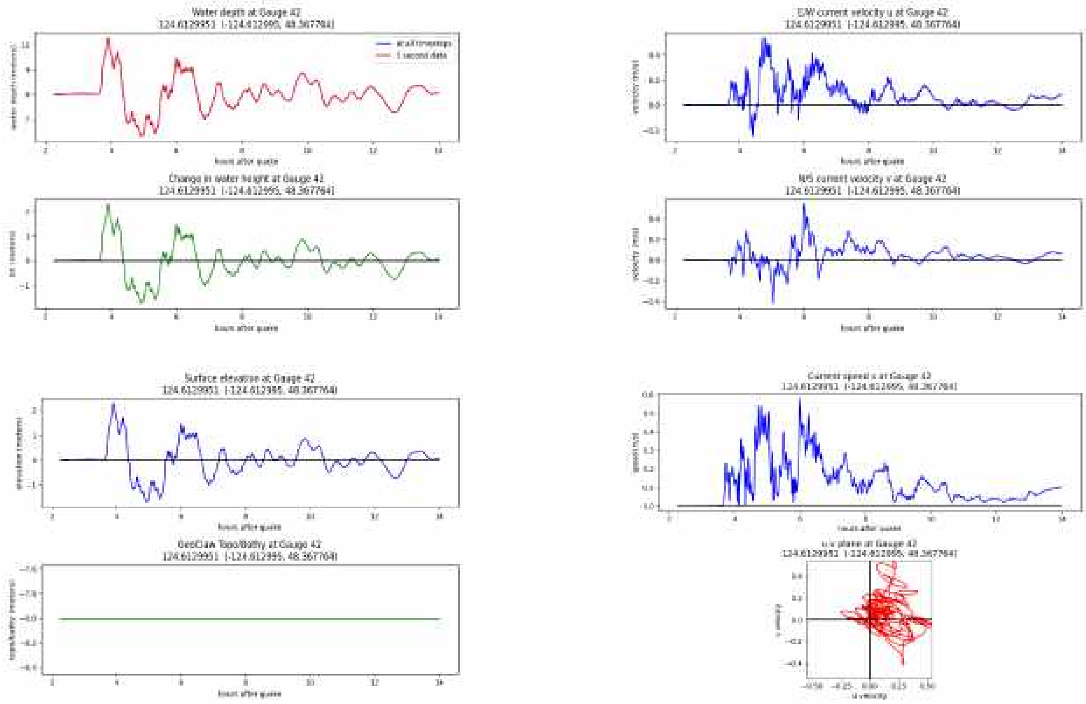




### Cascadia subduction zone scenario, MLW:

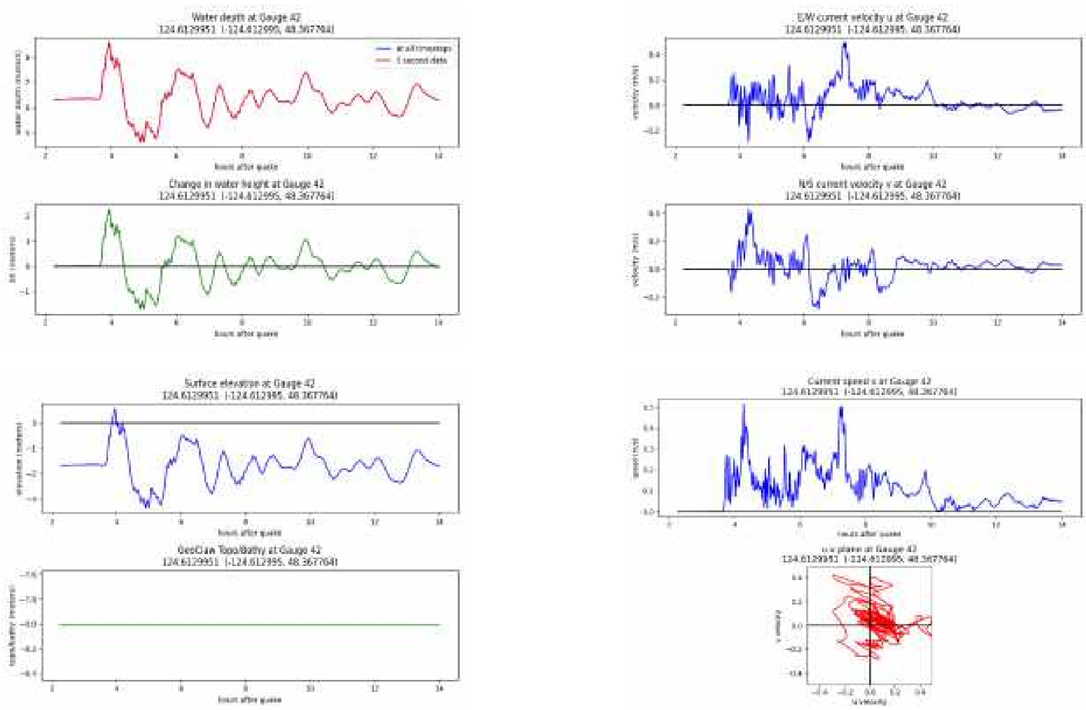


## Alaska-Aleutian subduction zone scenario, MHW:

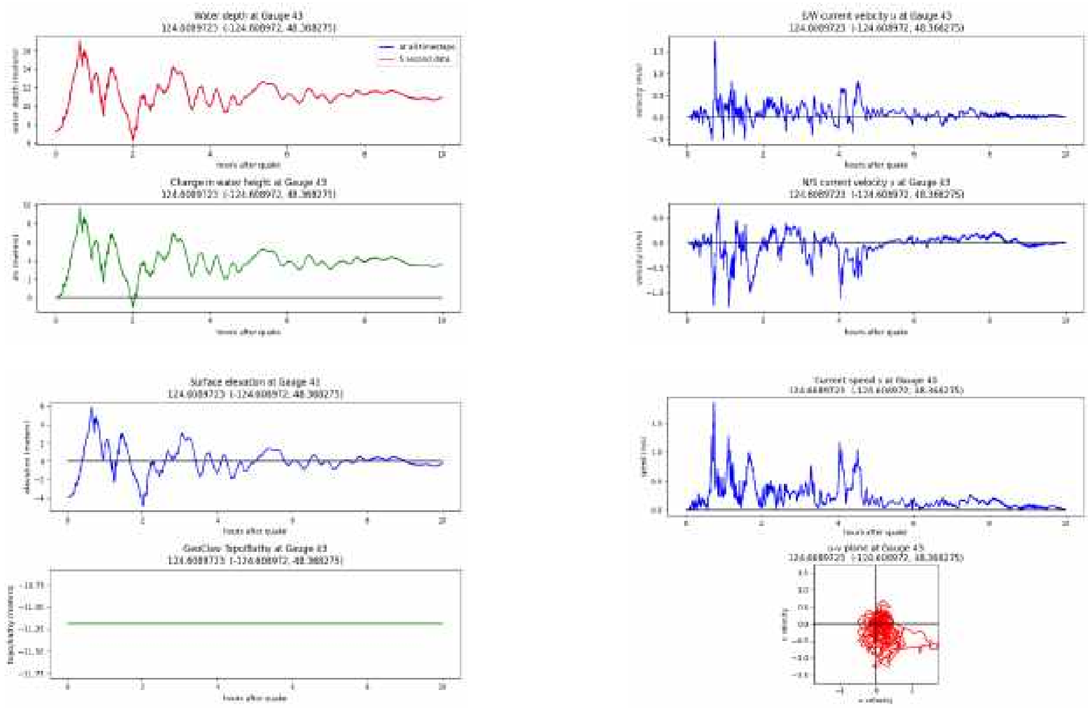



## Alaska-Aleutian subduction zone scenario, MLW:

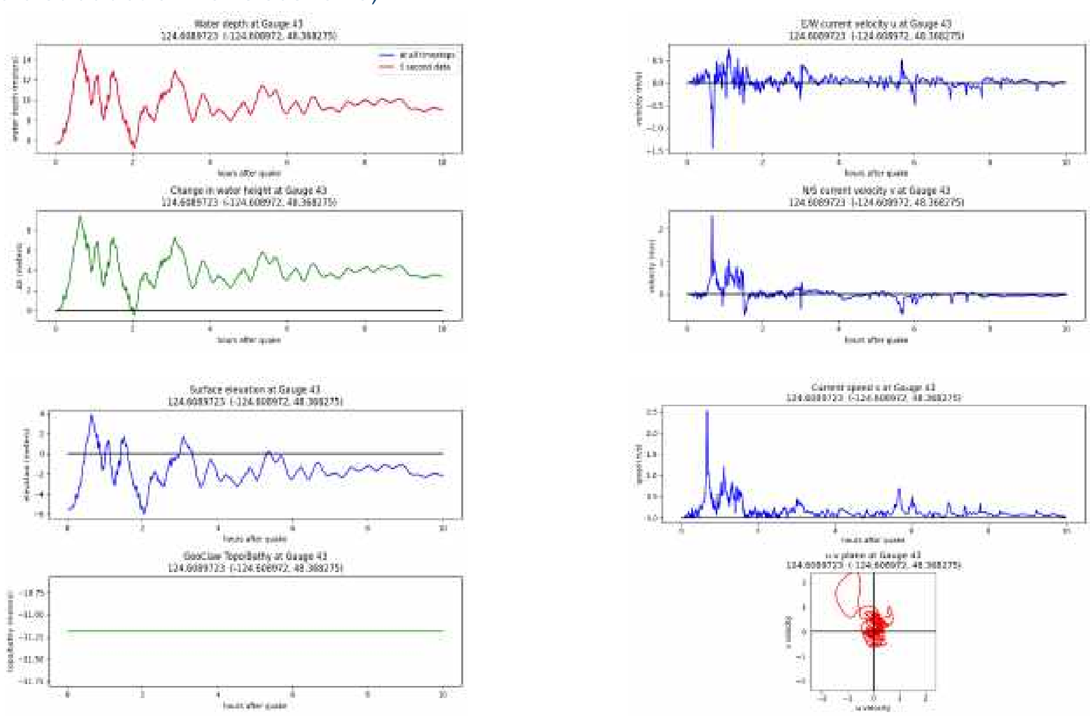


## Gauge 43: Makah Tribal Marina, east

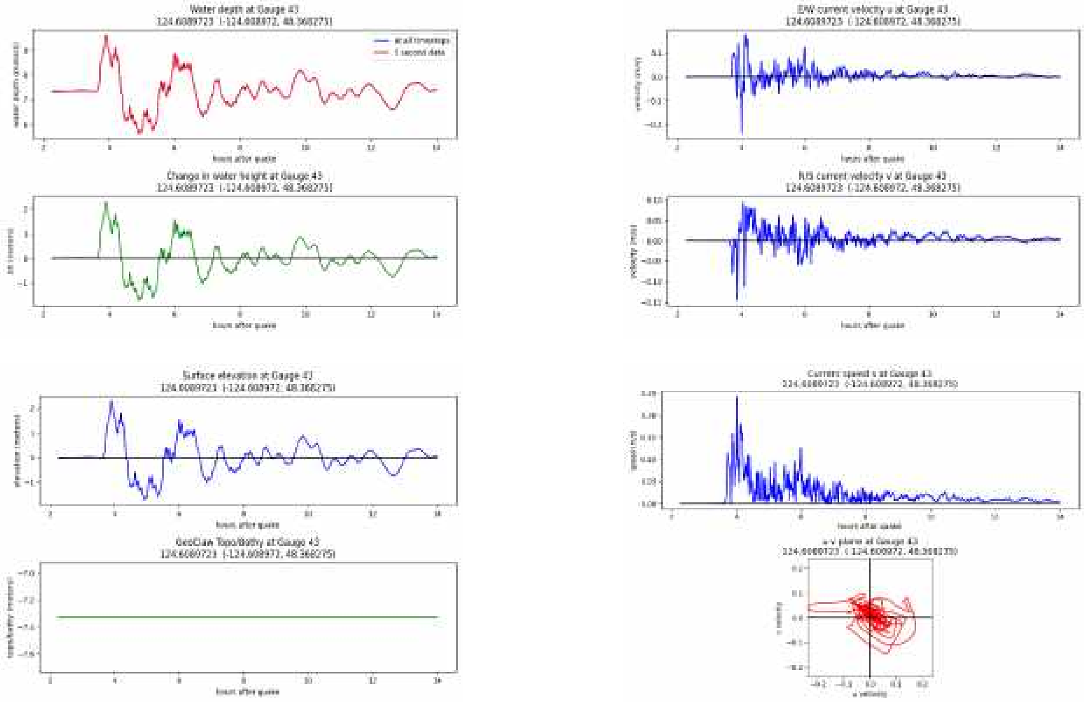
### Cascadia subduction zone scenario, MHW:



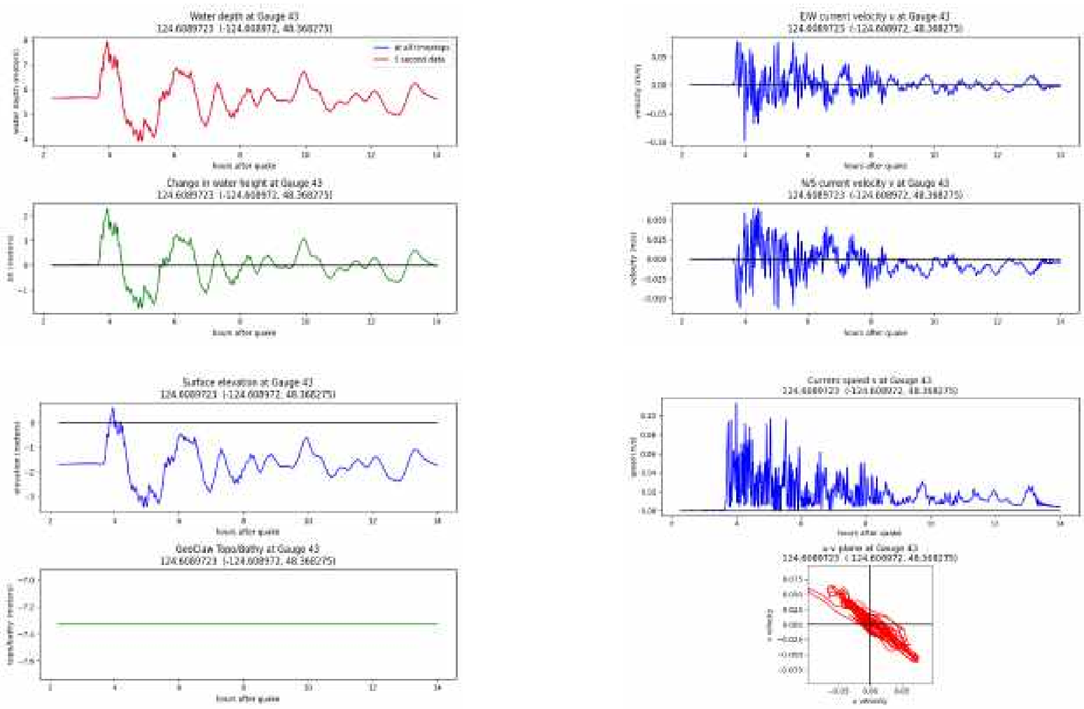

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

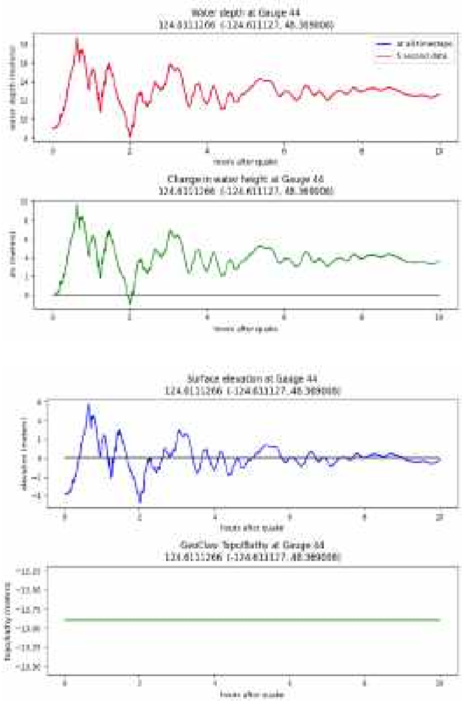


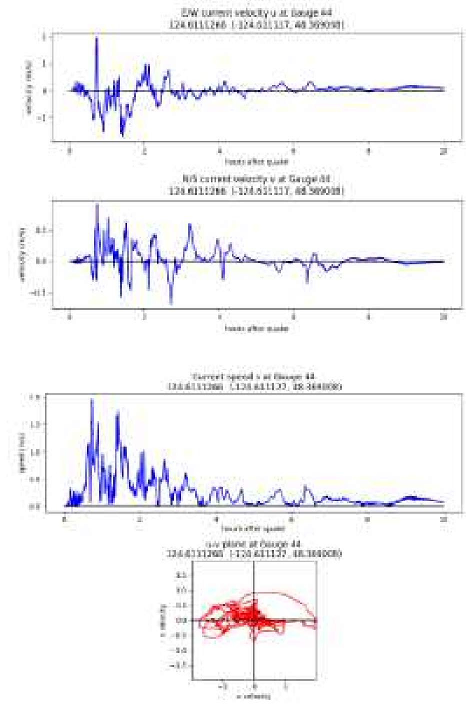

## Alaska-Aleutian subduction zone scenario, MLW:



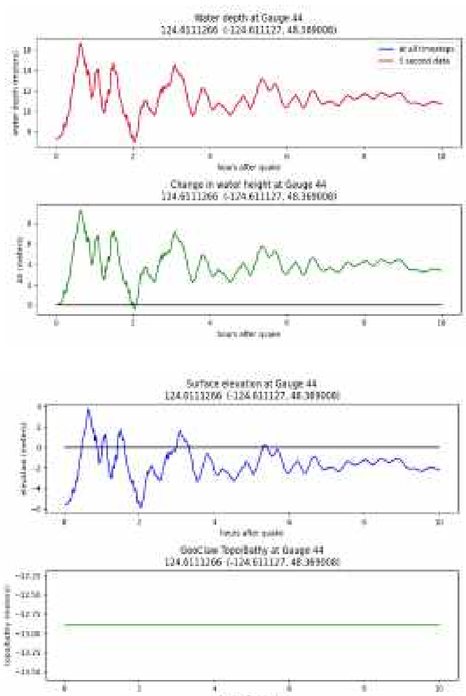
## Gauge 44: Makah Tribal Marina, north

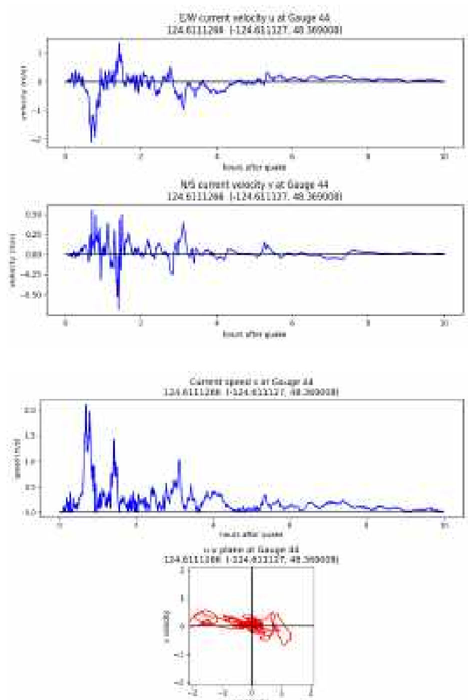
### Cascadia subduction zone scenario, MHW:



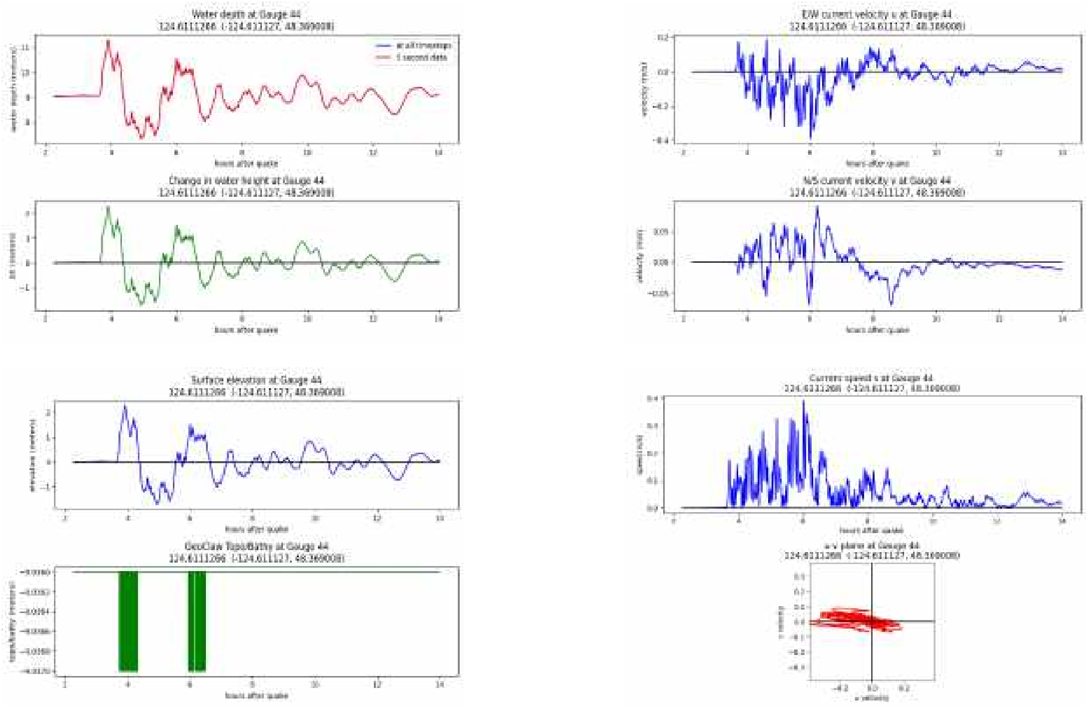


### Cascadia subduction zone scenario, MLW:

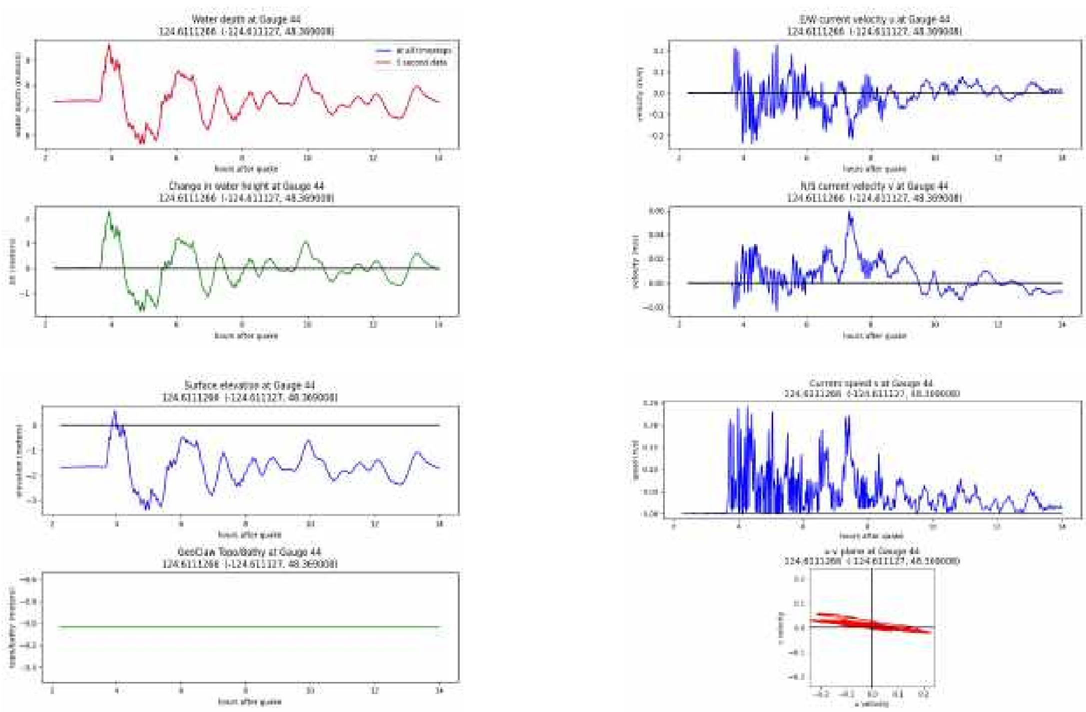




## Alaska-Aleutian subduction zone scenario, MHW:

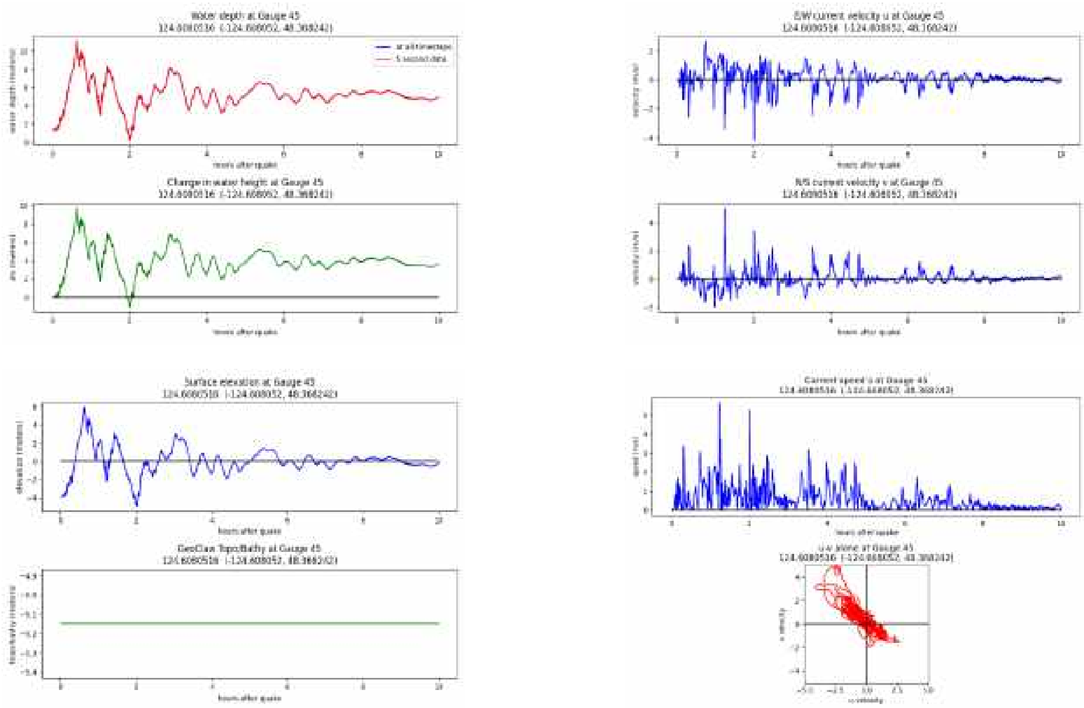



## Alaska-Aleutian subduction zone scenario, MLW:

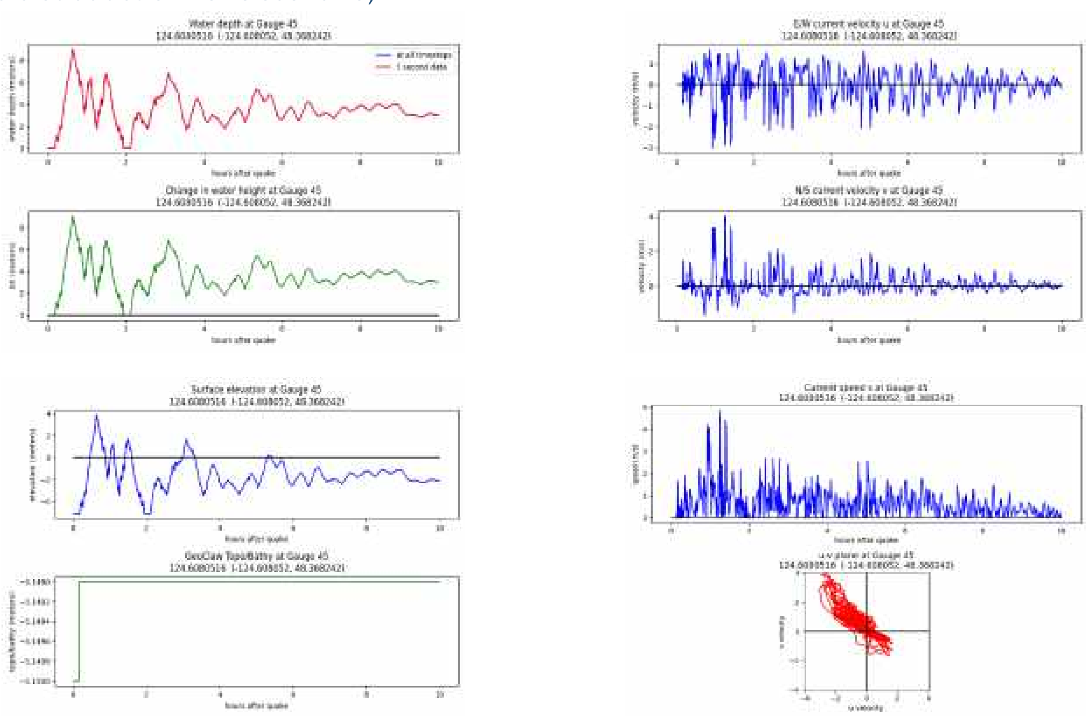


## Gauge 45: Makah Tribal Marina Breakwater, west entrance

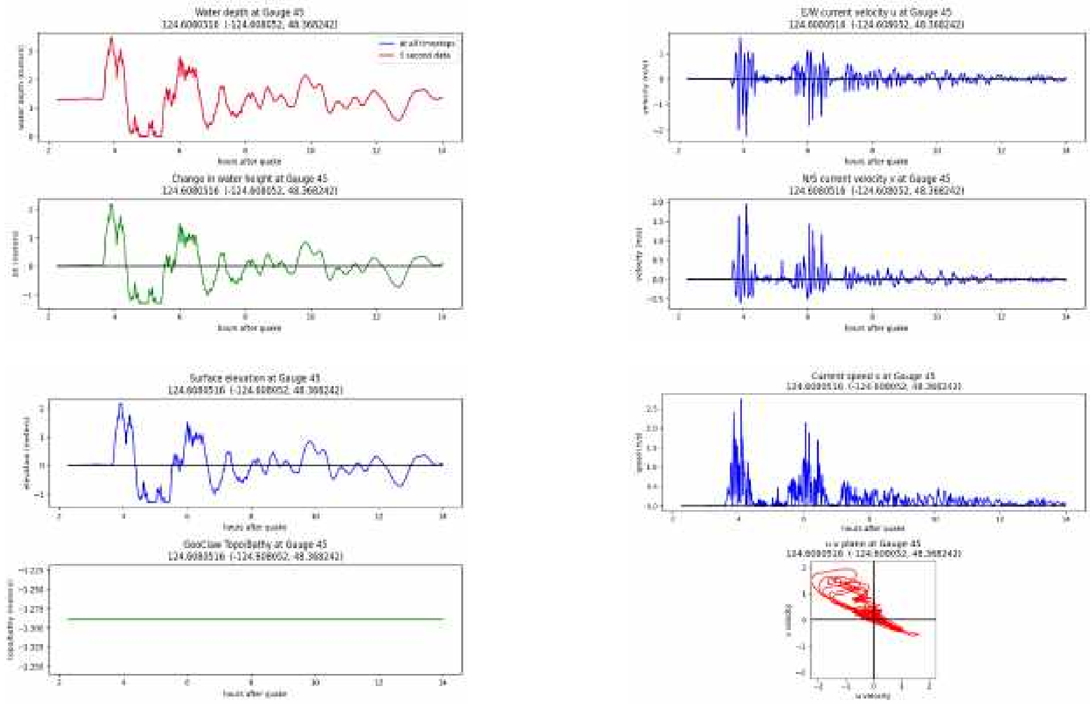
### Cascadia subduction zone scenario, MHW:



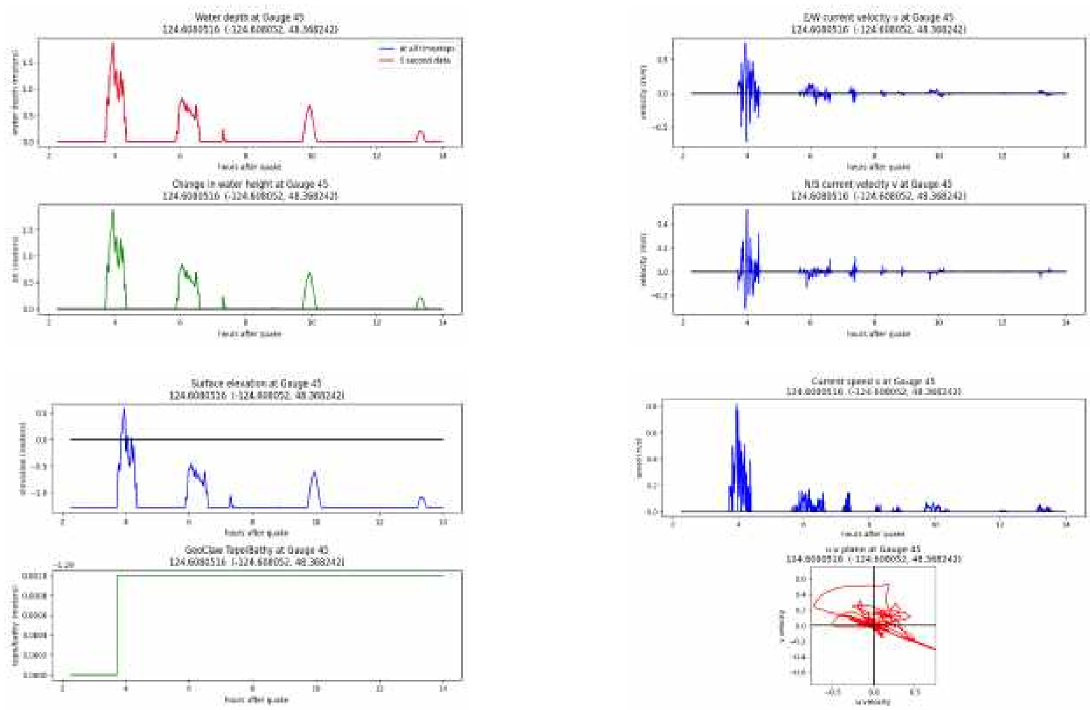

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

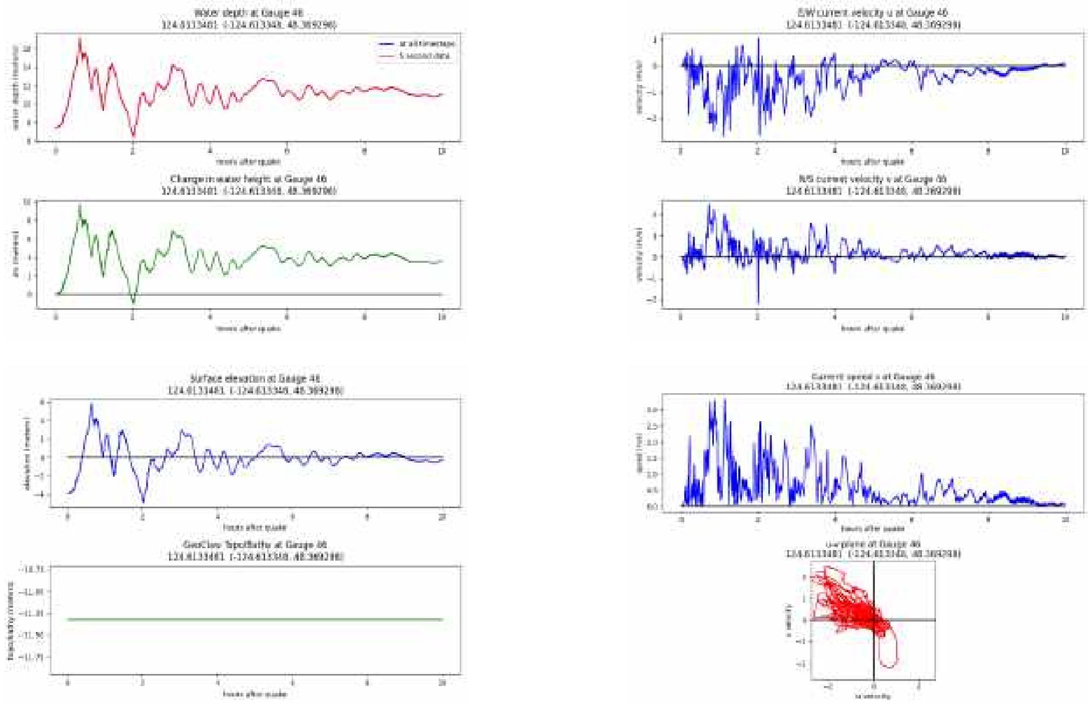


## Alaska-Aleutian subduction zone scenario, MLW:

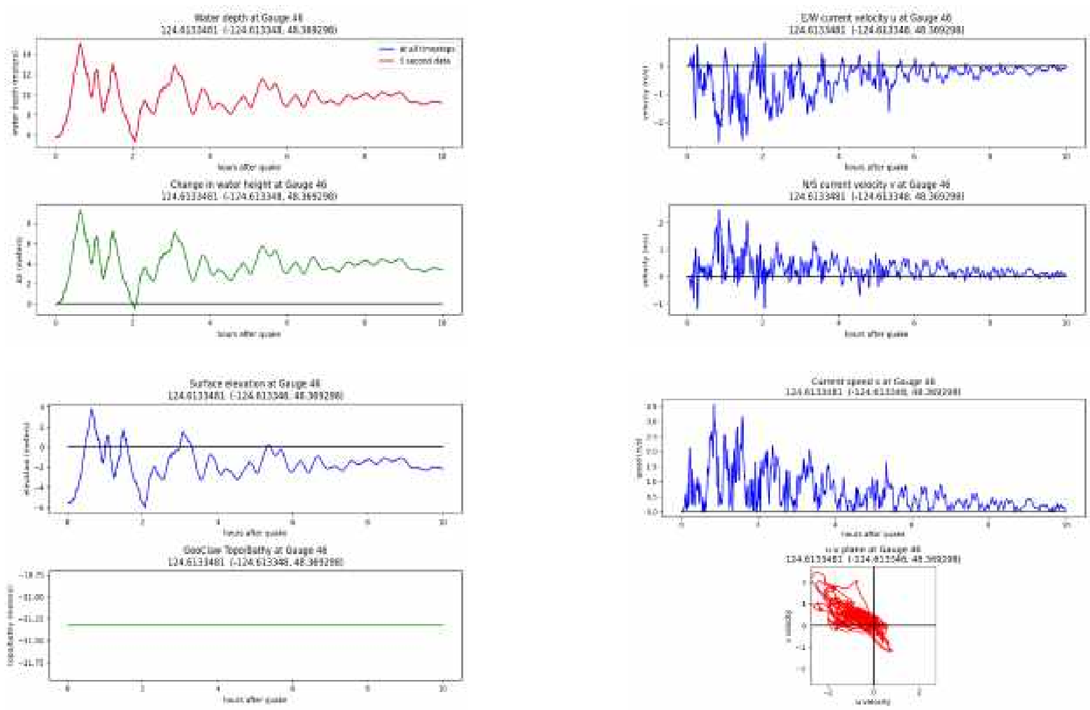


## Gauge 46: Makah Tribal Marina Breakwater, north entrance

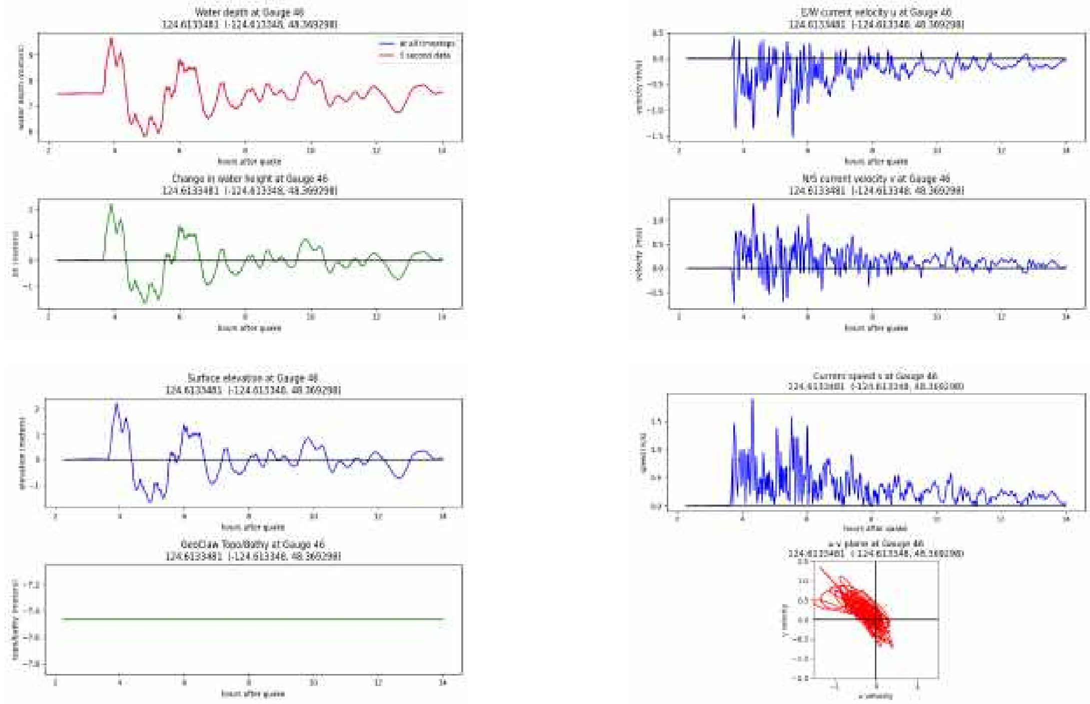
### Cascadia subduction zone scenario, MHW:



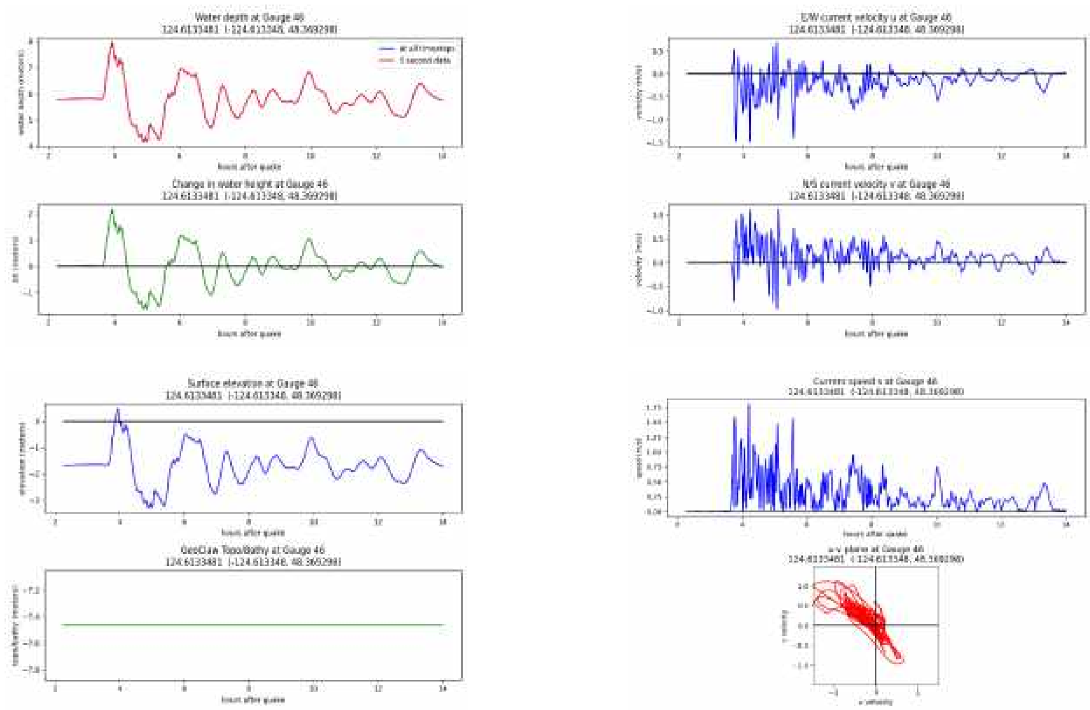
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

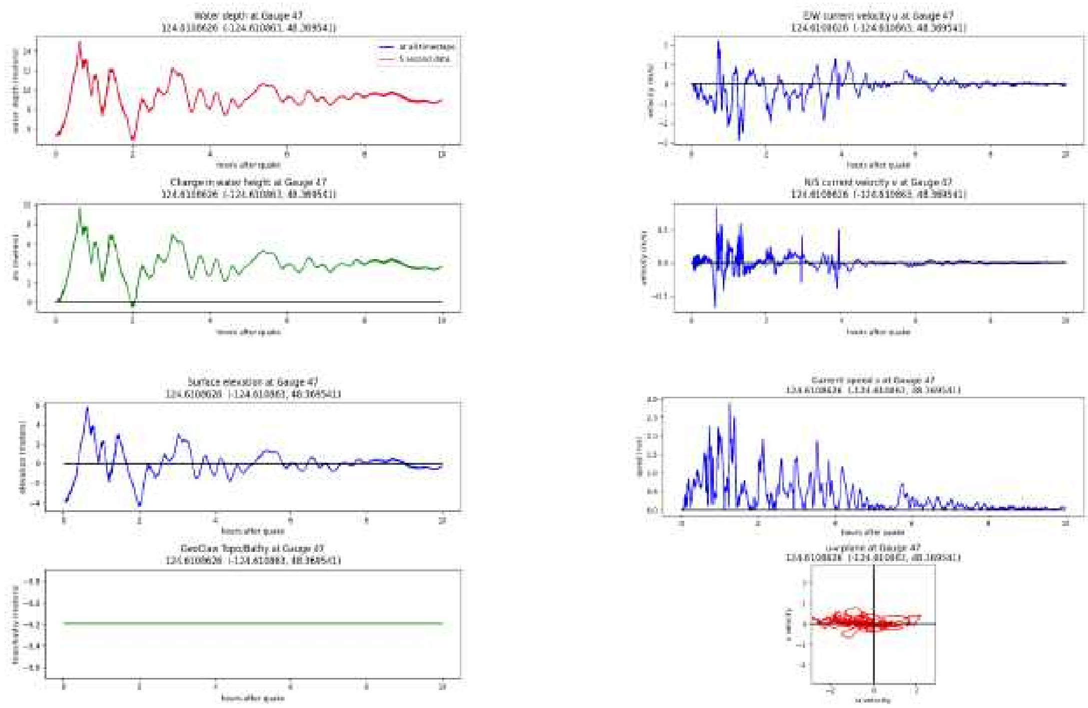



## Alaska-Aleutian subduction zone scenario, MLW:

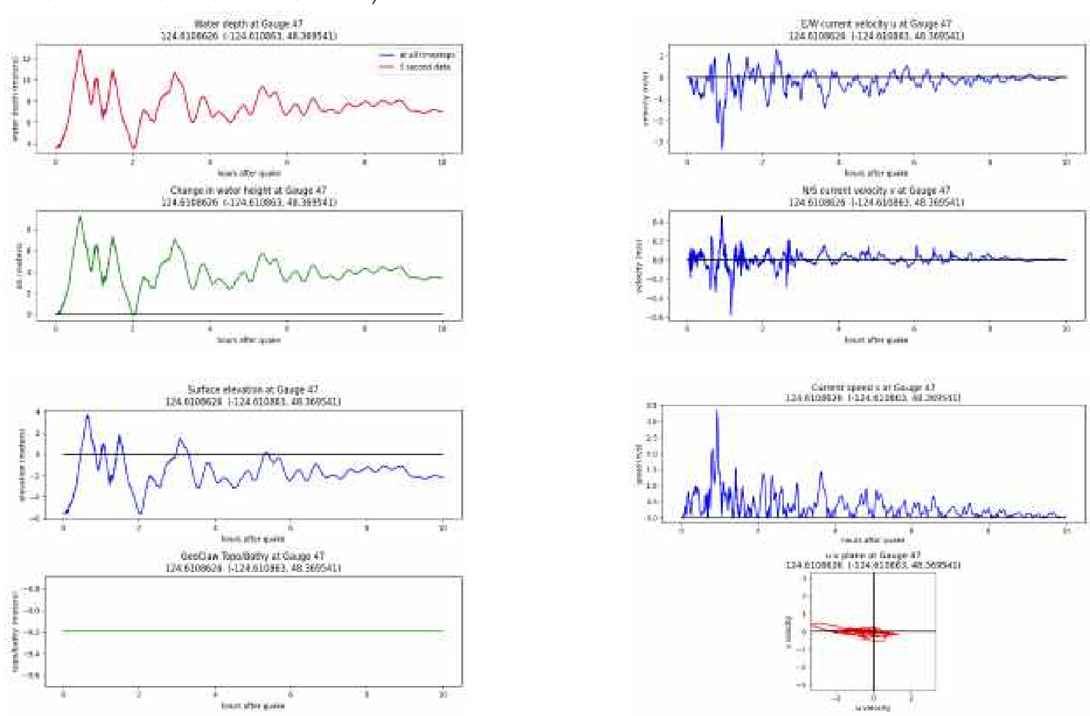


## Gauge 47: Makah Tribal Marina north of breakwater, center

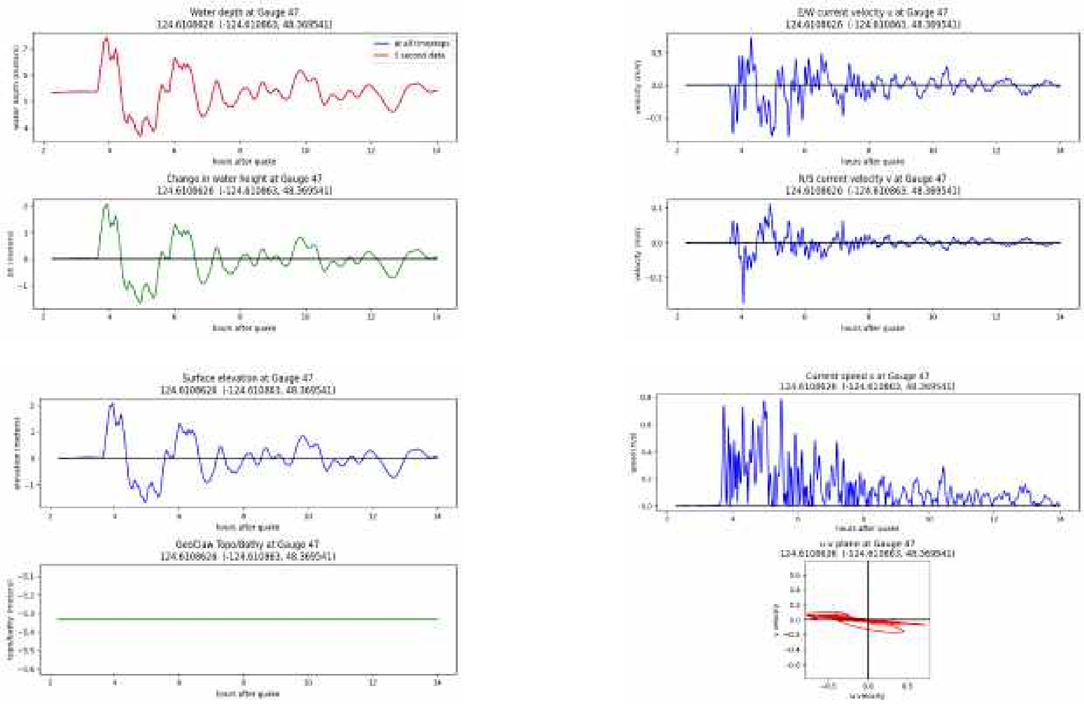
### Cascadia subduction zone scenario, MHW:



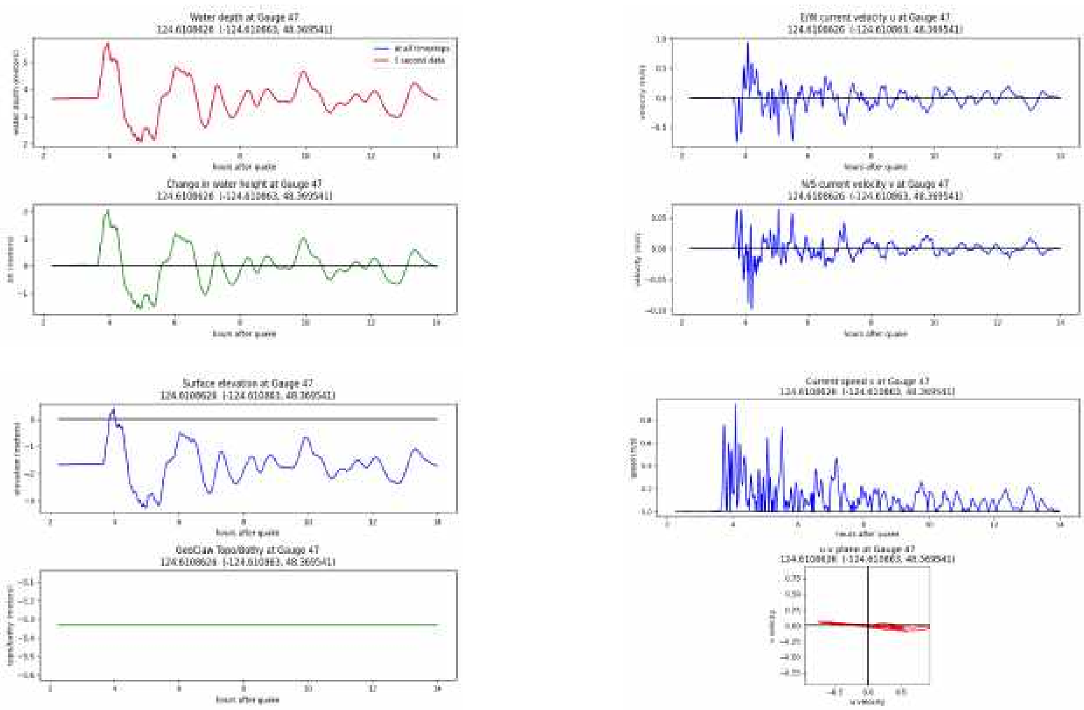

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

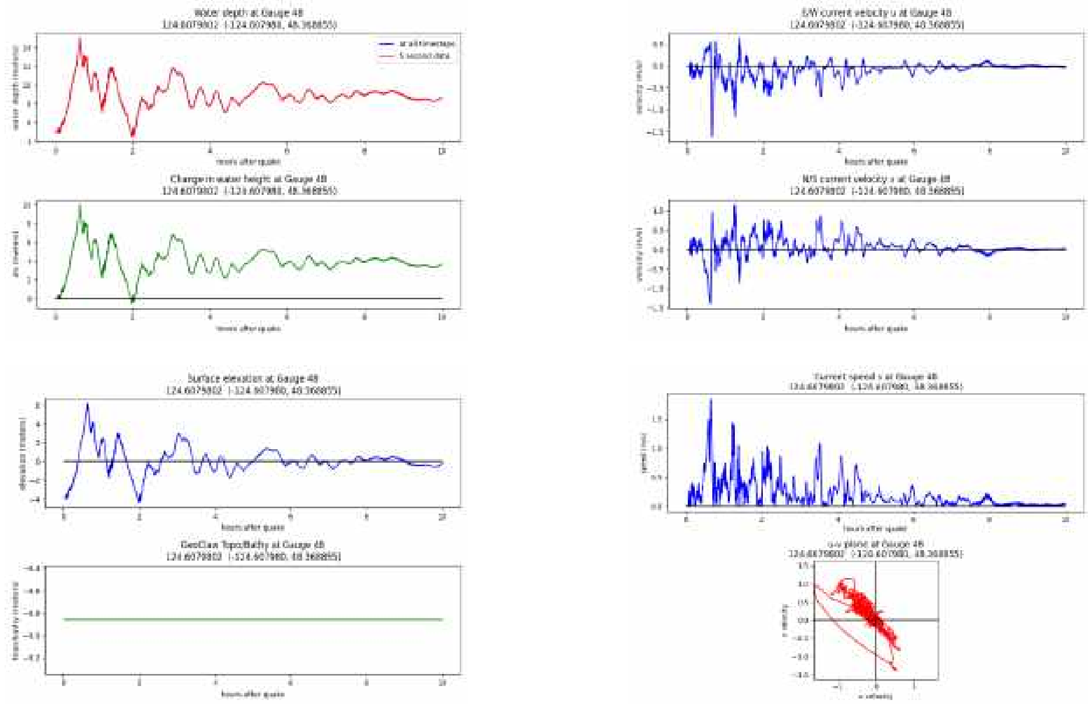



## Alaska-Aleutian subduction zone scenario, MLW:

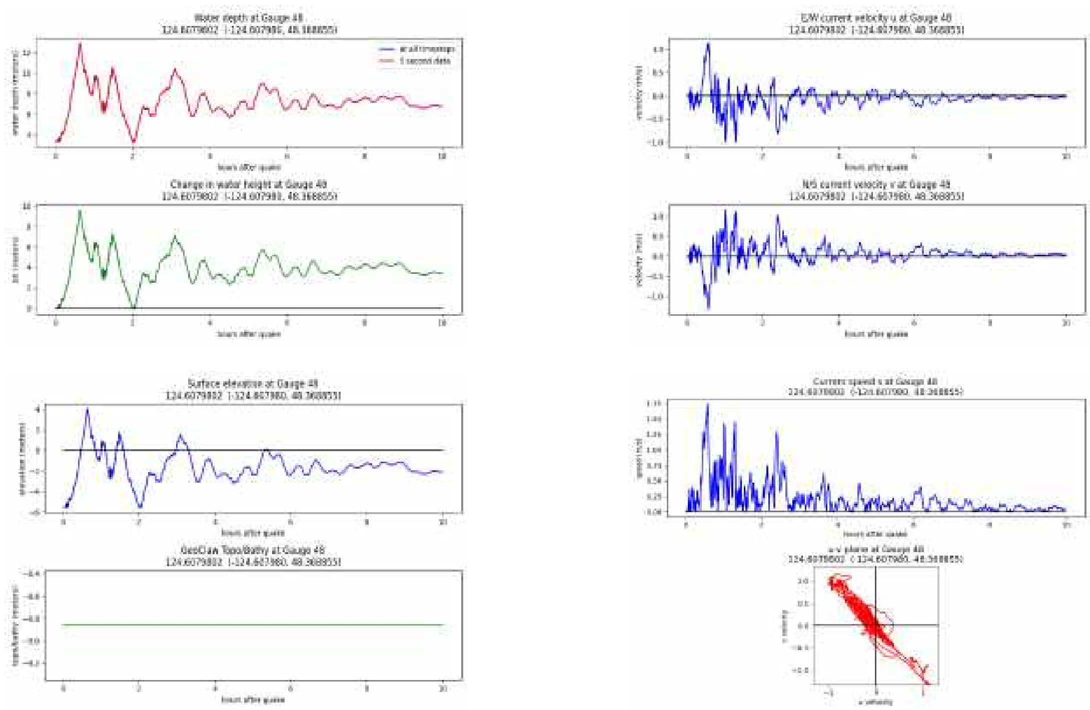


## Gauge 48: Makah Tribal Marina north of breakwater, northeast

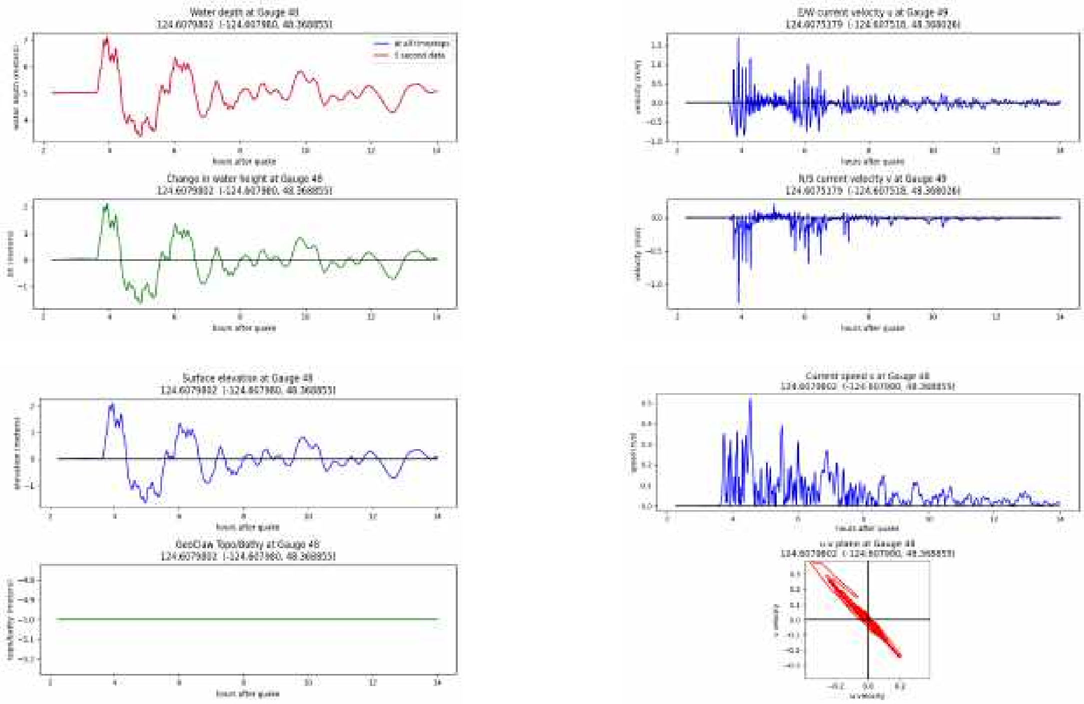
### Cascadia subduction zone scenario, MHW:



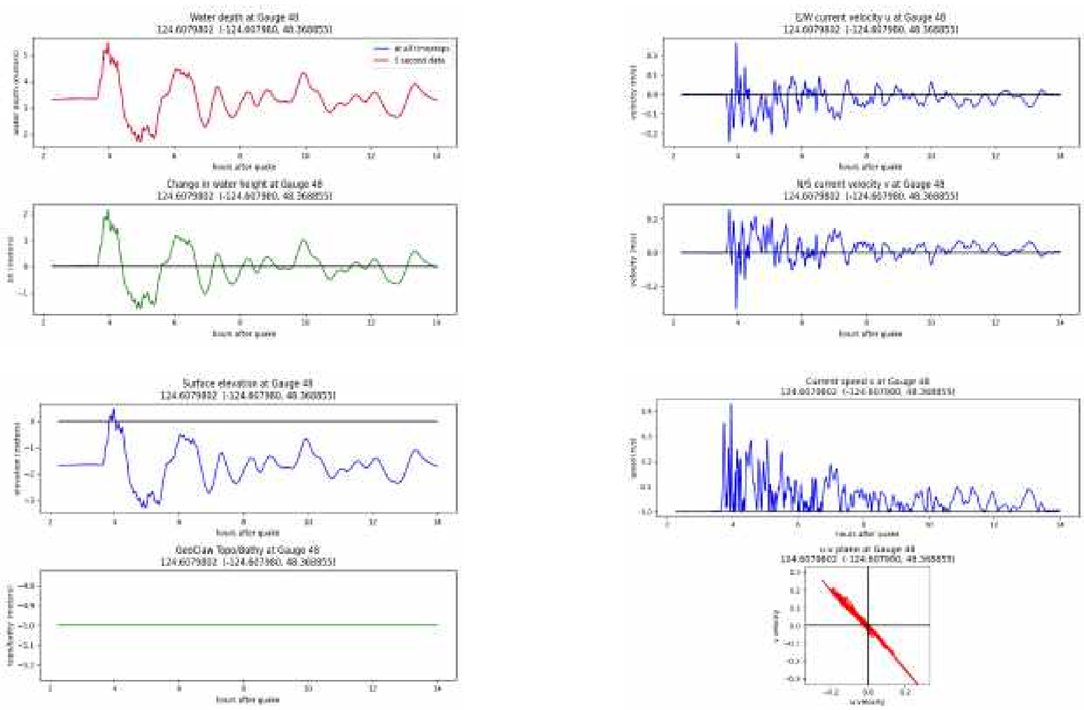
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

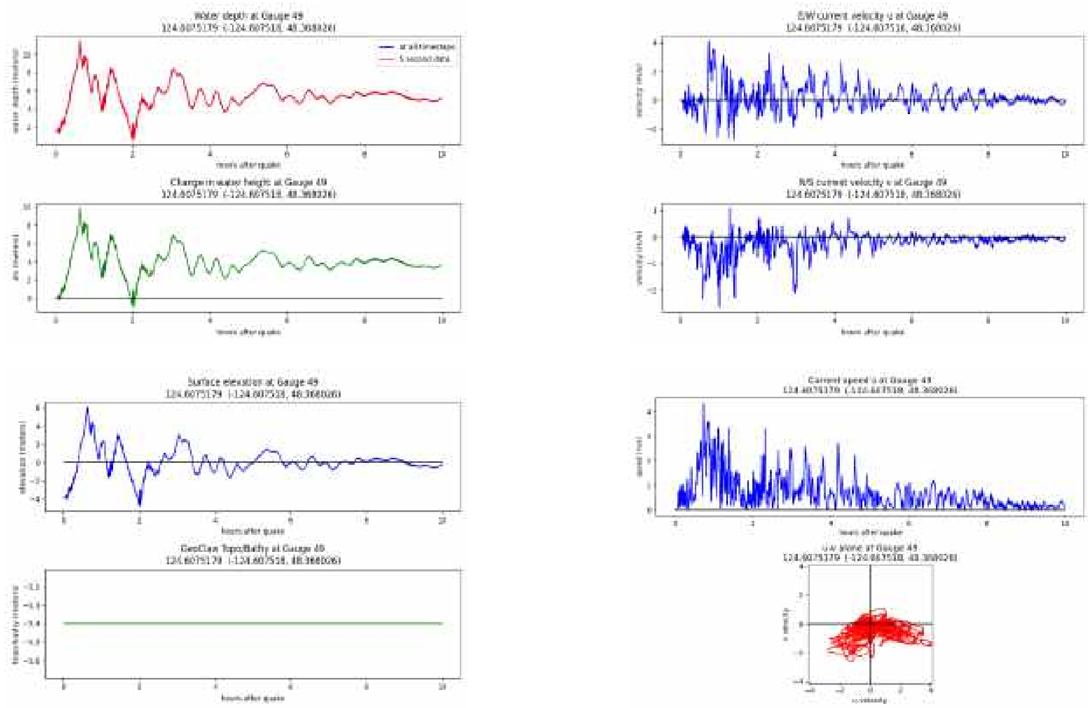


Alaska-Aleutian subduction zone scenario, MLW:

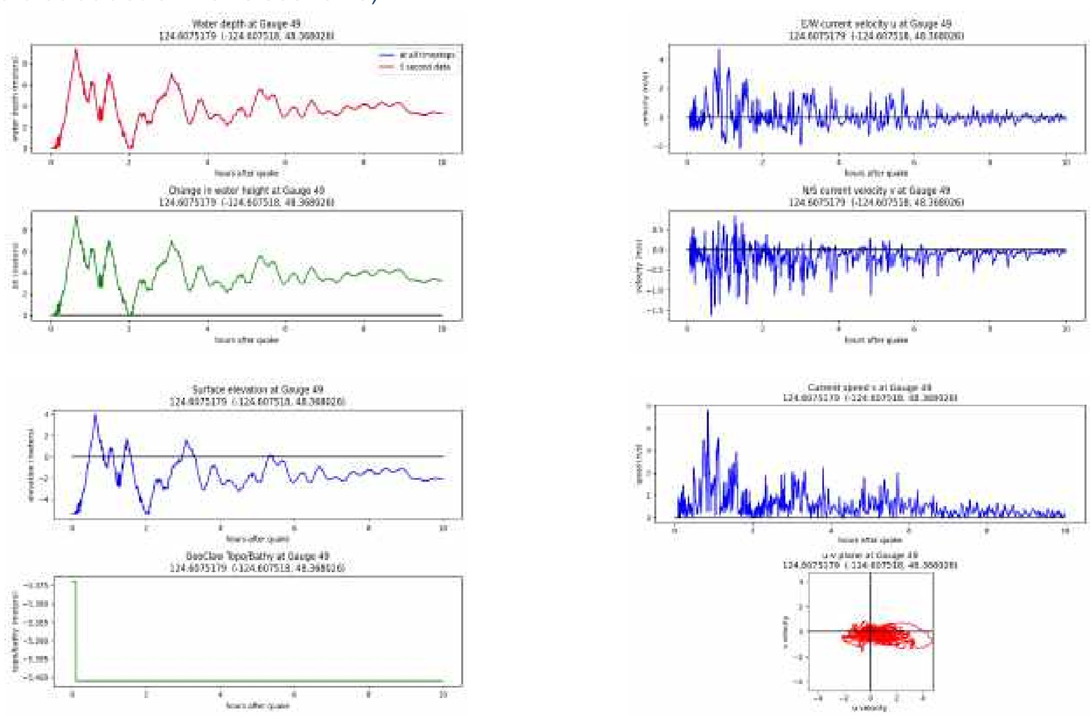


## Gauge 49: Makah Tribal Marina north of breakwater, southeast

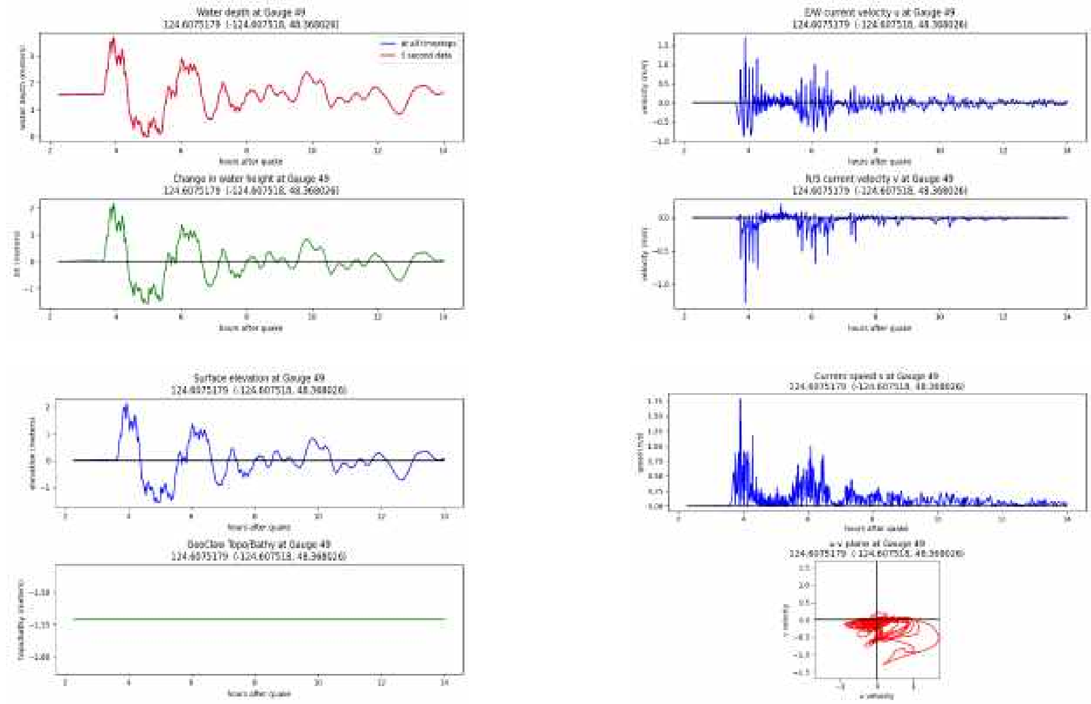
### Cascadia subduction zone scenario, MHW:



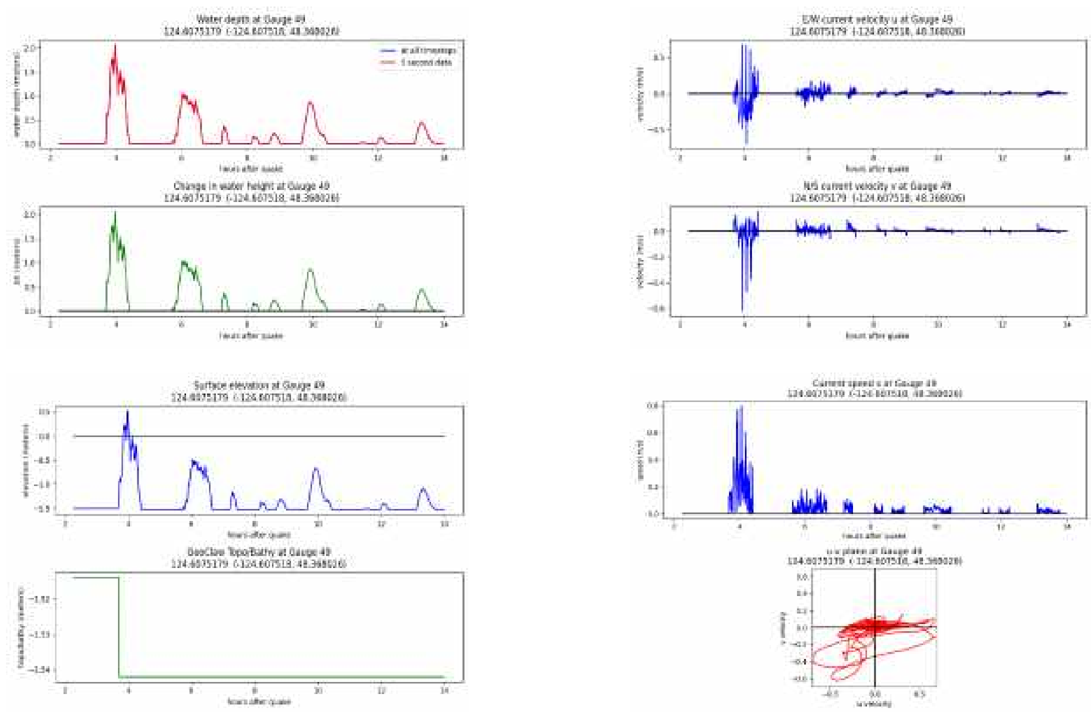

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

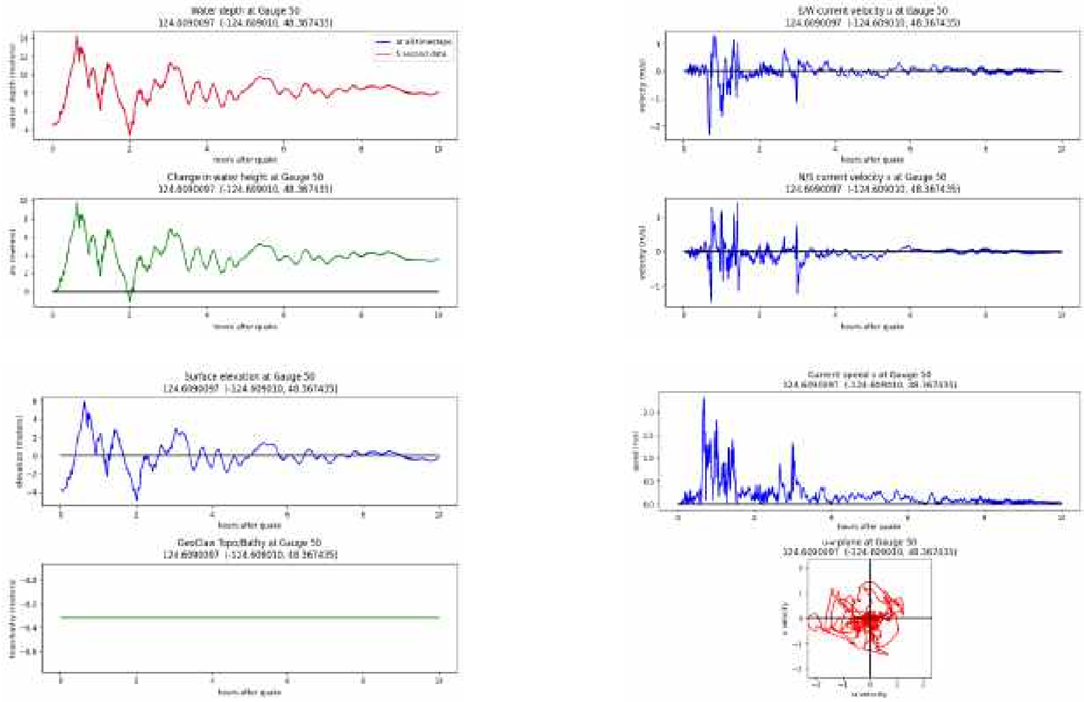


## Alaska-Aleutian subduction zone scenario, MLW:

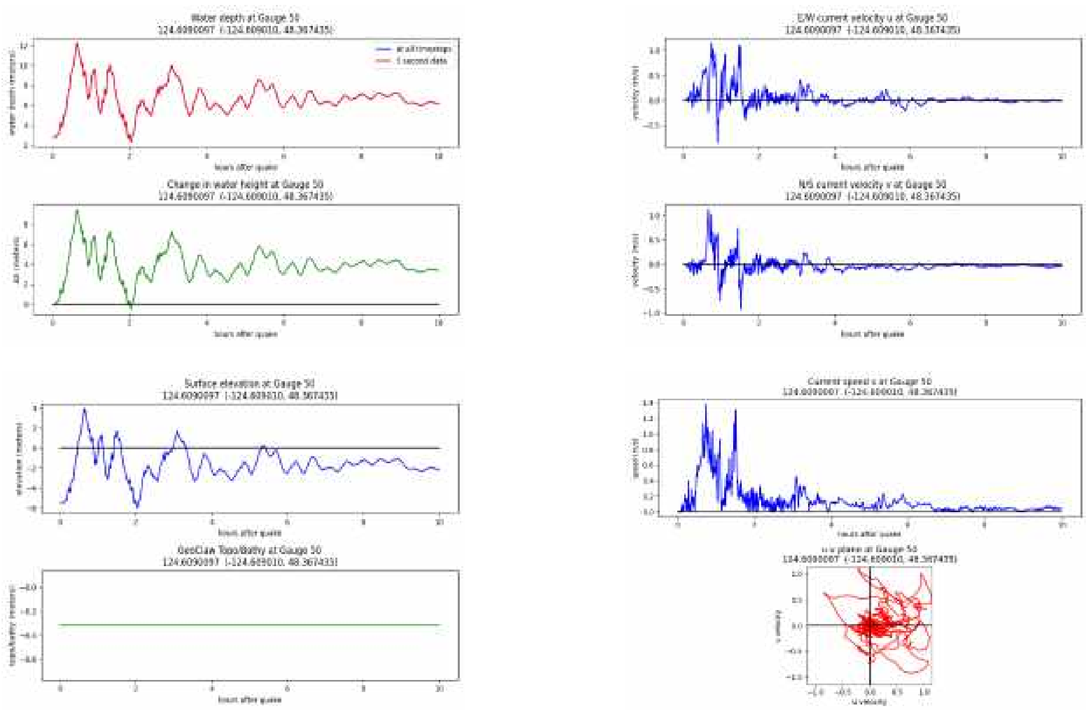


## Gauge 50: Makah Tribal Marina, southeast

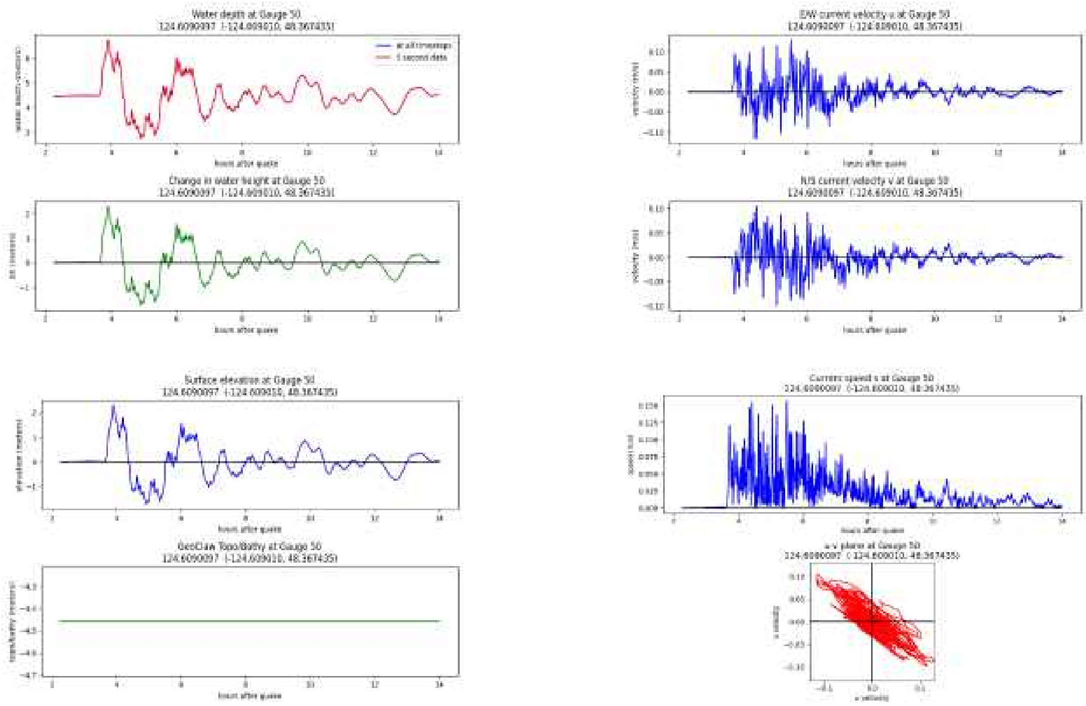
### Cascadia subduction zone scenario, MHW:



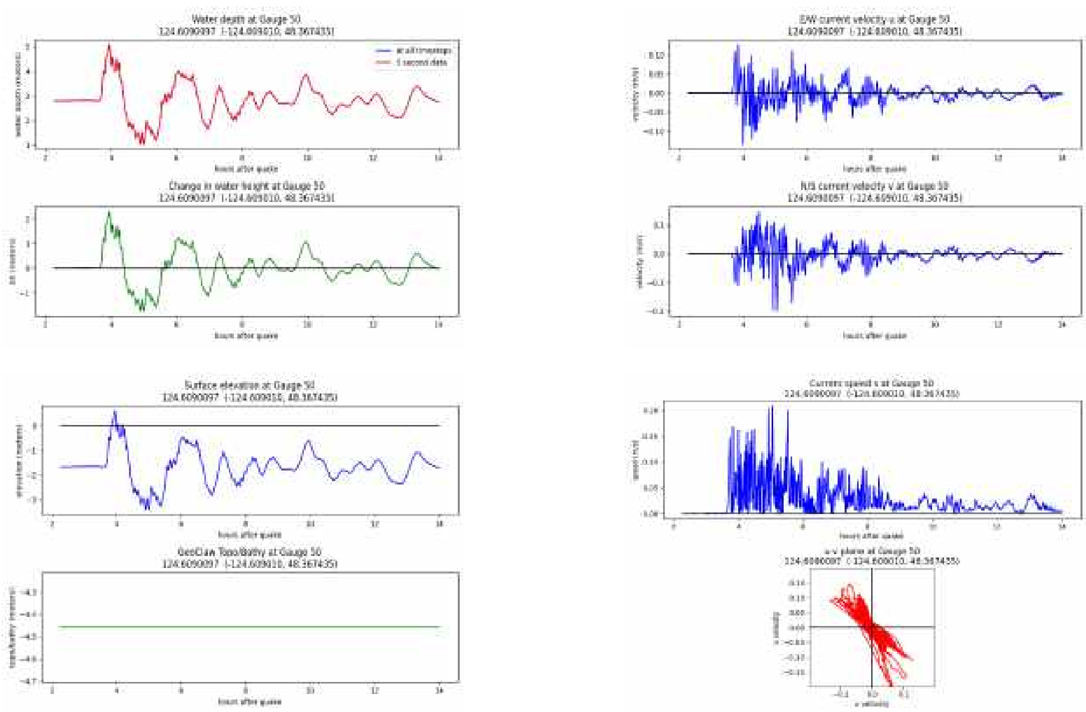
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

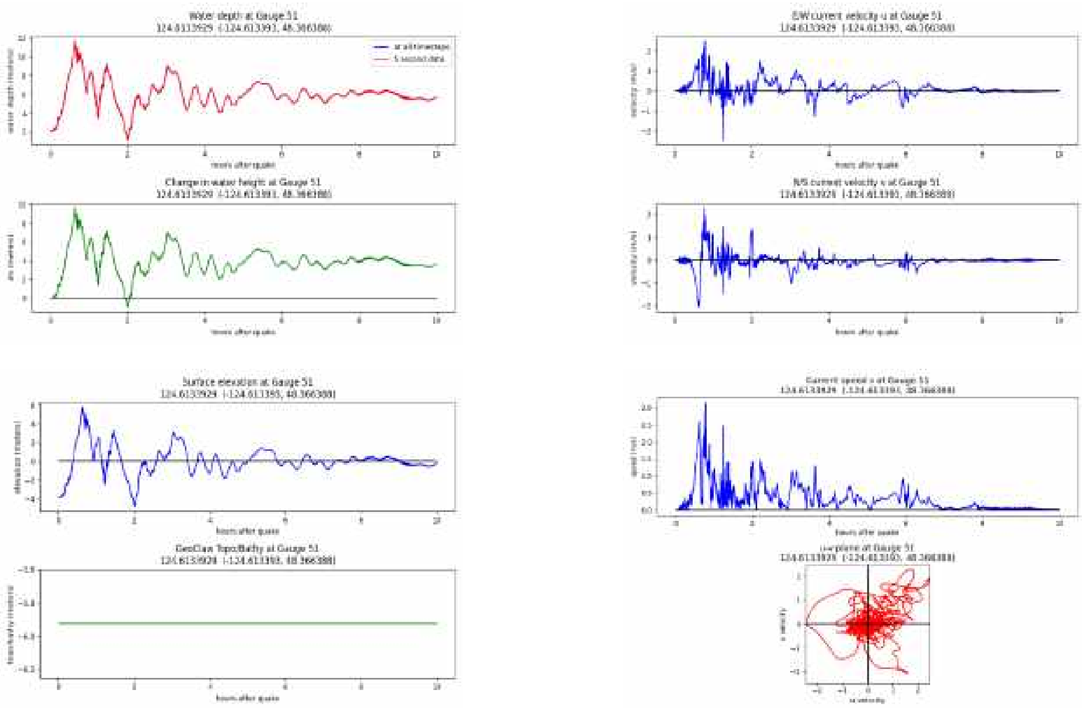


## Alaska-Aleutian subduction zone scenario, MLW:

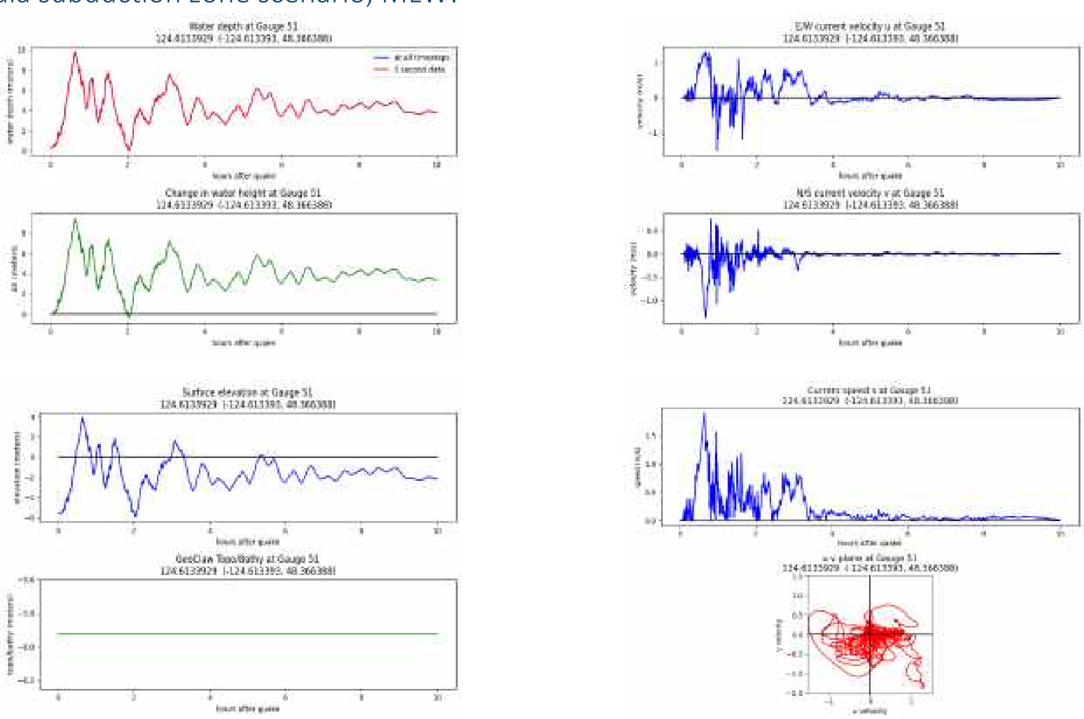


## Gauge 51: Makah Tribal Marina, southwest

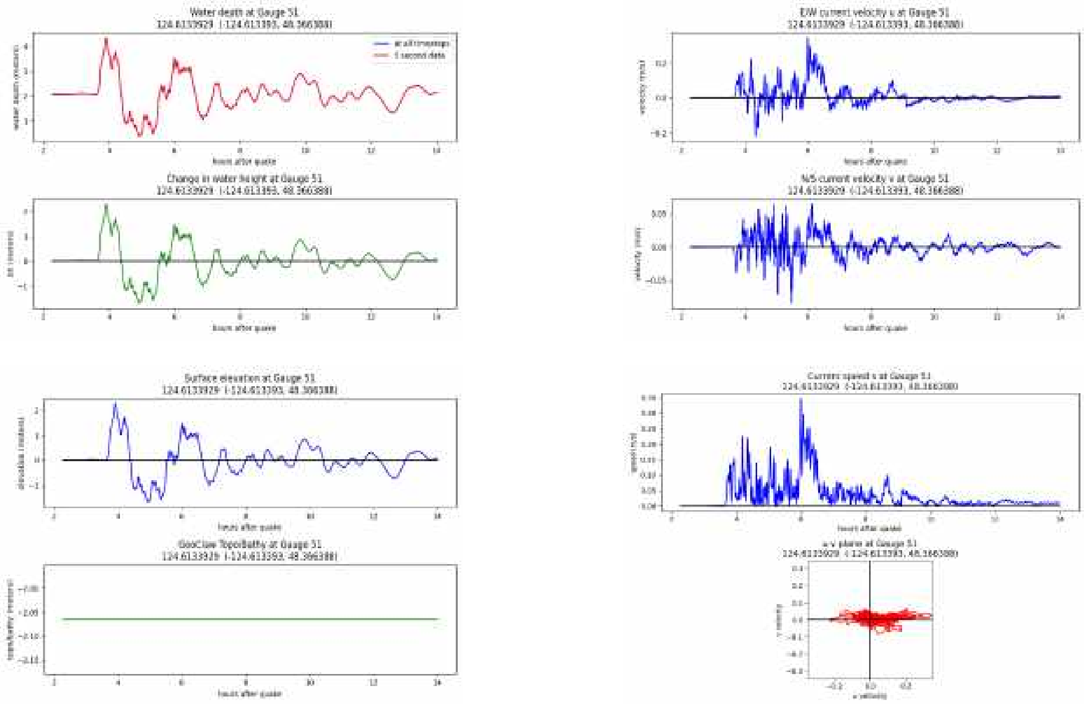
### Cascadia subduction zone scenario, MHW:



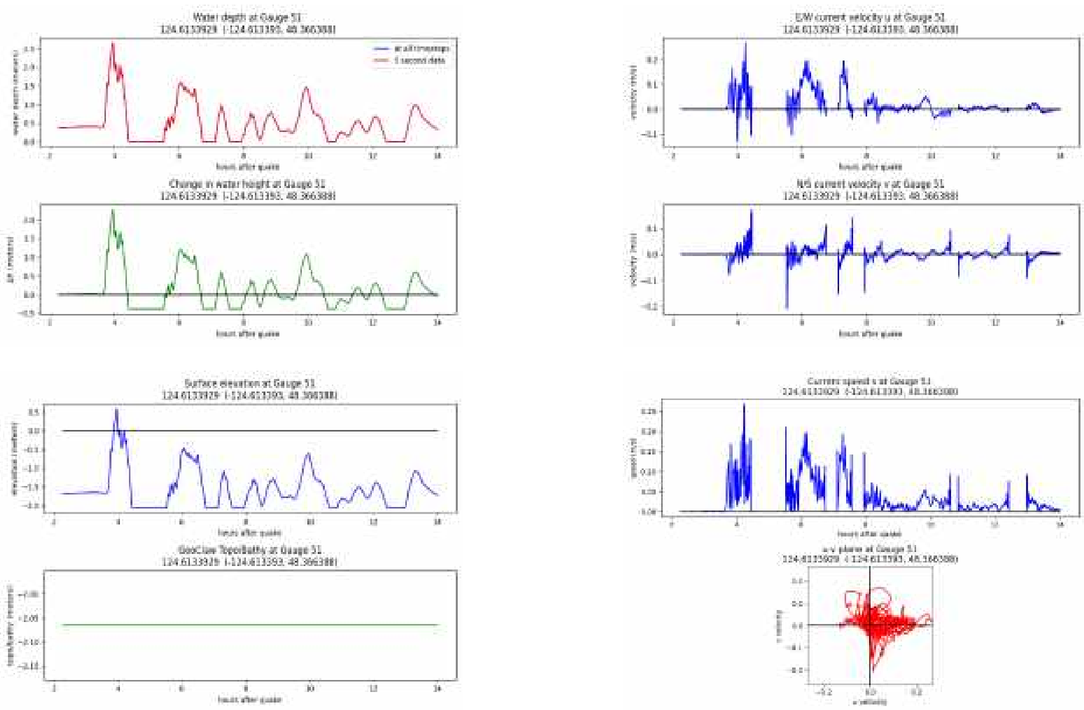
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

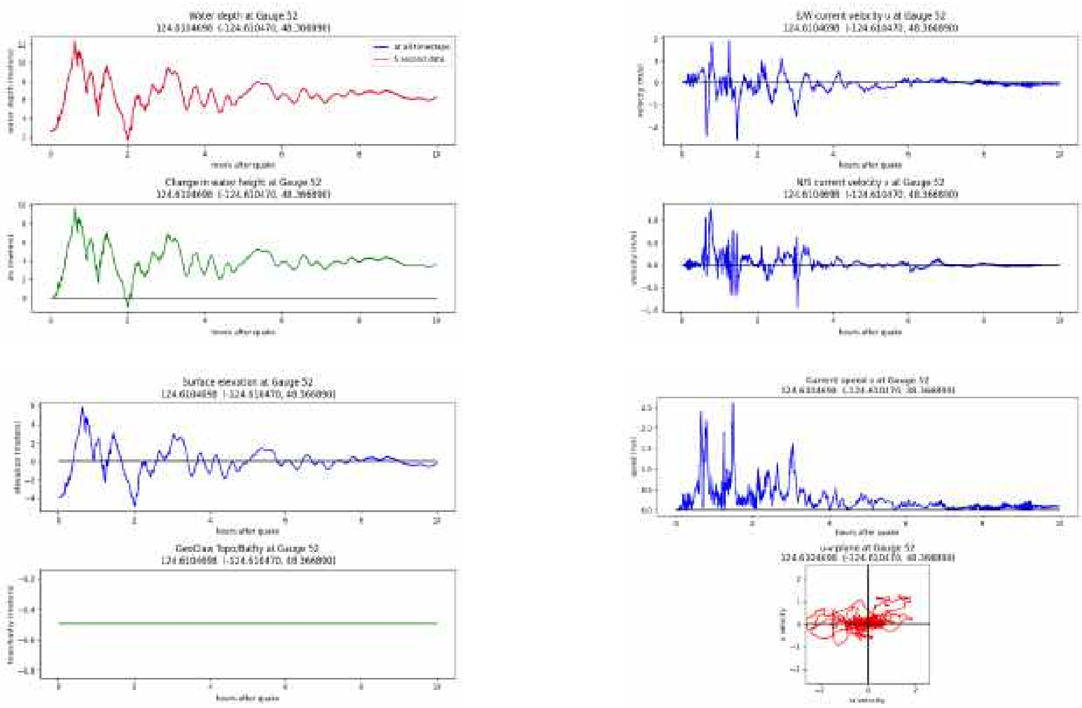



## Alaska-Aleutian subduction zone scenario, MLW:

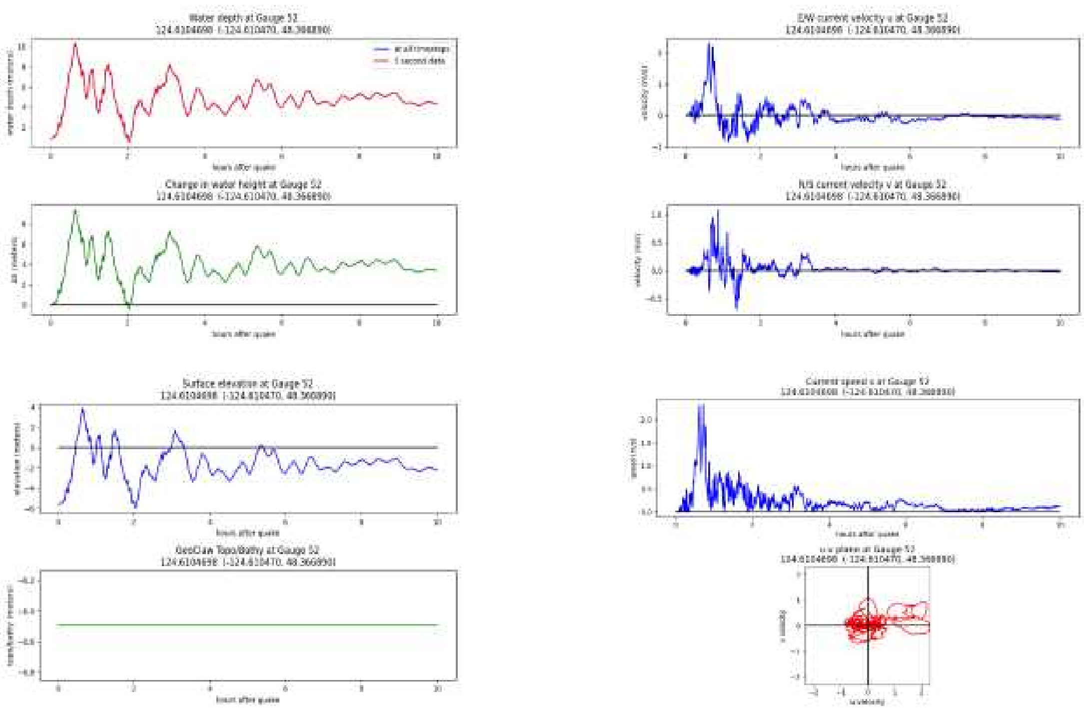


## Gauge 52: Makah Tribal Marina, south (2)

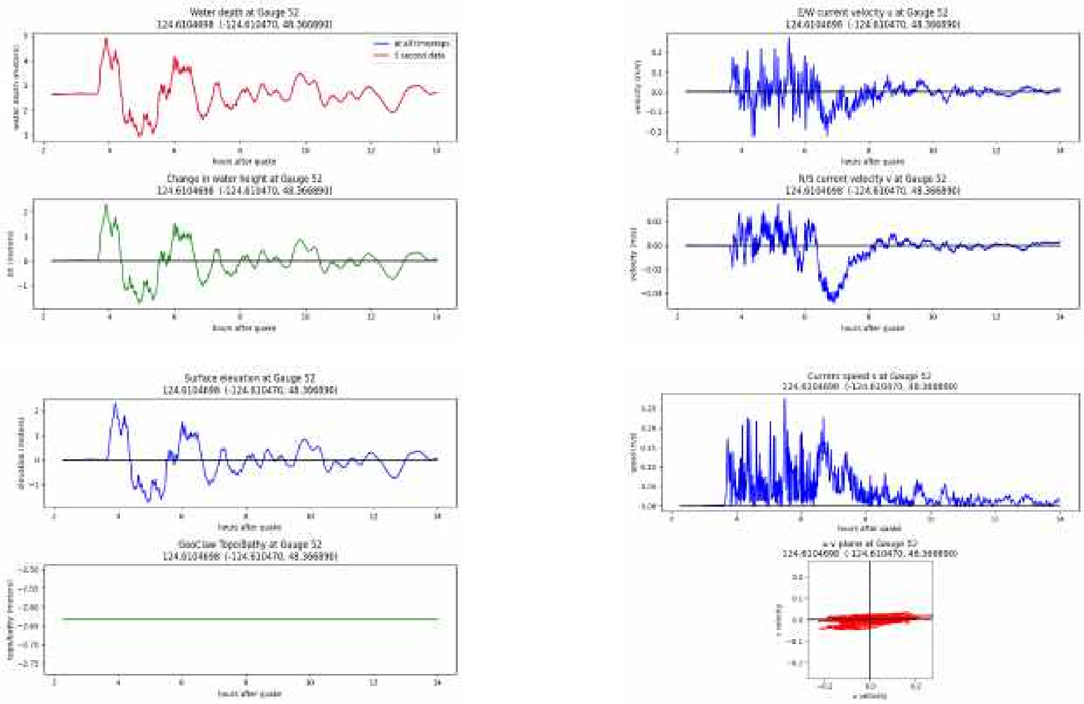
### Cascadia subduction zone scenario, MHW:



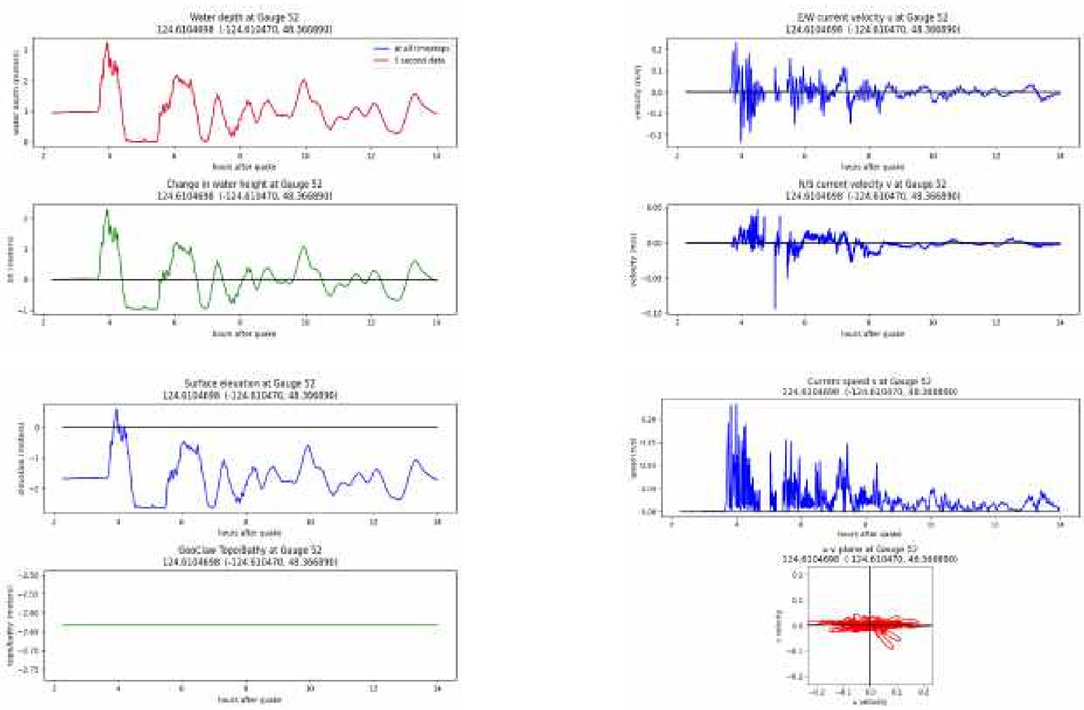

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

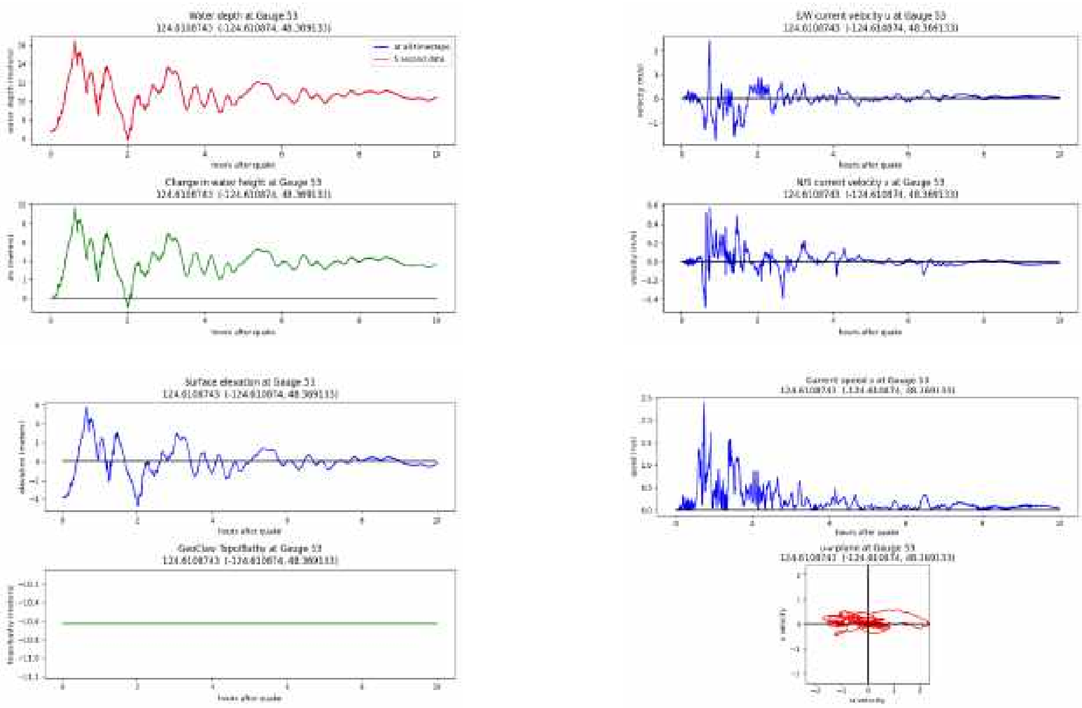


## Alaska-Aleutian subduction zone scenario, MLW:

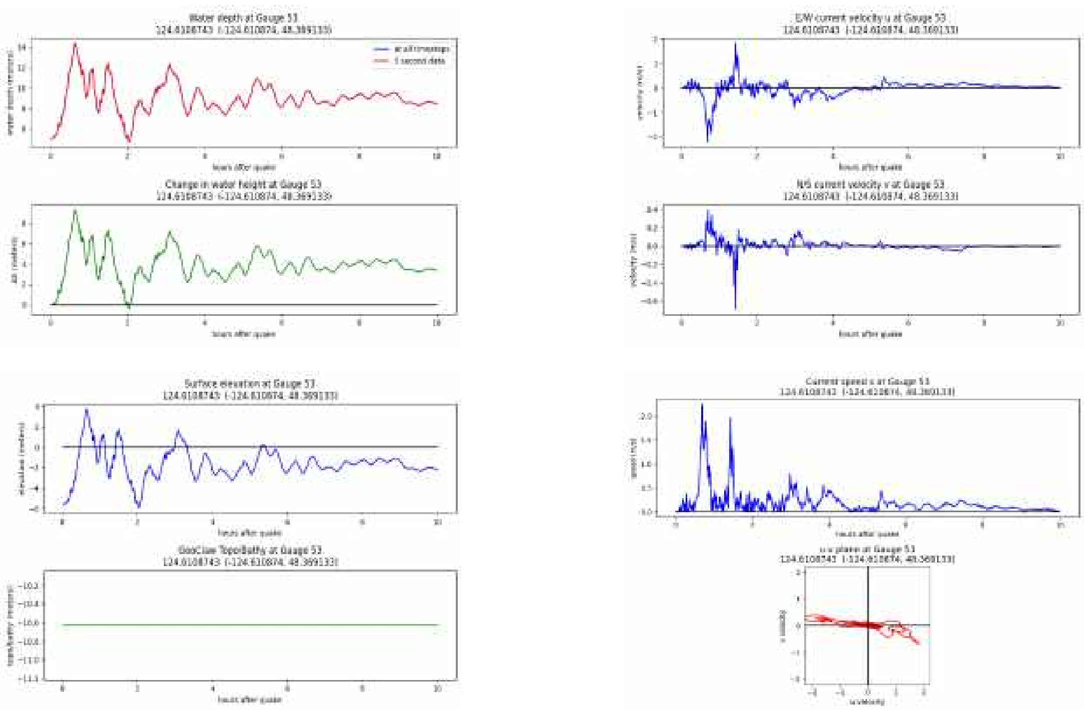


## Gauge 53: Makah Tribal Marina south of breakwater, center

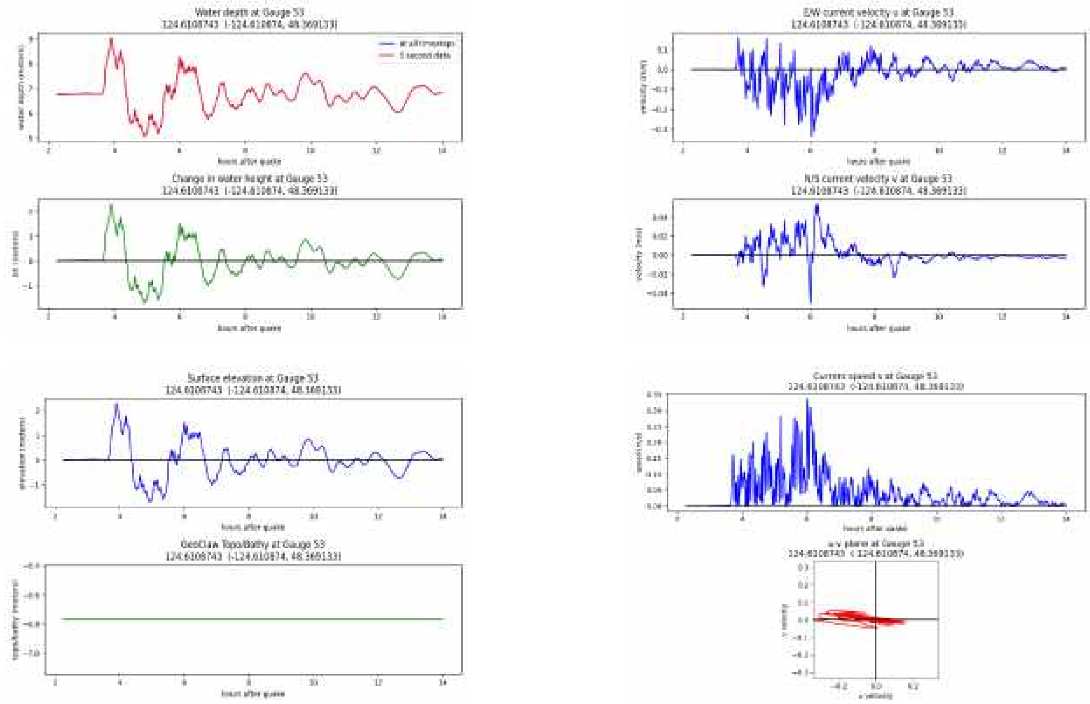
### Cascadia subduction zone scenario, MHW:



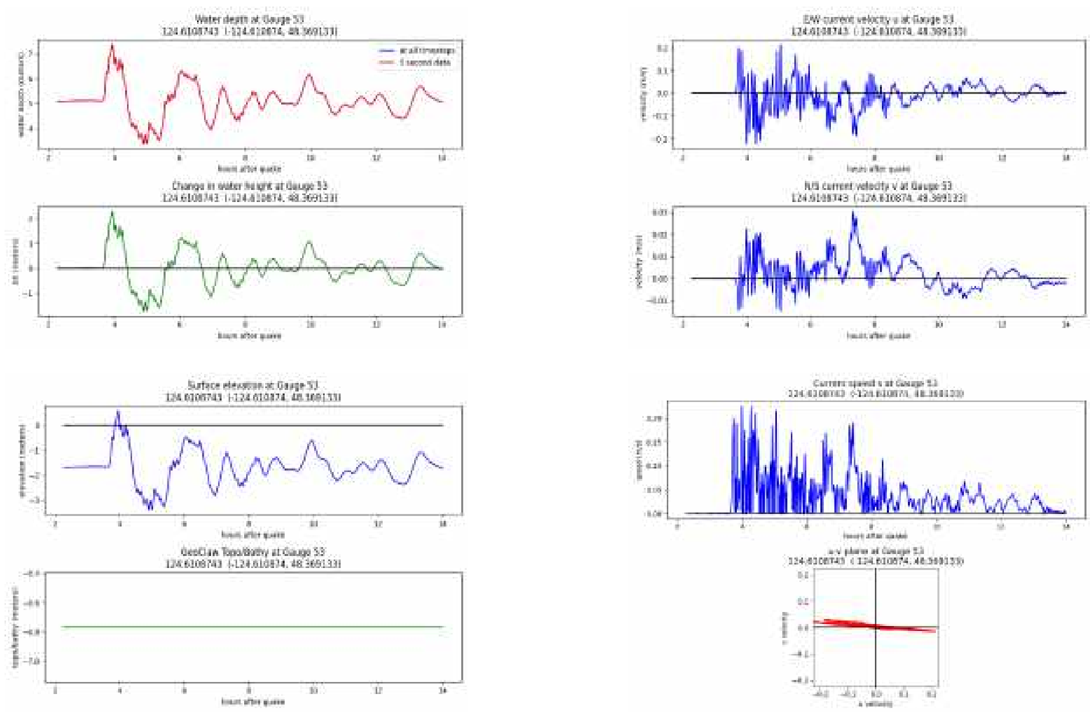

### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

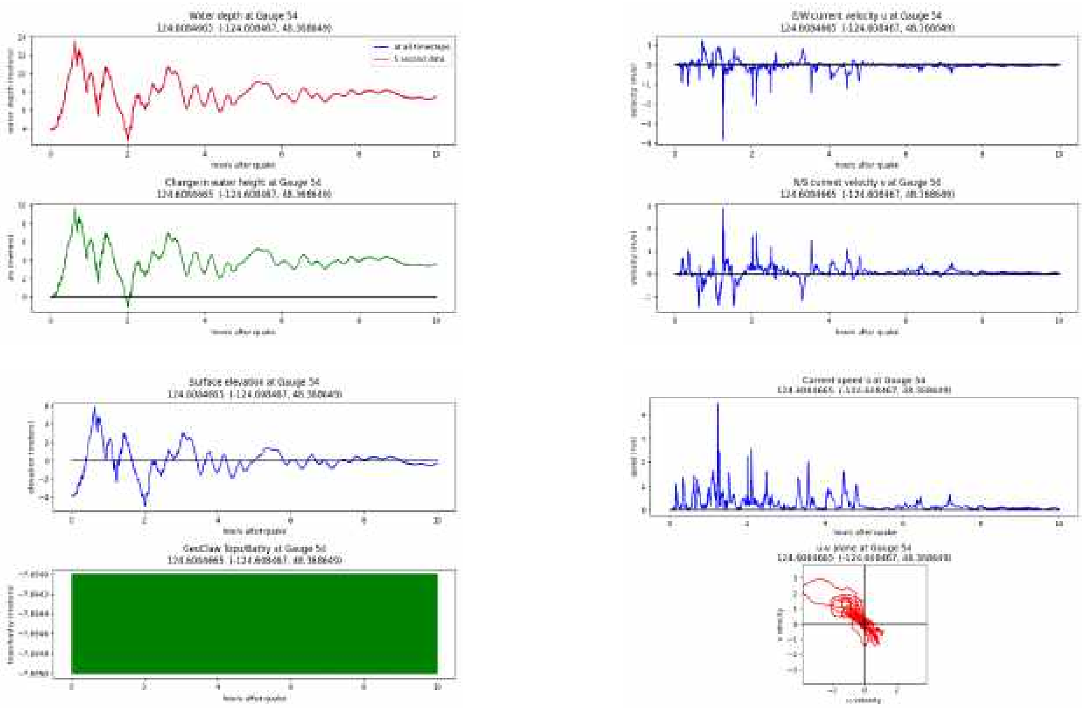



Alaska-Aleutian subduction zone scenario, MLW:

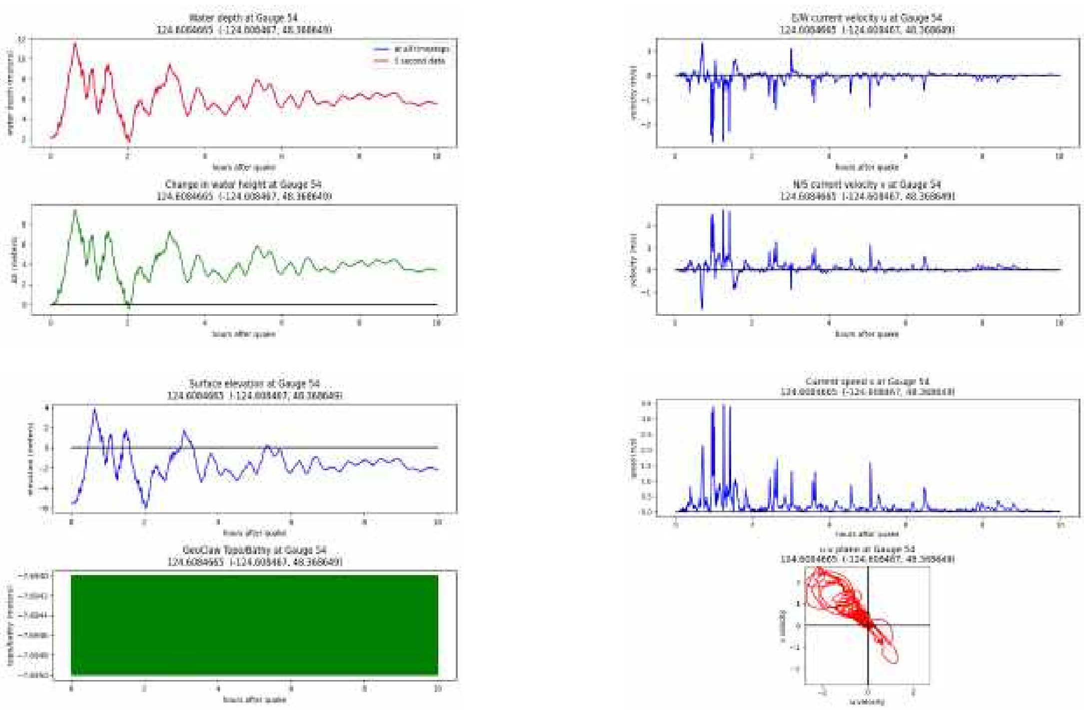


## Gauge 54: Makah Tribal Marina west of breakwater, northeast

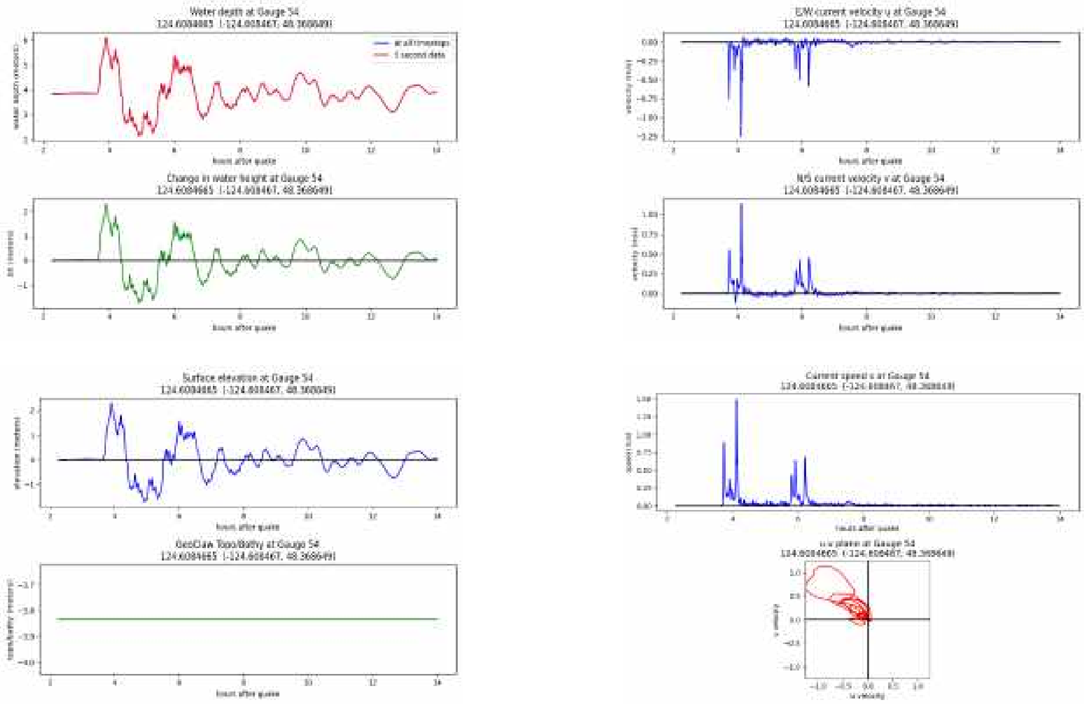
### Cascadia subduction zone scenario, MHW:



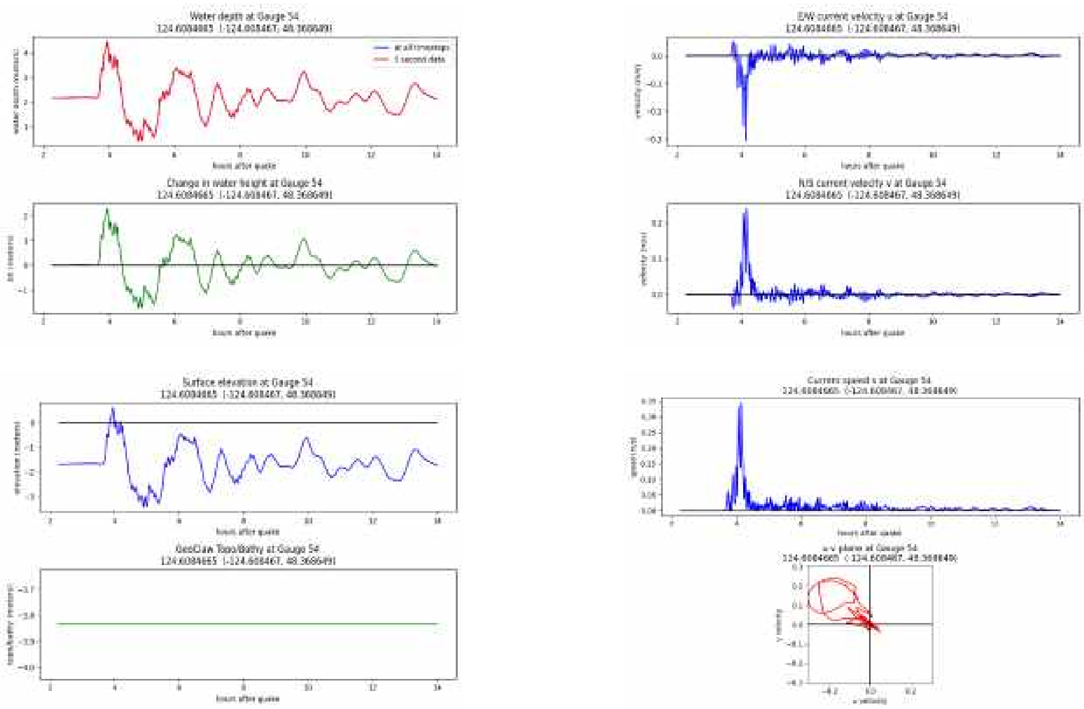
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

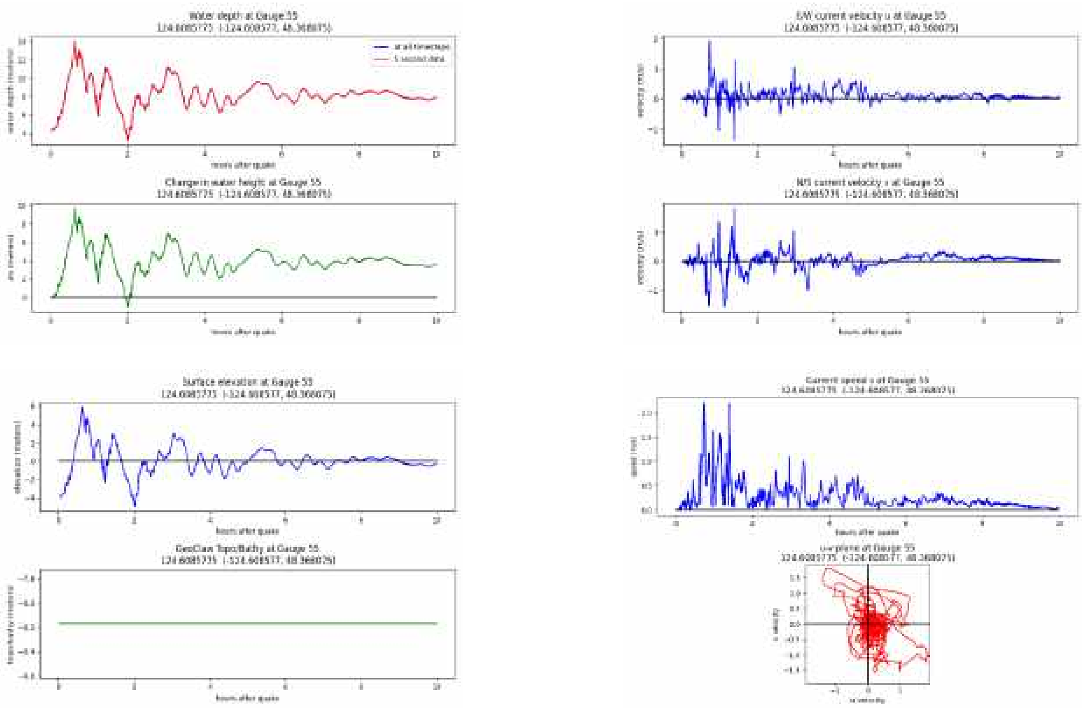


Alaska-Aleutian subduction zone scenario, MLW:

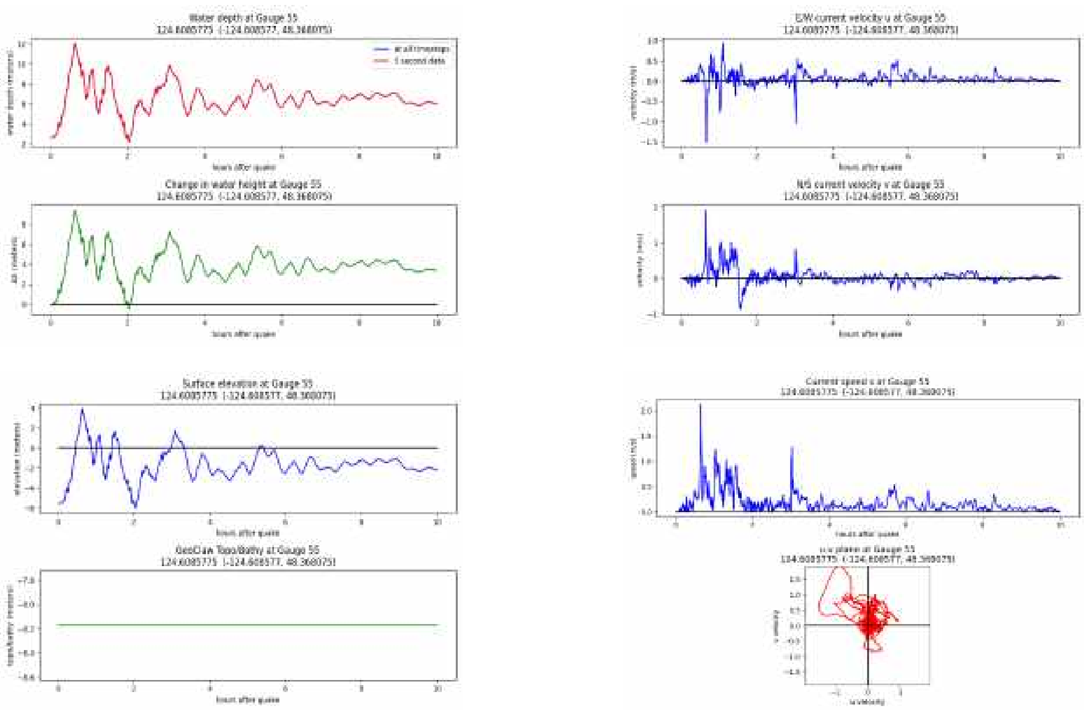


## Gauge 55: Makah Tribal Marina northwest of southeast Jetty

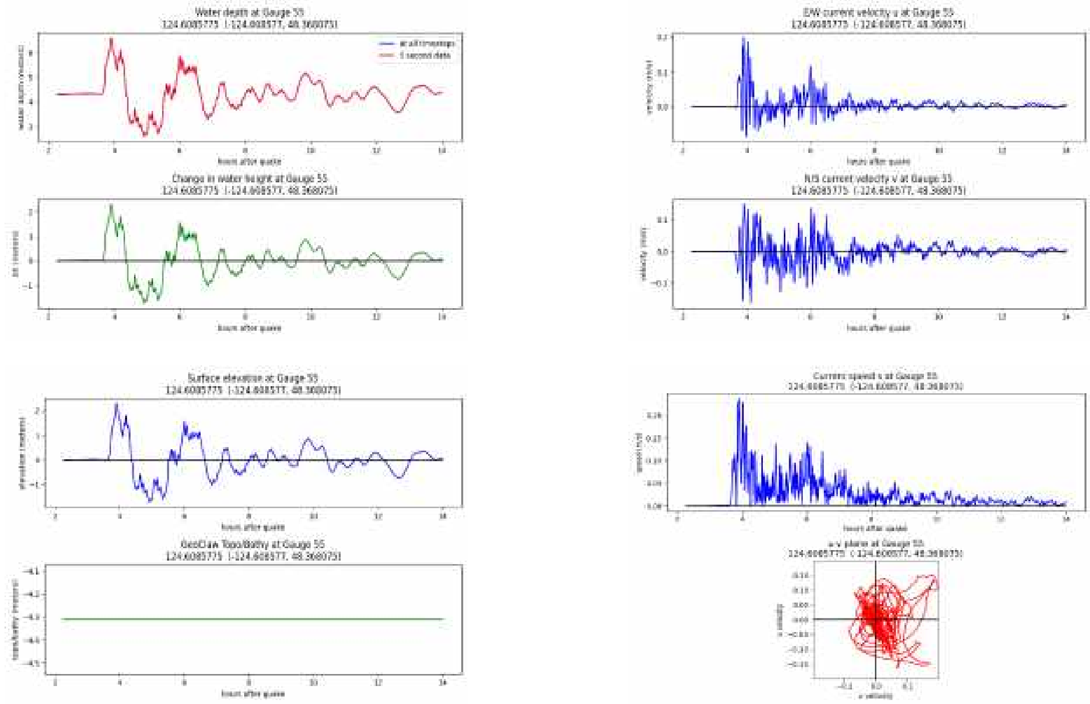
### Cascadia subduction zone scenario, MHW:



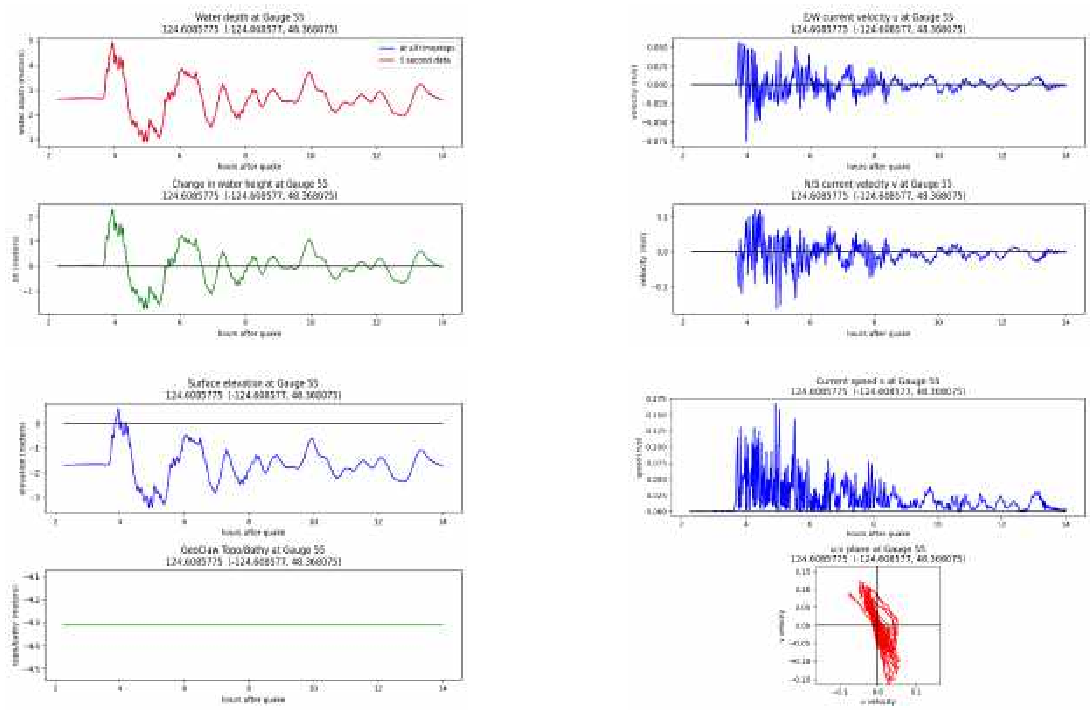

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

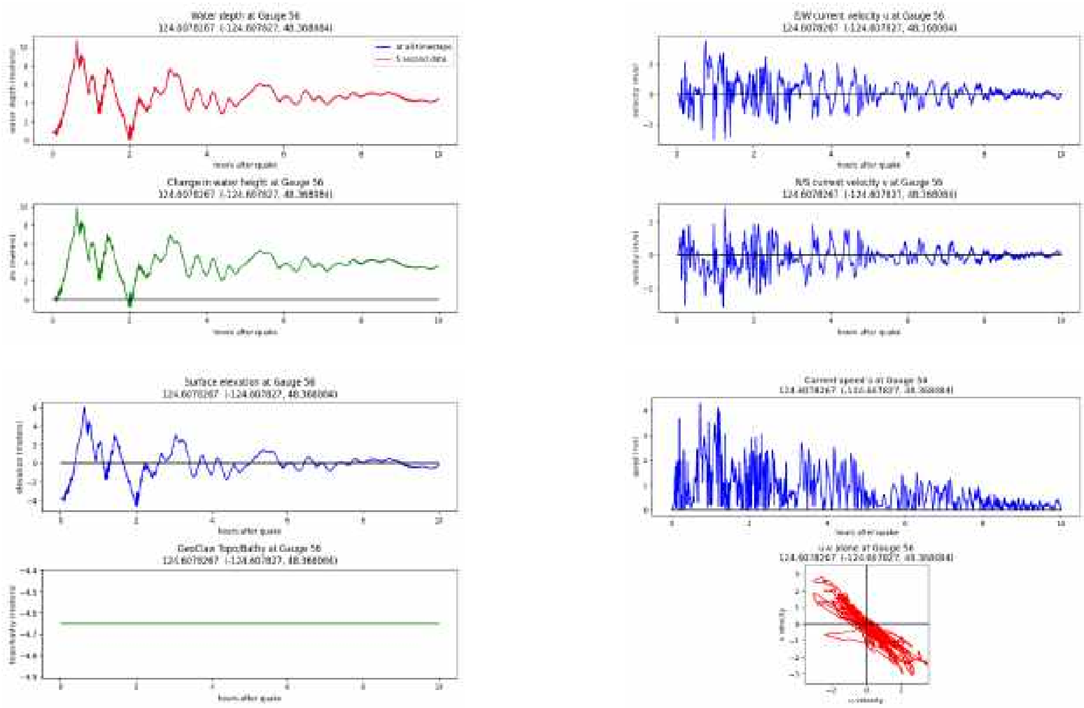



## Alaska-Aleutian subduction zone scenario, MLW:

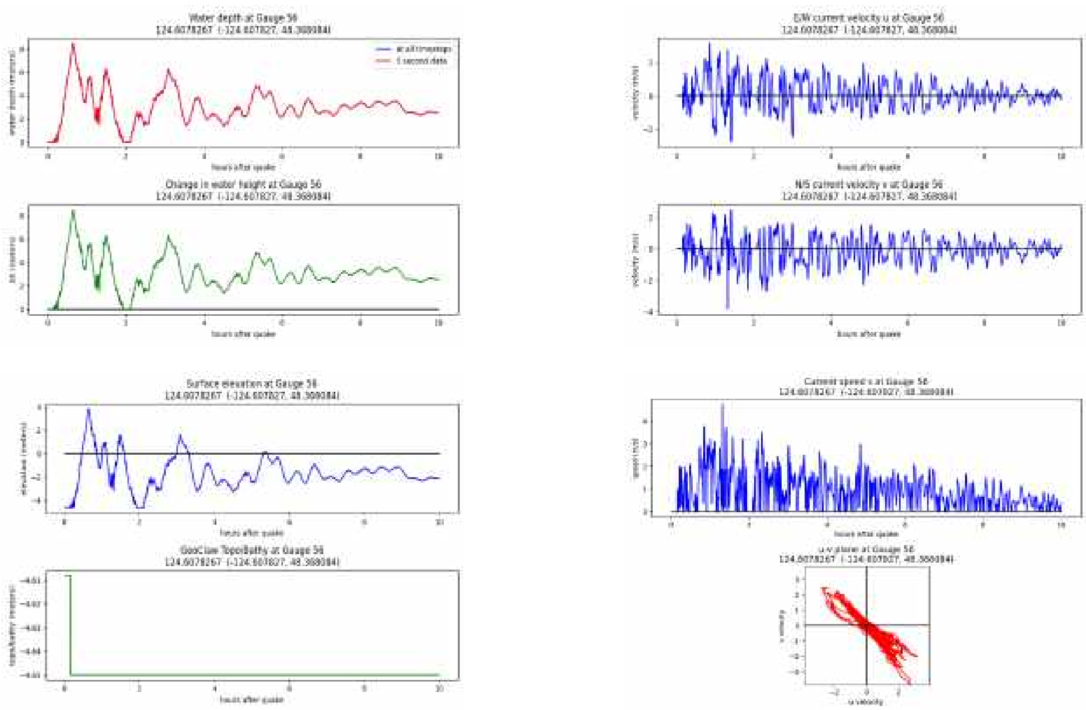


## Gauge 56: Makah Tribal Marina Breakwater west, entrance (2)

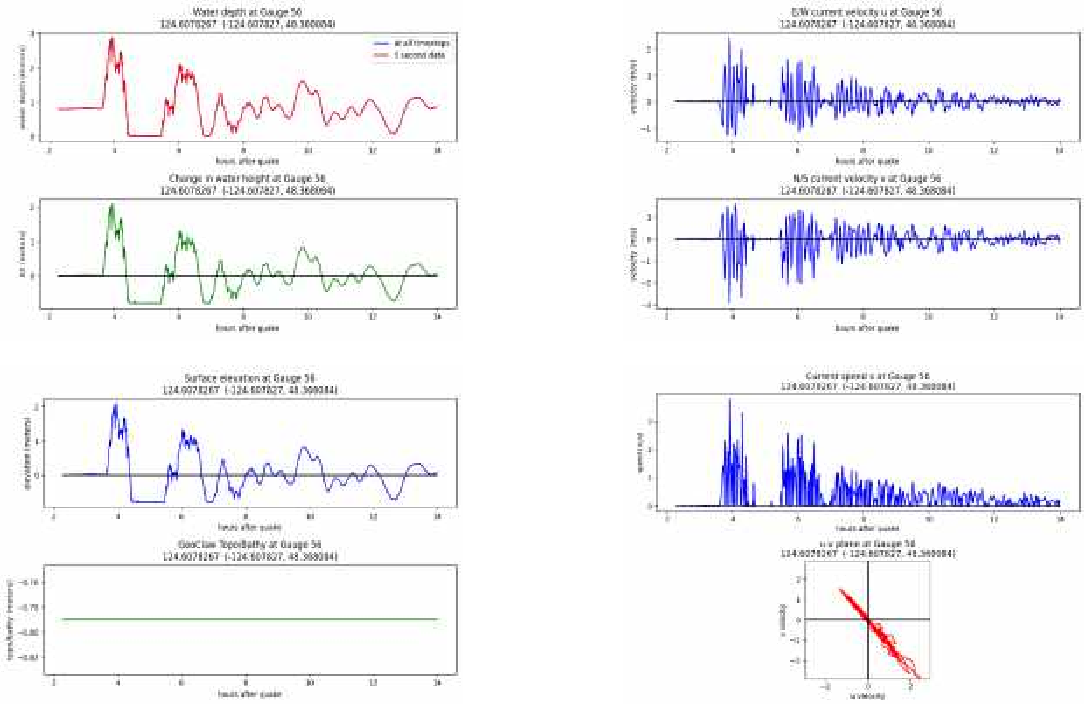
### Cascadia subduction zone scenario, MHW:



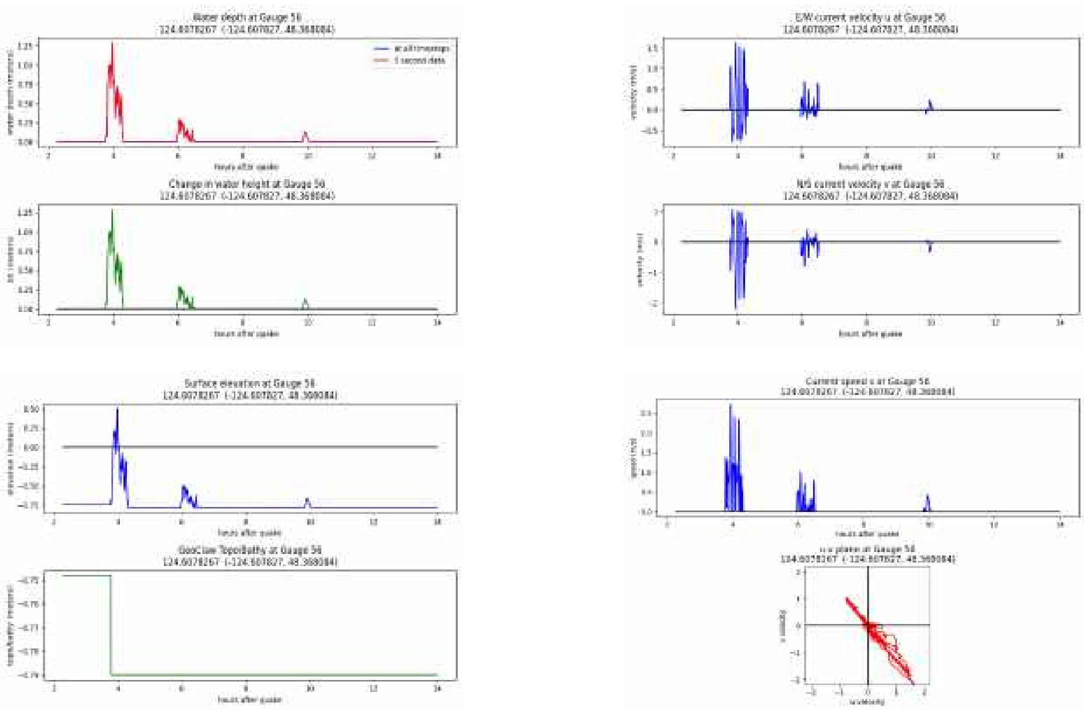
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

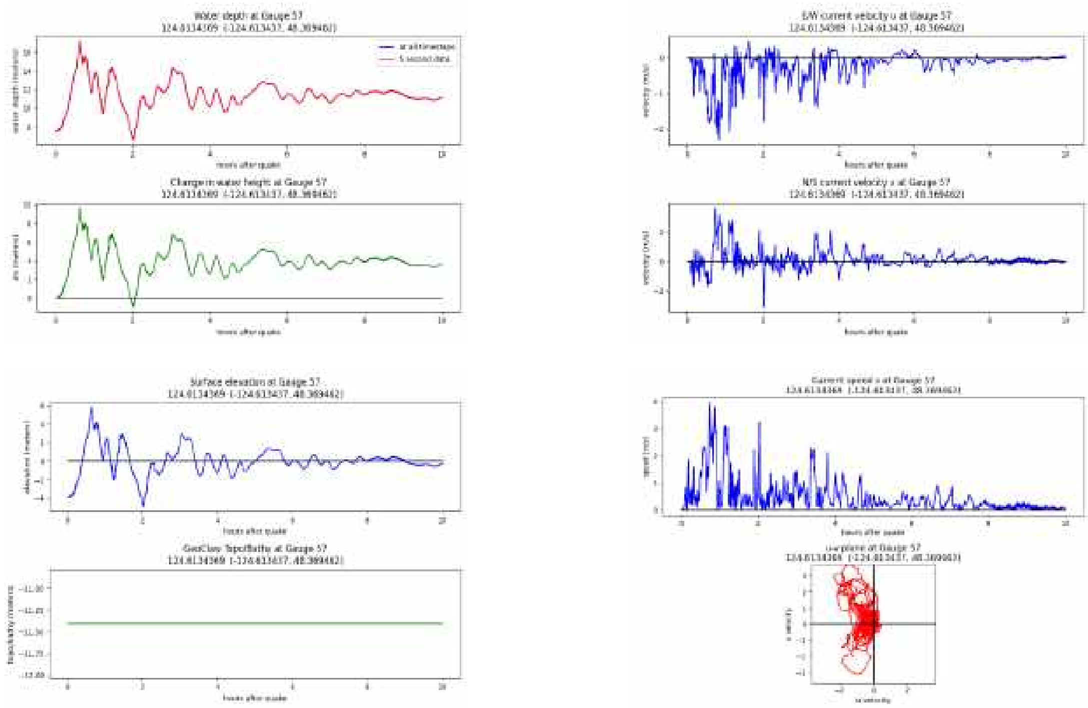



## Alaska-Aleutian subduction zone scenario, MLW:

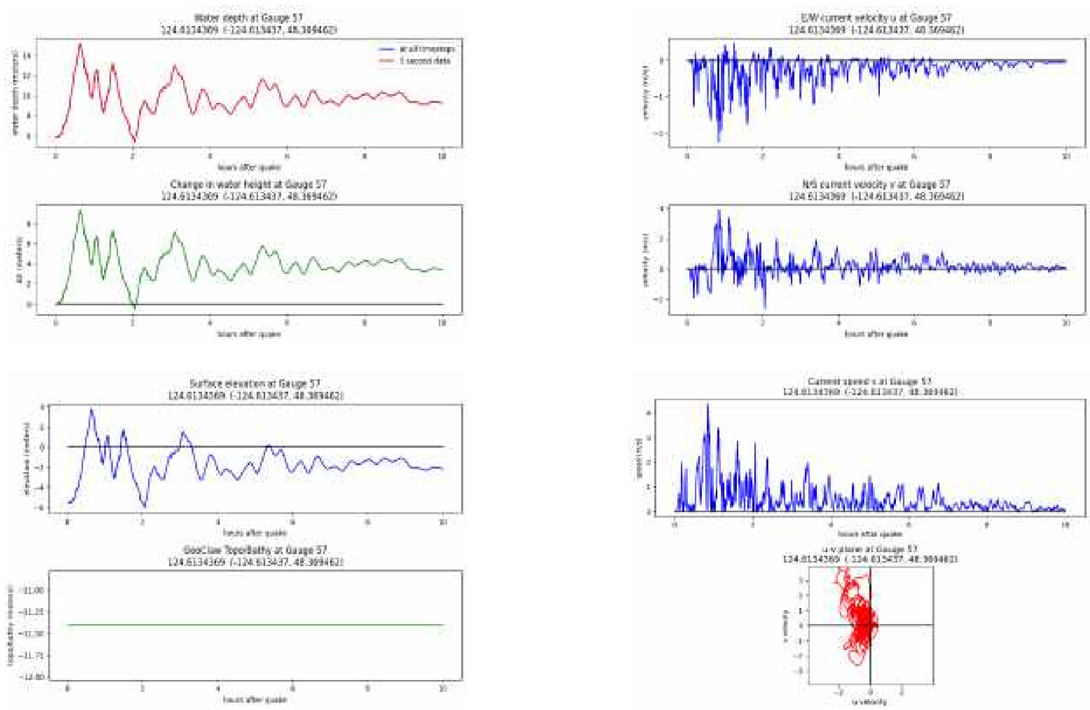


## Gauge 57: Makah Tribal Marina west of north Breakwater, entrance

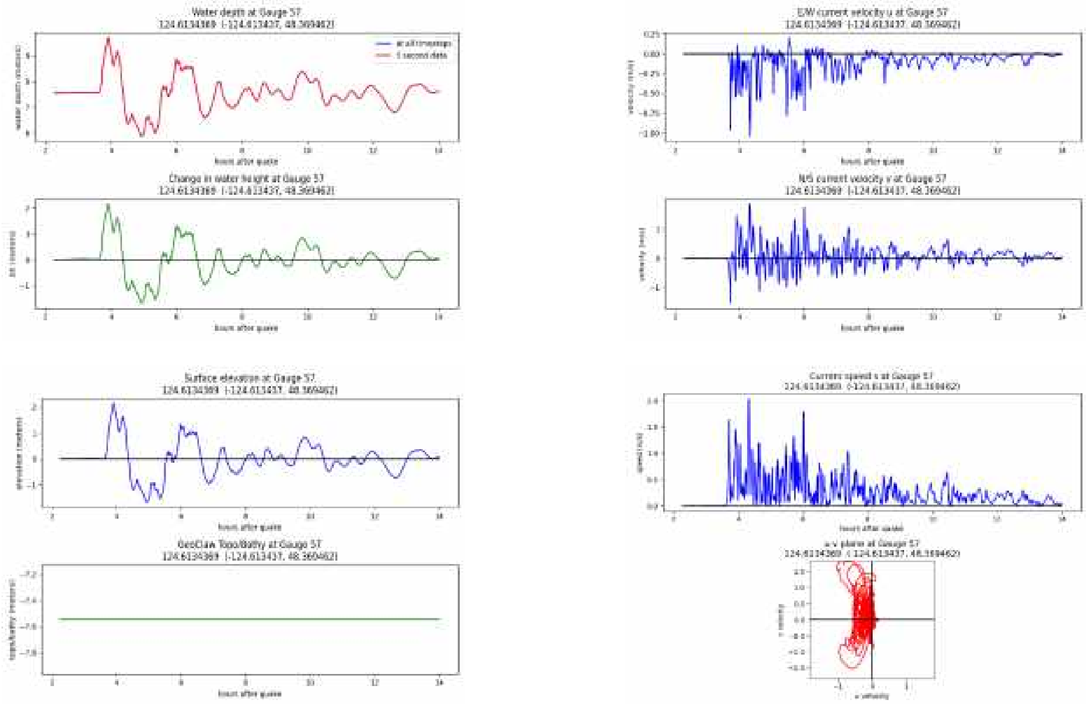
### Cascadia subduction zone scenario, MHW:



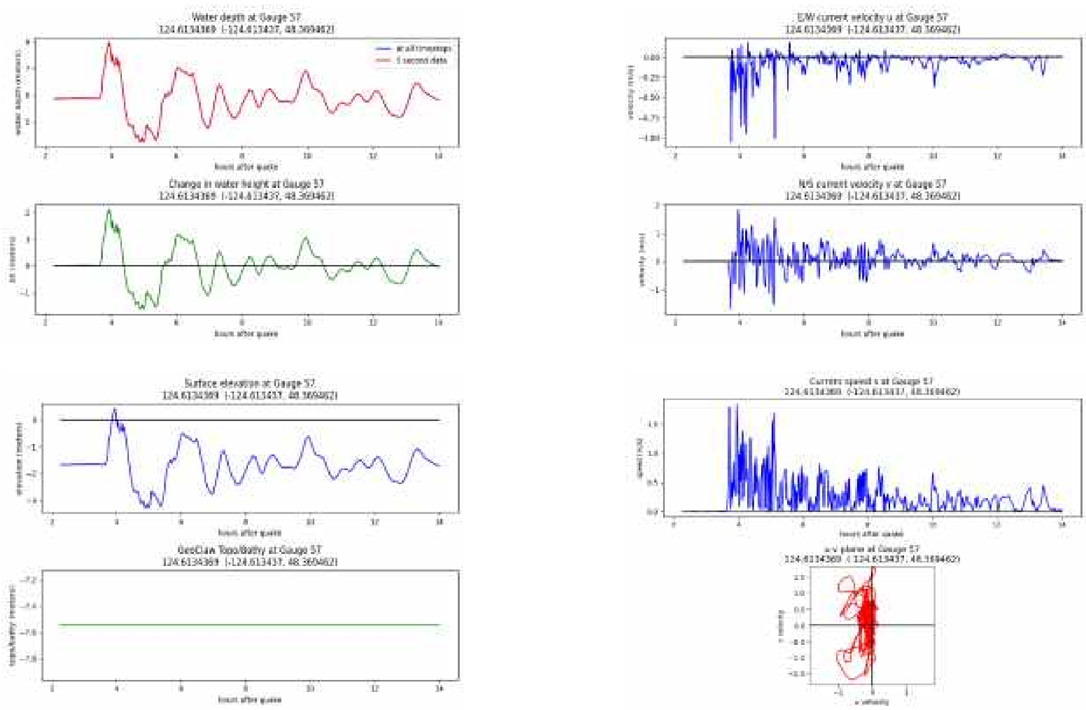

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

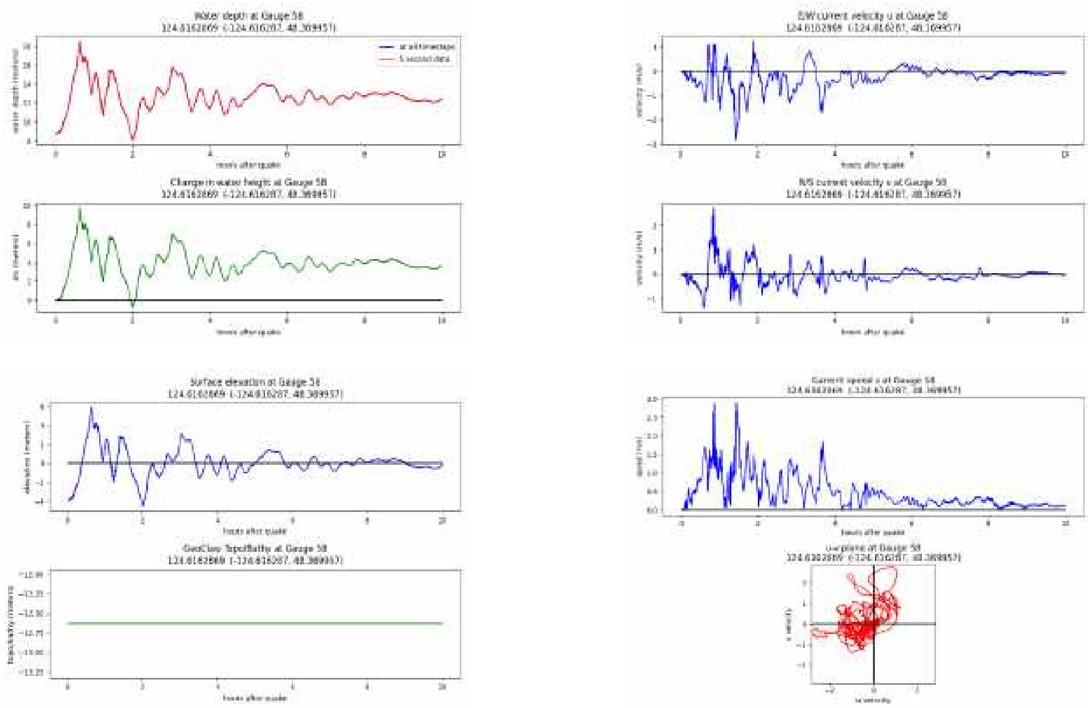



## Alaska-Aleutian subduction zone scenario, MLW:

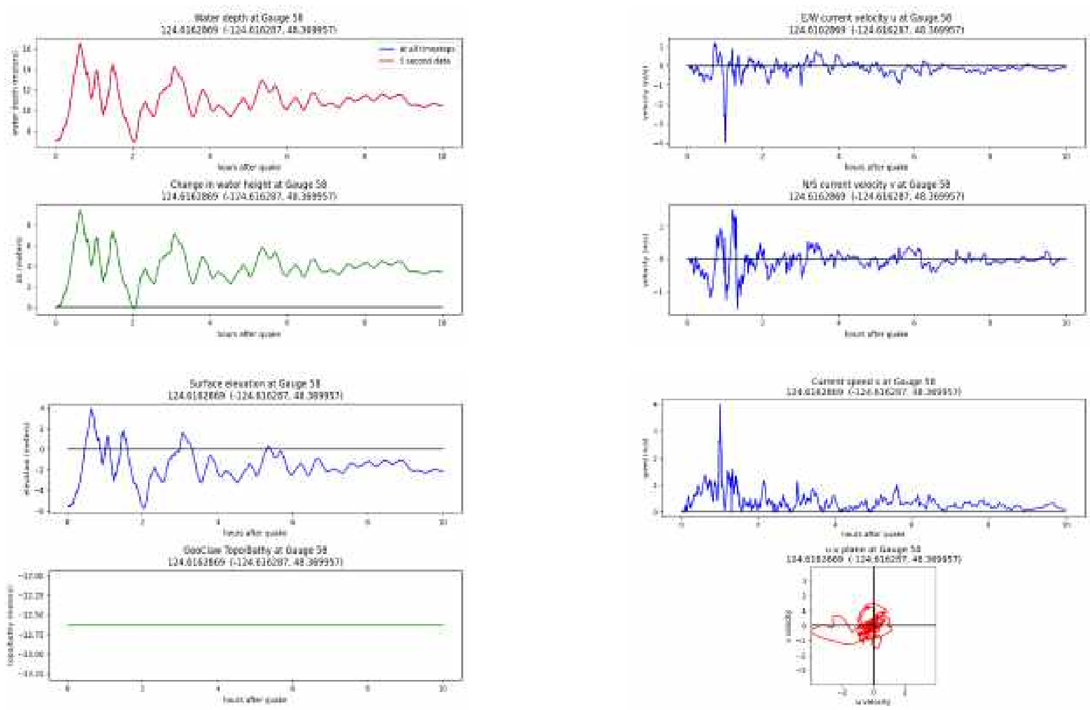


## Gauge 58: Neah Bay northwest of Makah Tribal Marina

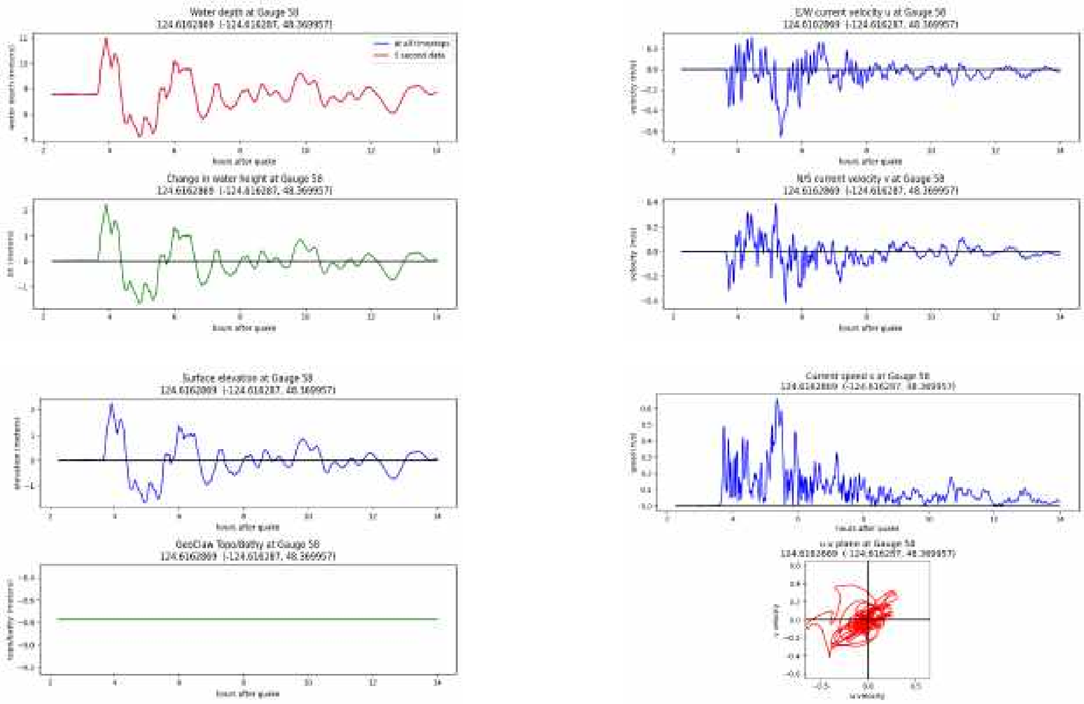
### Cascadia subduction zone scenario, MHW:



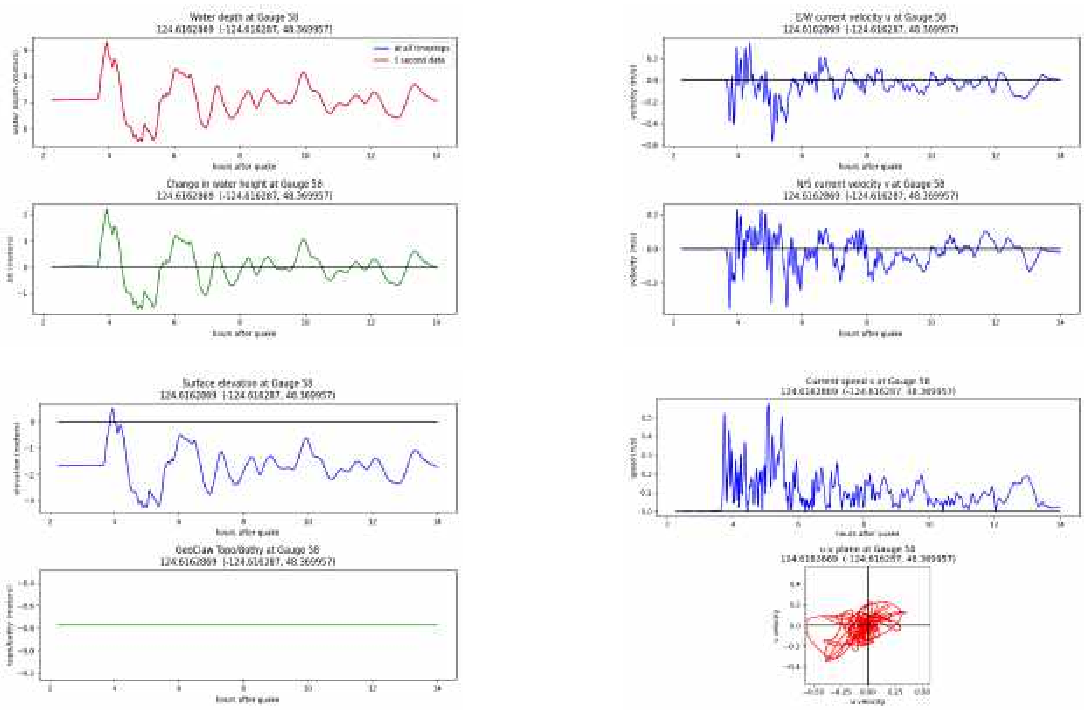

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

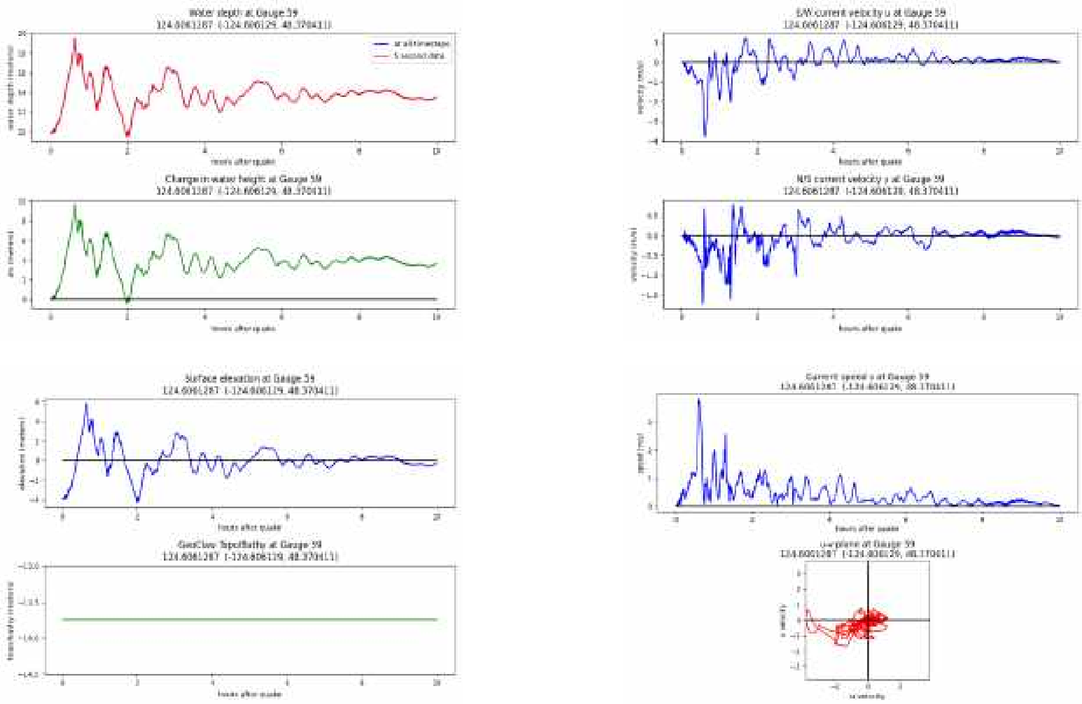



## Alaska-Aleutian subduction zone scenario, MLW:

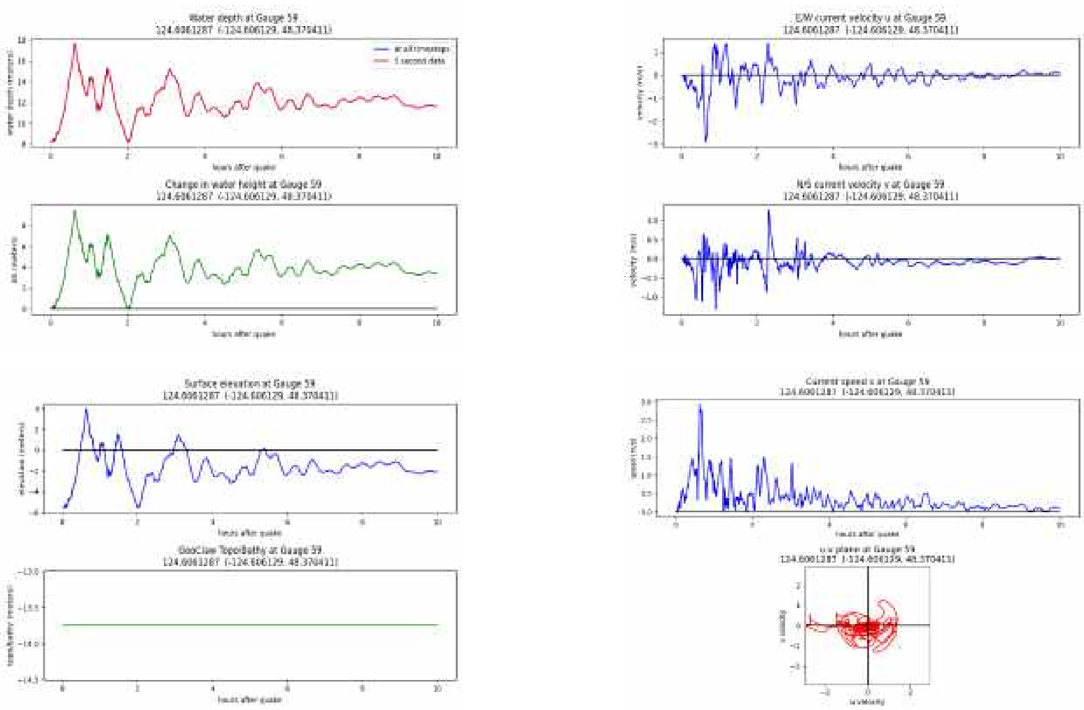


## Gauge 59: Neah Bay northeast of Makah Tribal Marina

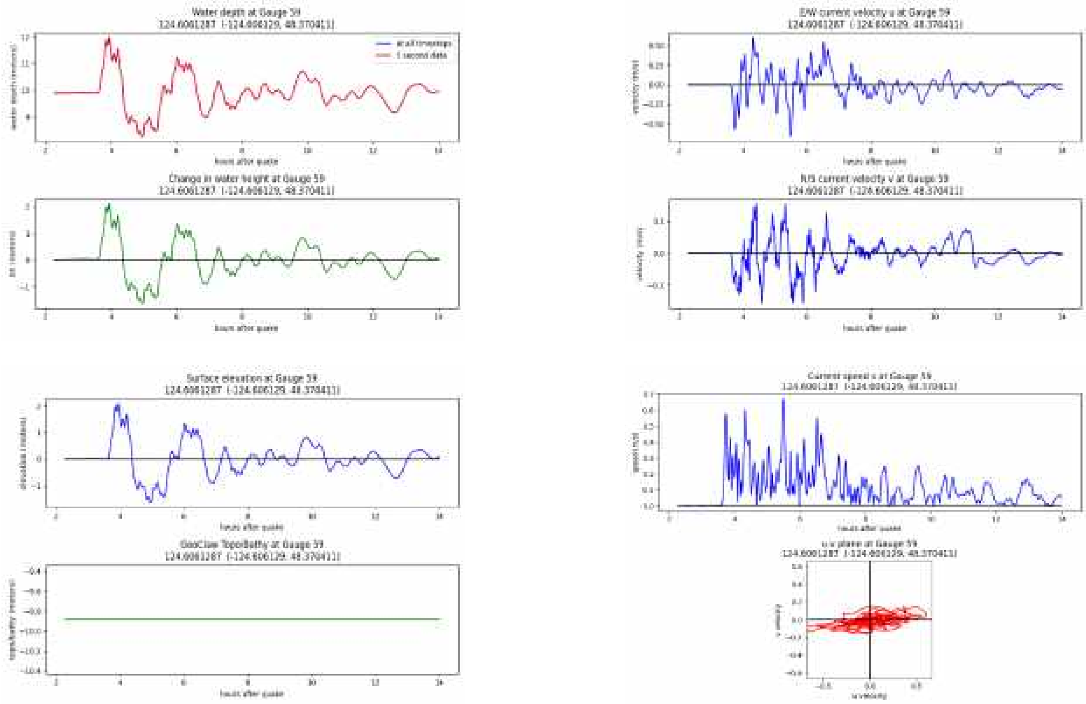
### Cascadia subduction zone scenario, MHW:



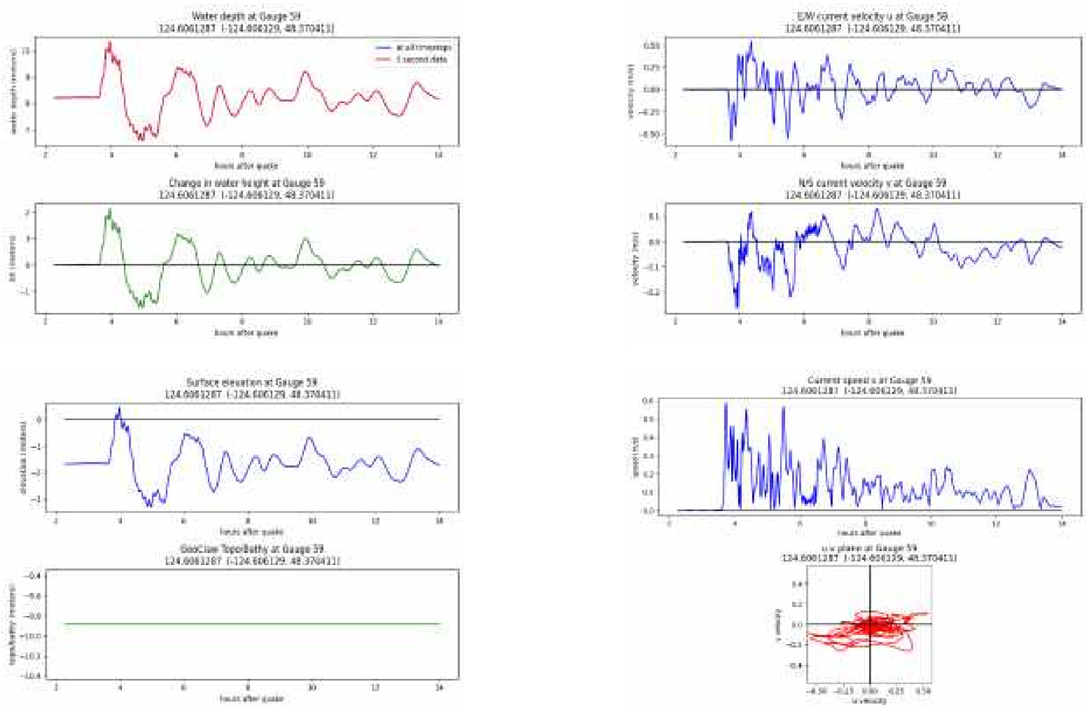

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

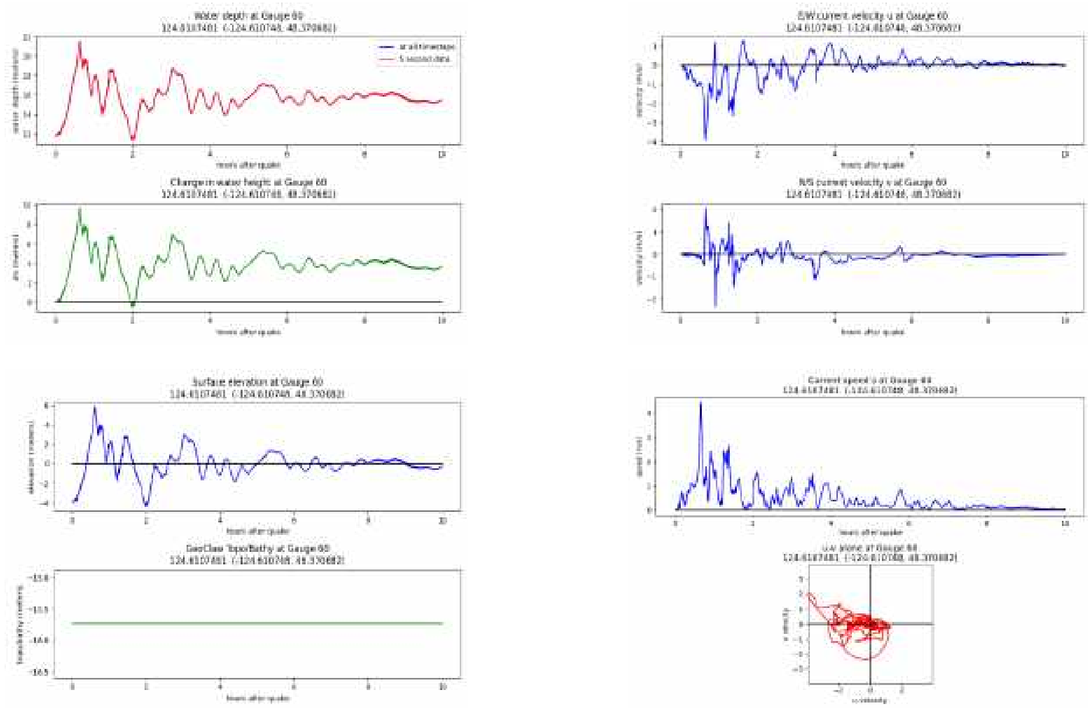



## Alaska-Aleutian subduction zone scenario, MLW:

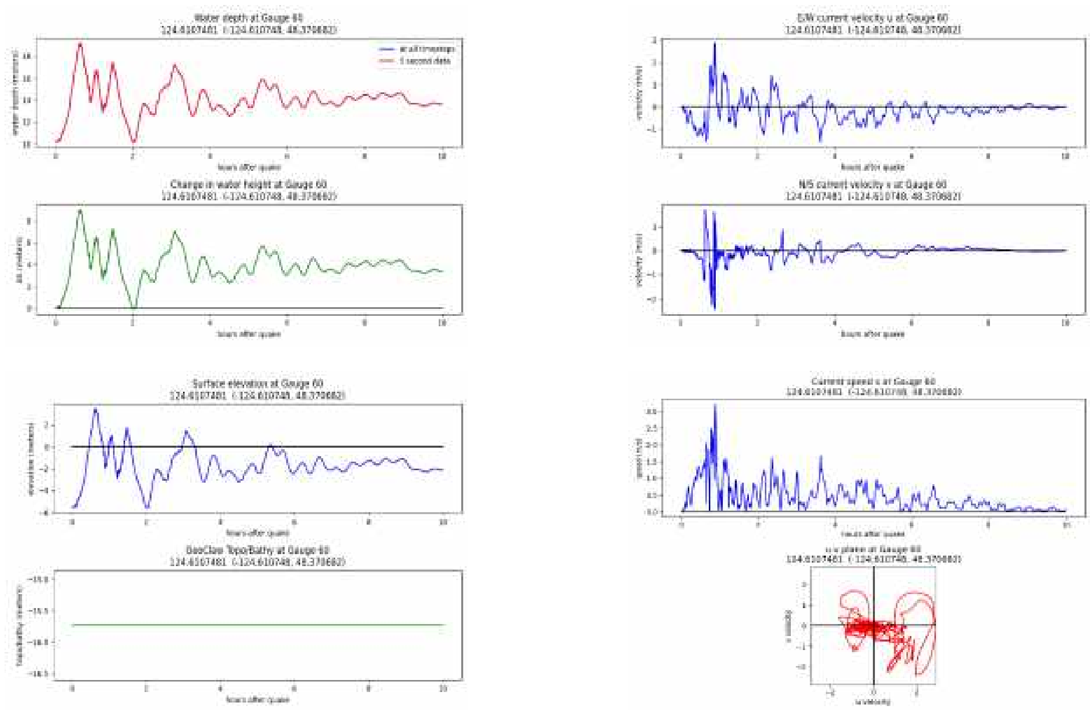


## Gauge 60: Neah Bay north of Makah Tribal Marina

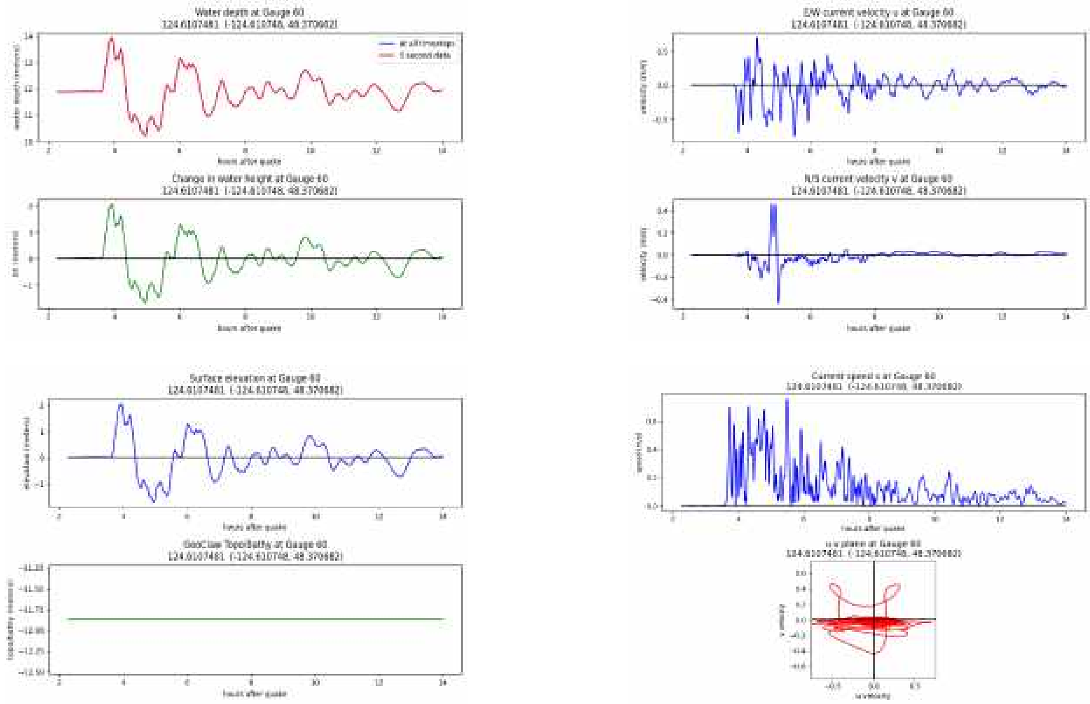
### Cascadia subduction zone scenario, MHW:



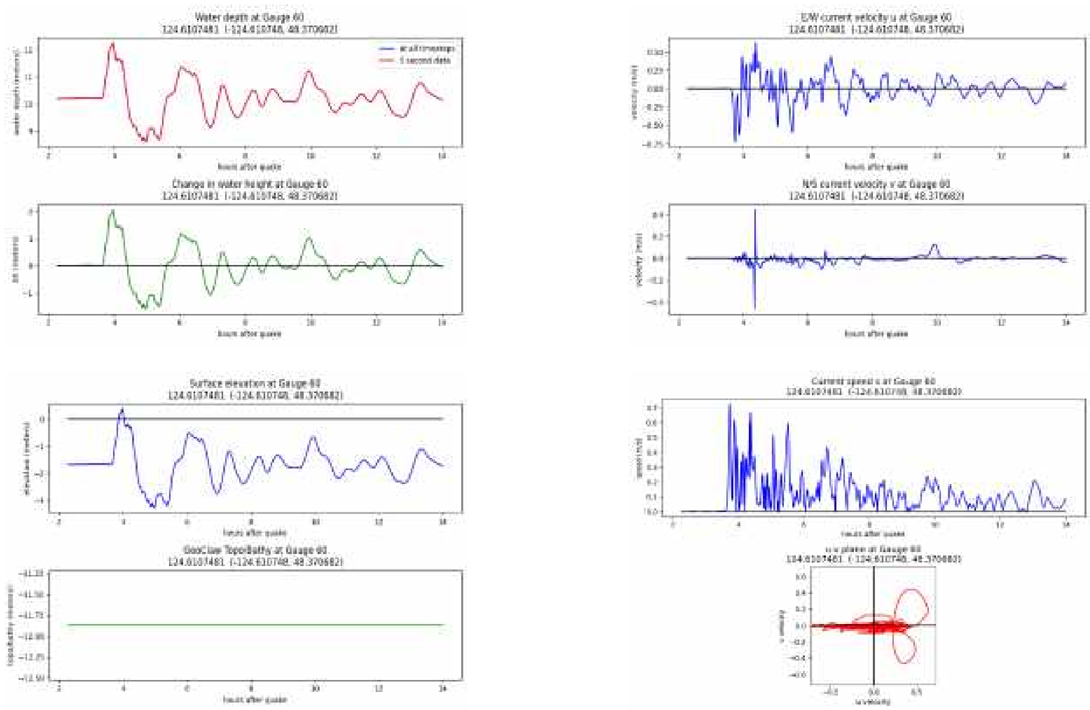

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

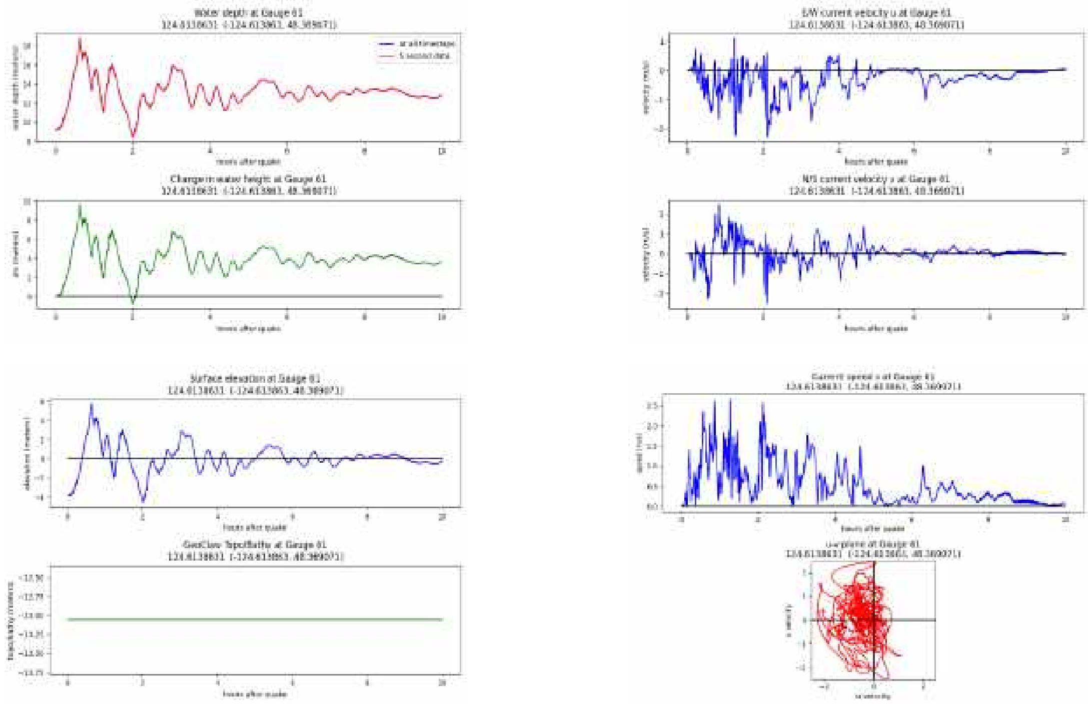



## Alaska-Aleutian subduction zone scenario, MLW:

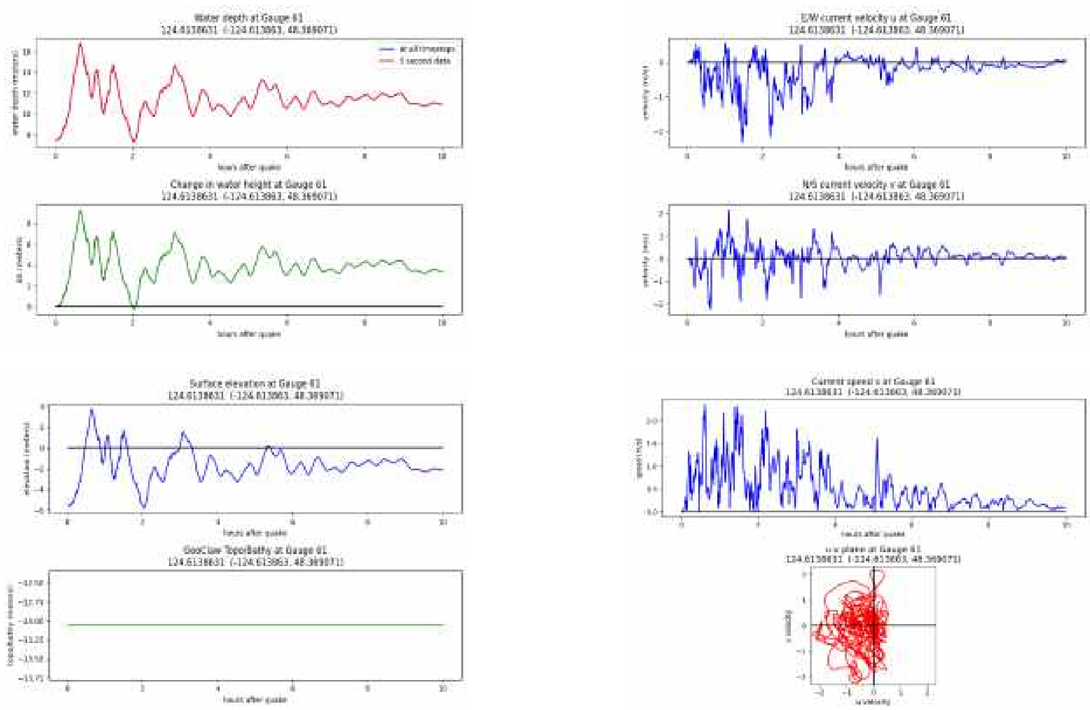


## Gauge 61: Makah Tribal Marina, northwest

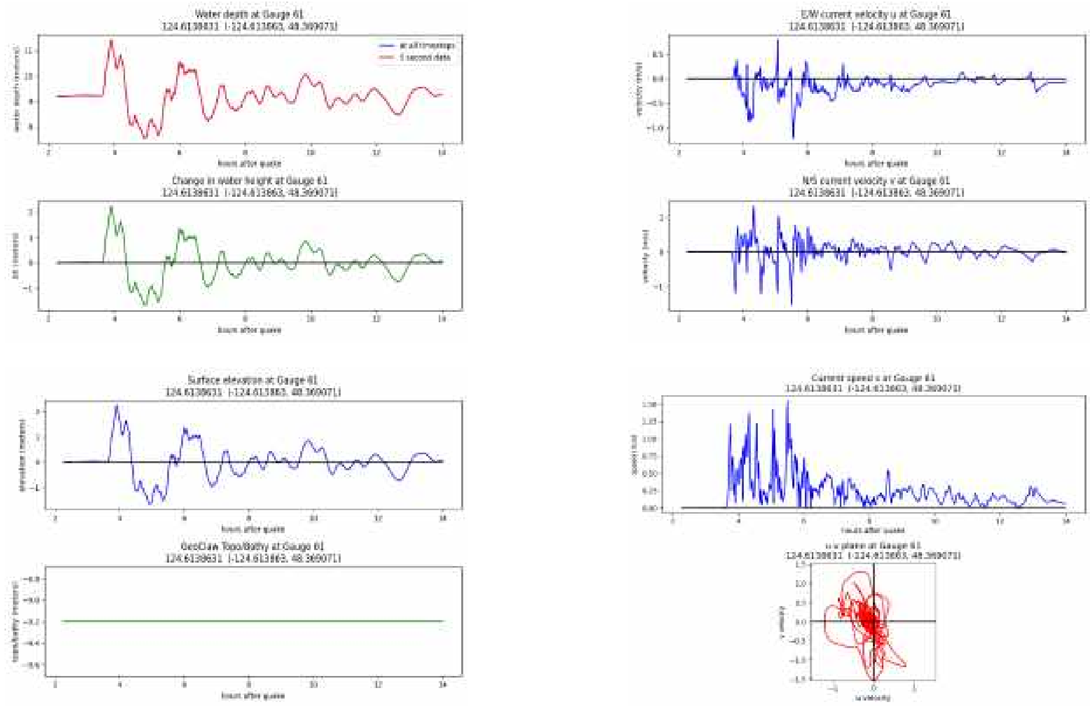
### Cascadia subduction zone scenario, MHW:



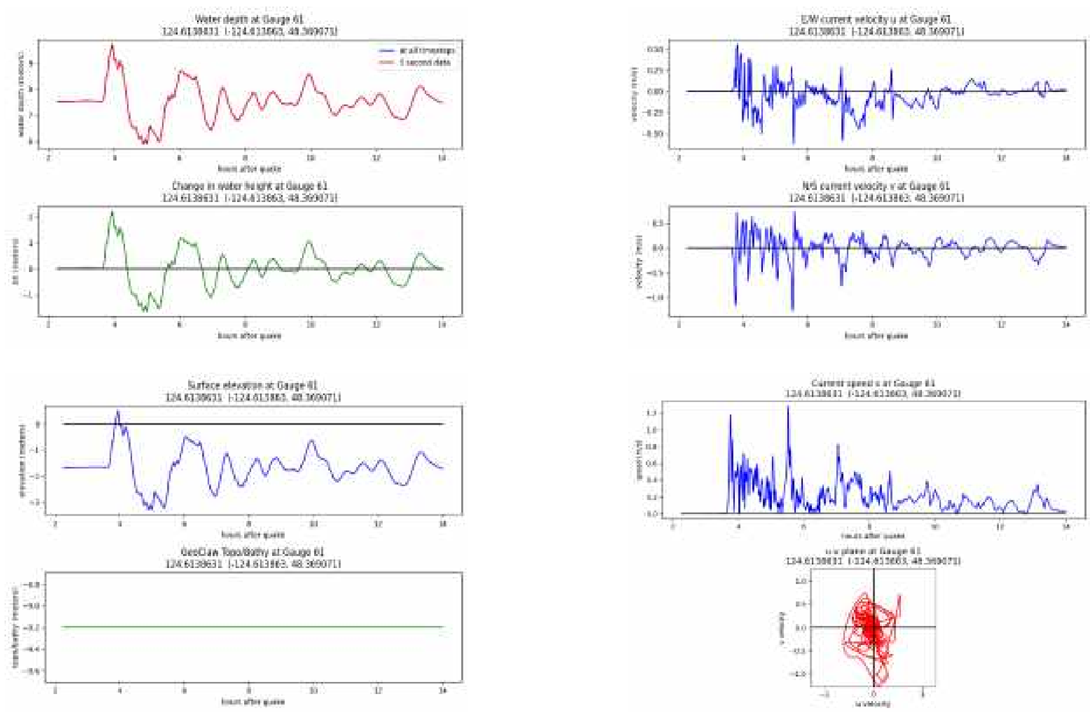
### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

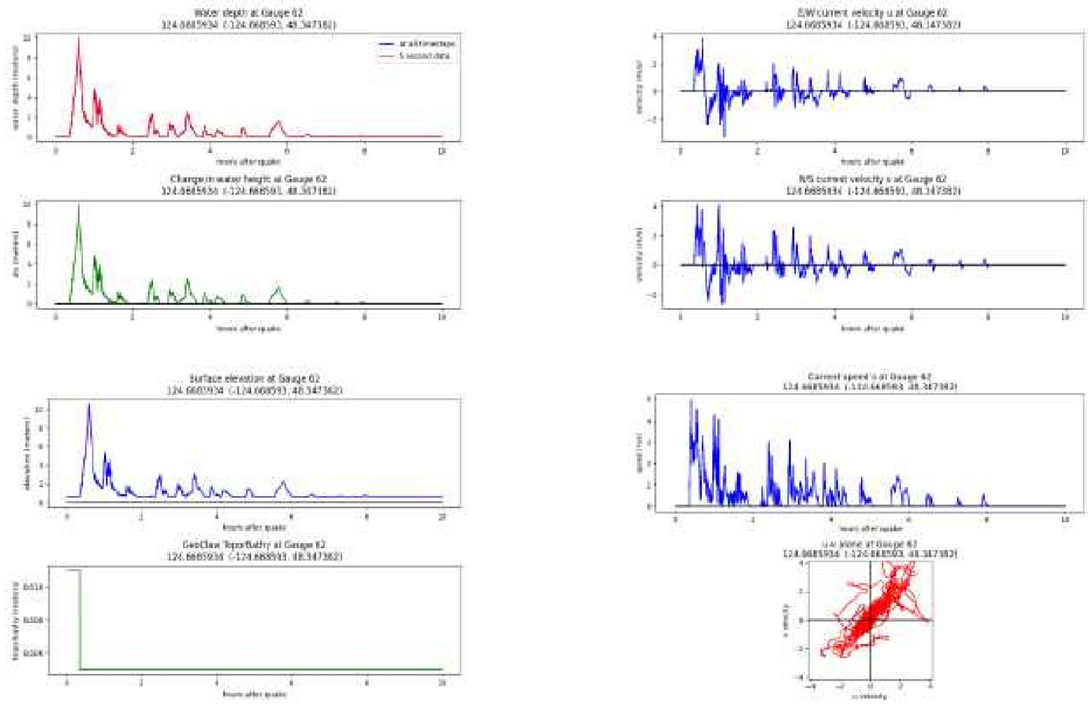



Alaska-Aleutian subduction zone scenario, MLW:

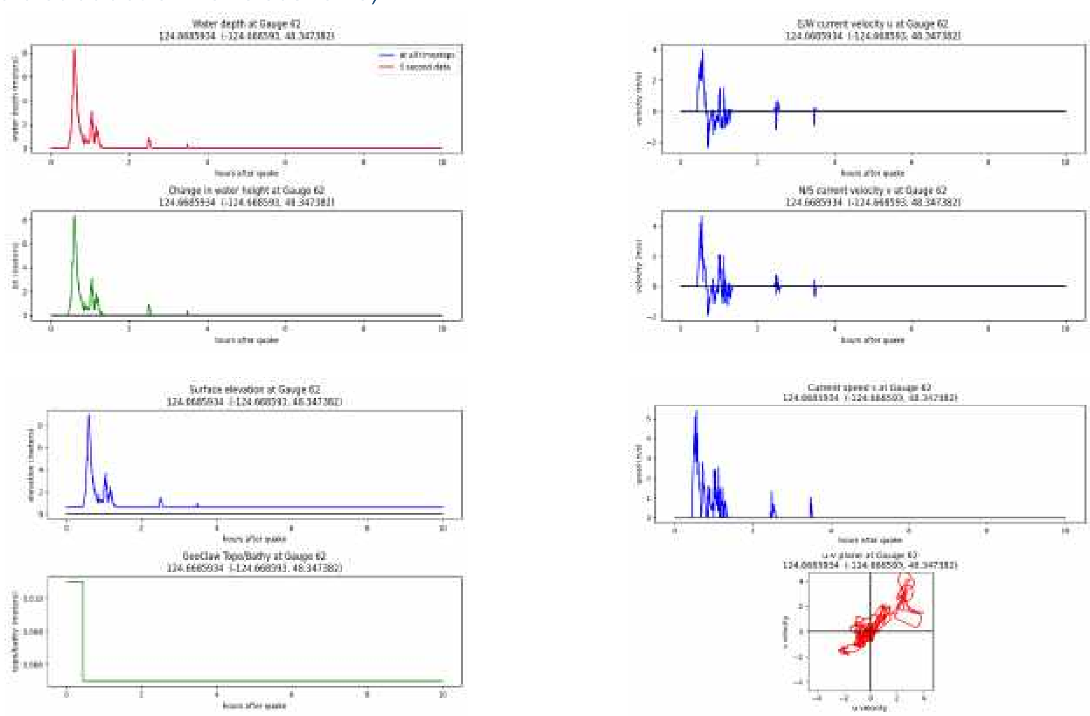


## Gauge 62: Makah Tribal Council

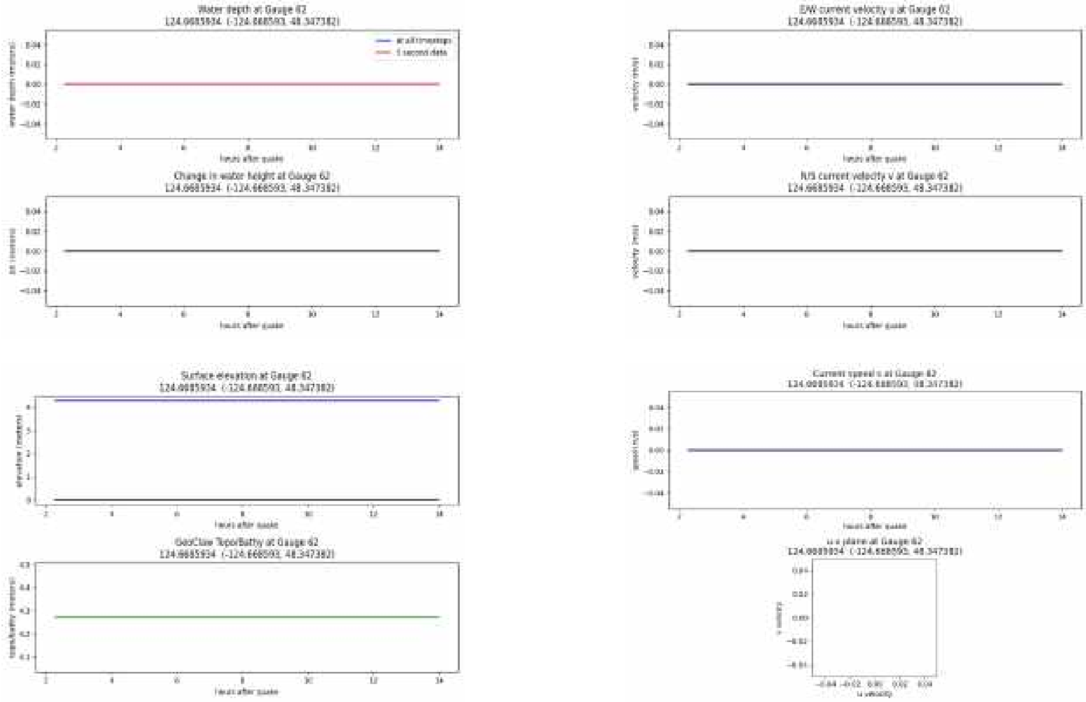
### Cascadia subduction zone scenario, MHW:



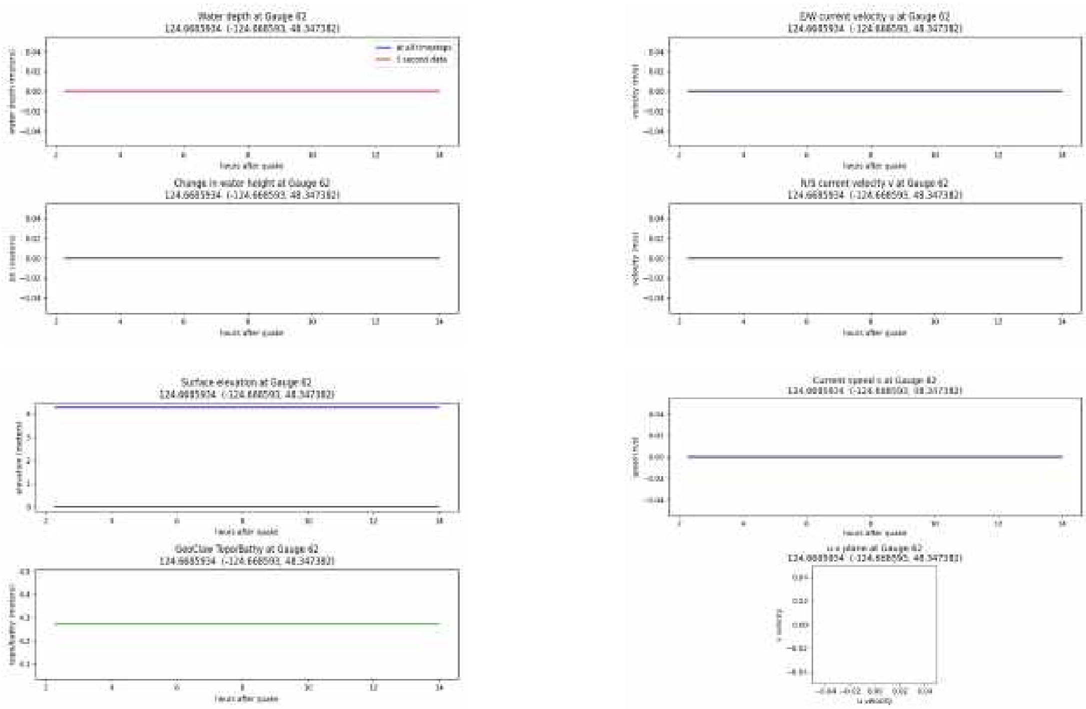

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

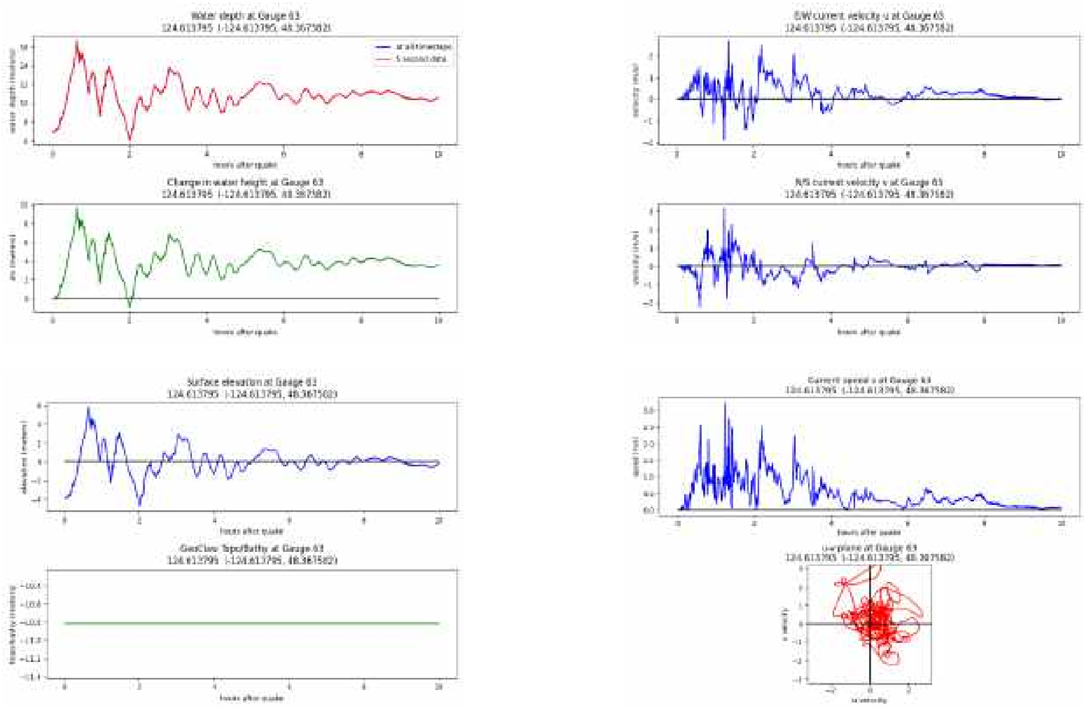


## Alaska-Aleutian subduction zone scenario, MLW:

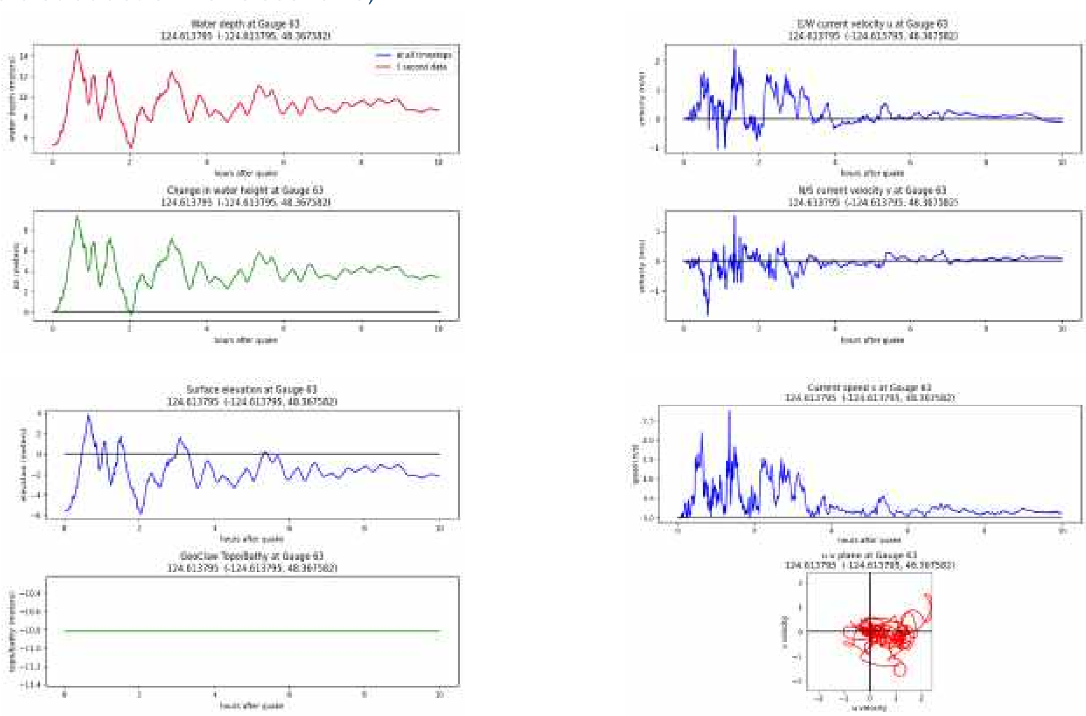


## Gauge 63: Makah Dock Ice Machine

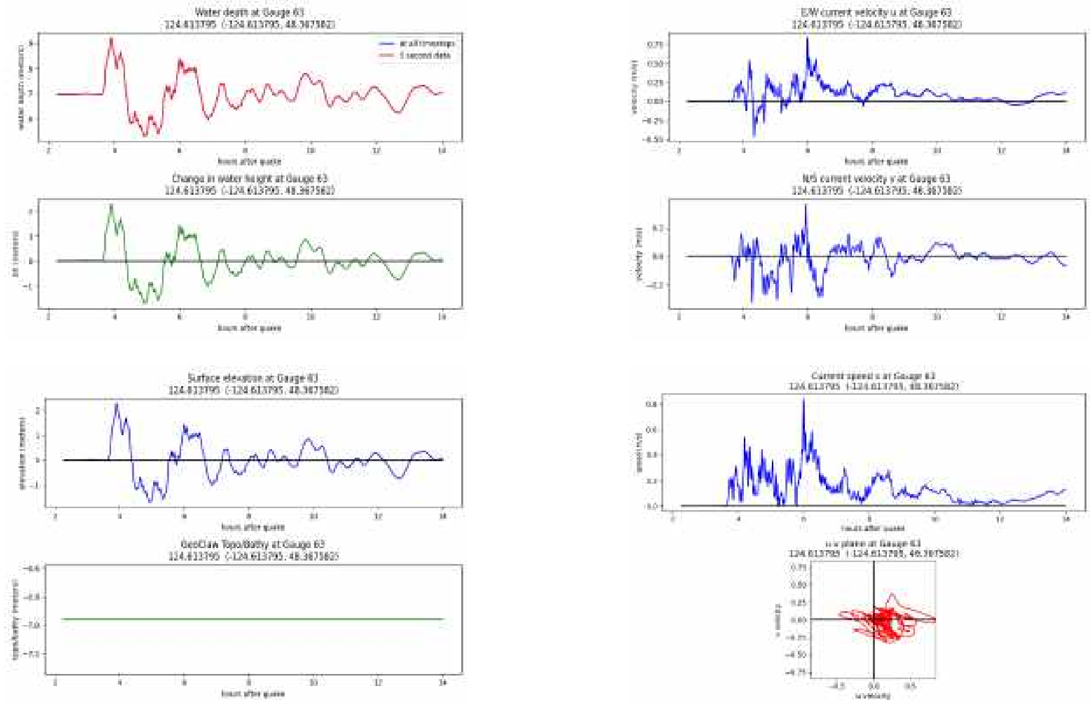
### Cascadia subduction zone scenario, MHW:



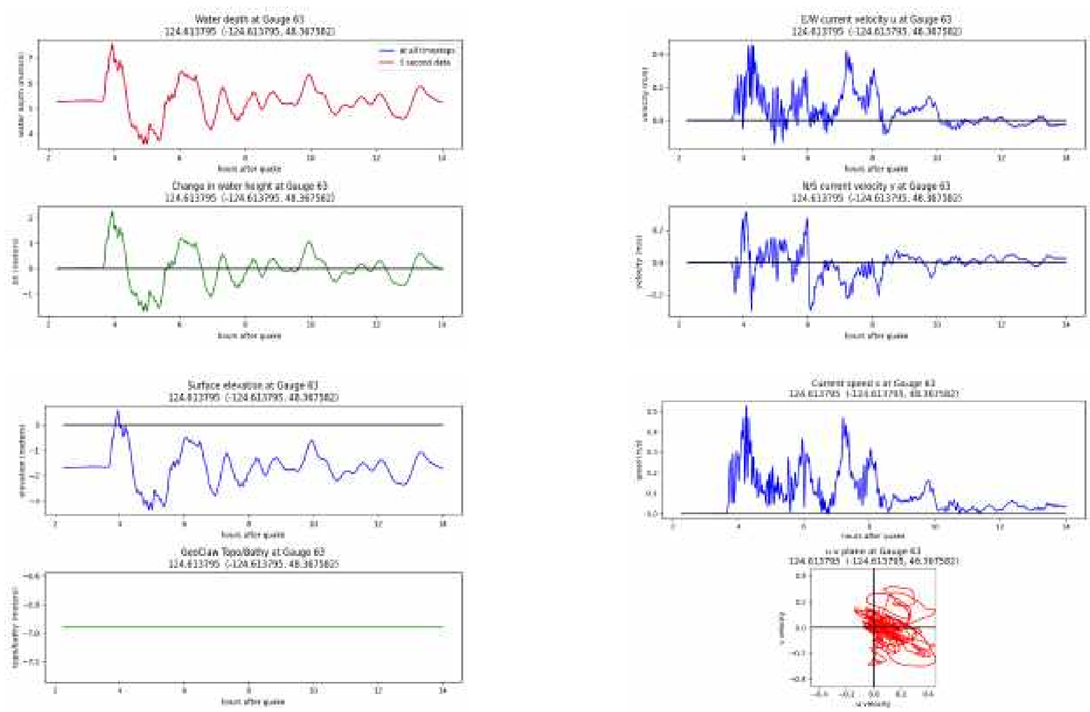
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

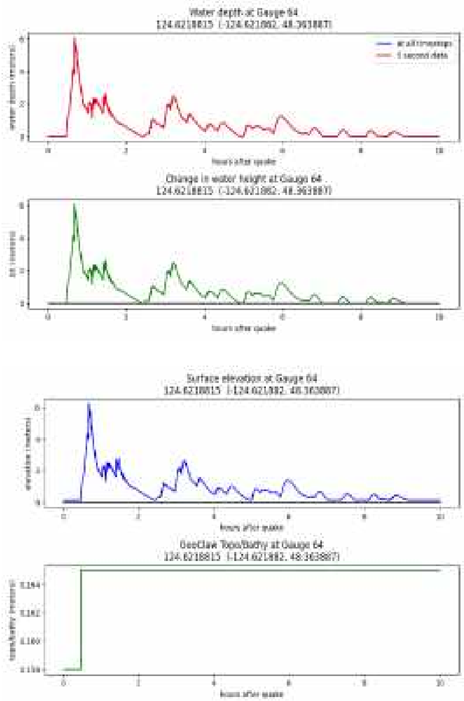


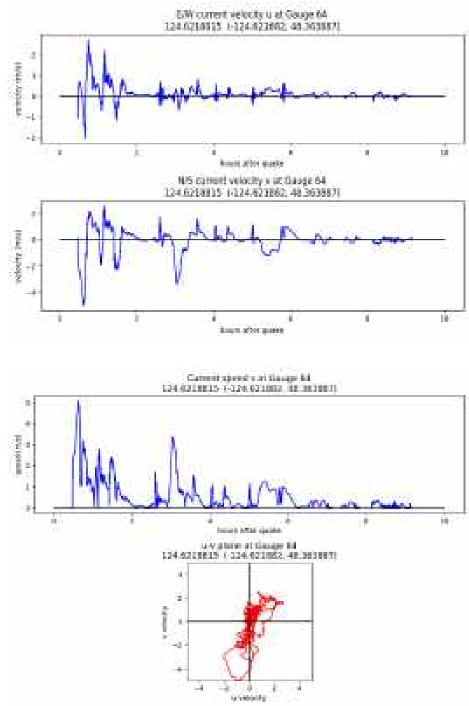

## Alaska-Aleutian subduction zone scenario, MLW:



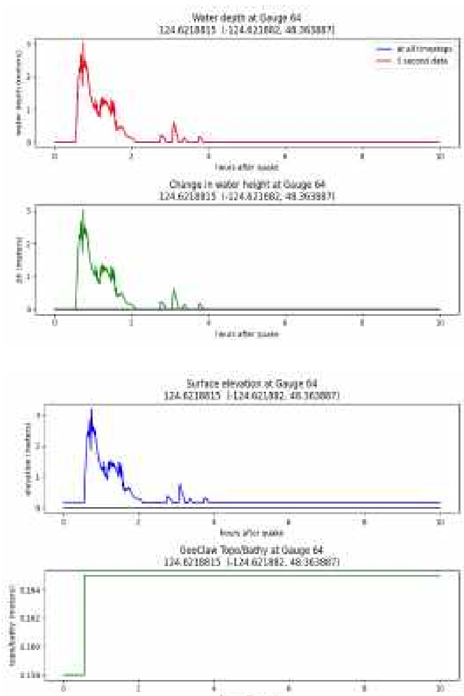
## Gauge 64: Neah Bay Elementary School

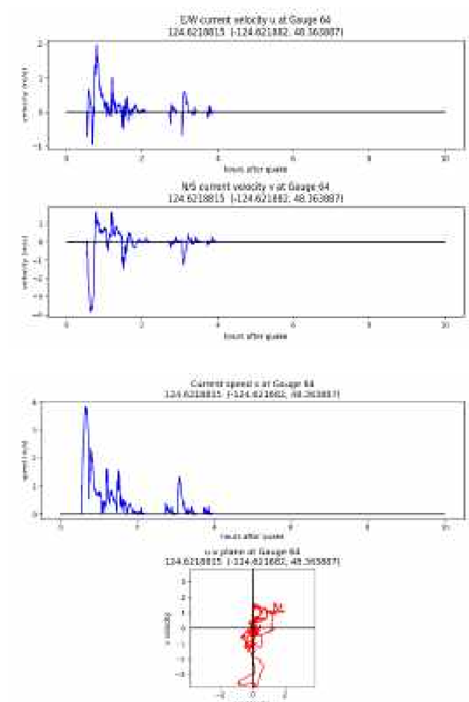
### Cascadia subduction zone scenario, MHW:



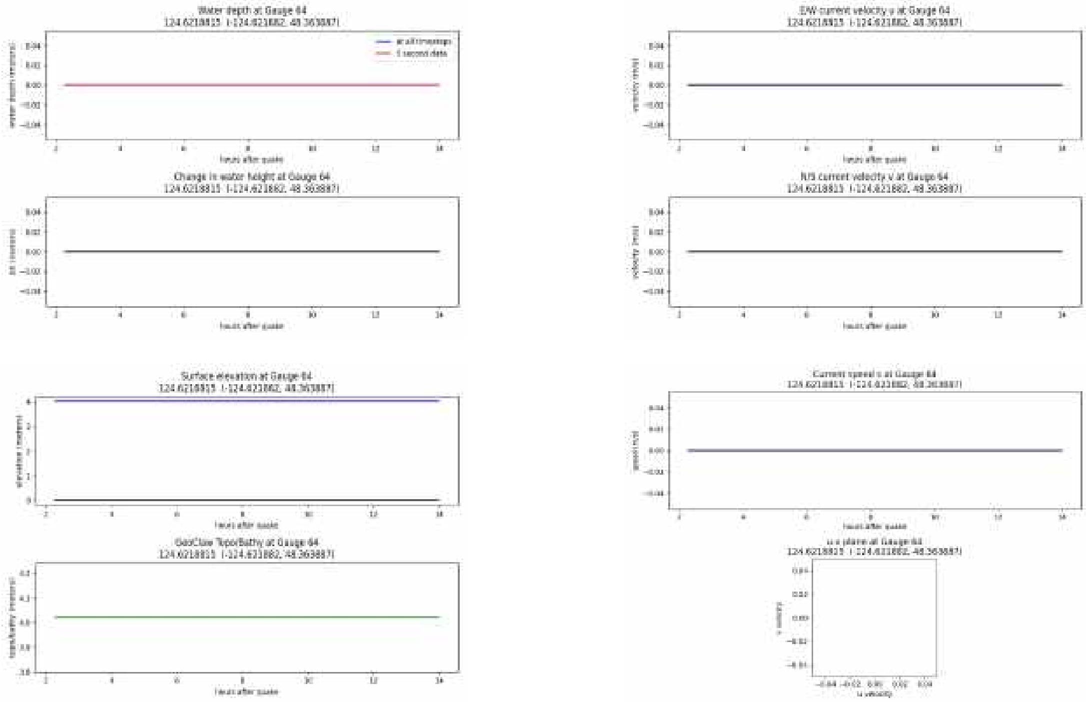




### Cascadia subduction zone scenario, MLW:

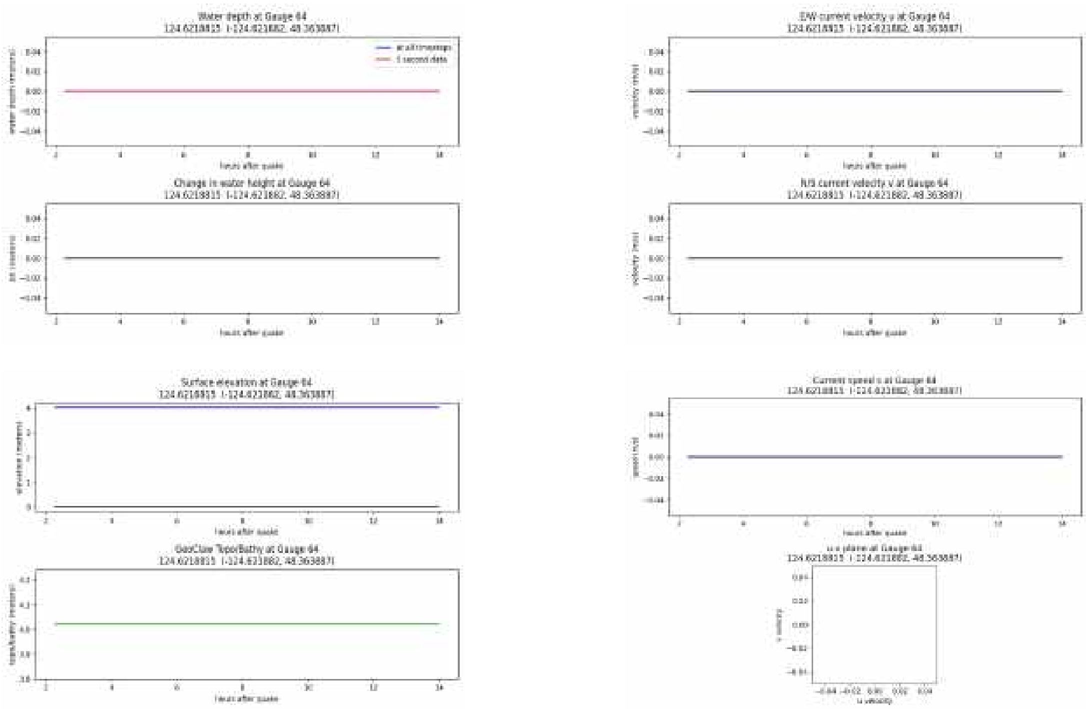


## Alaska-Aleutian subduction zone scenario, MHW:

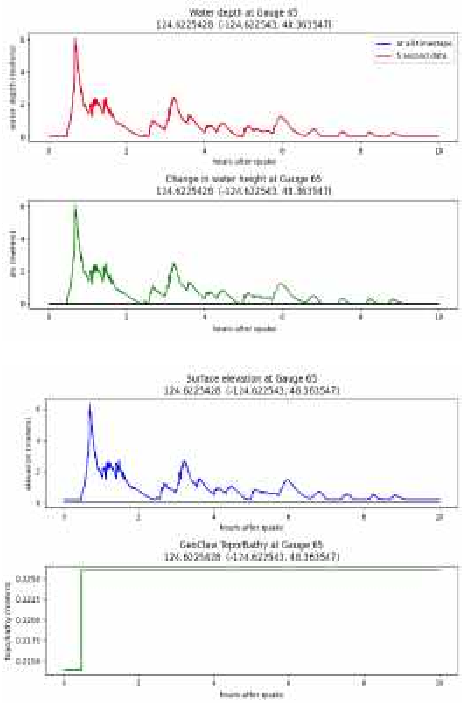


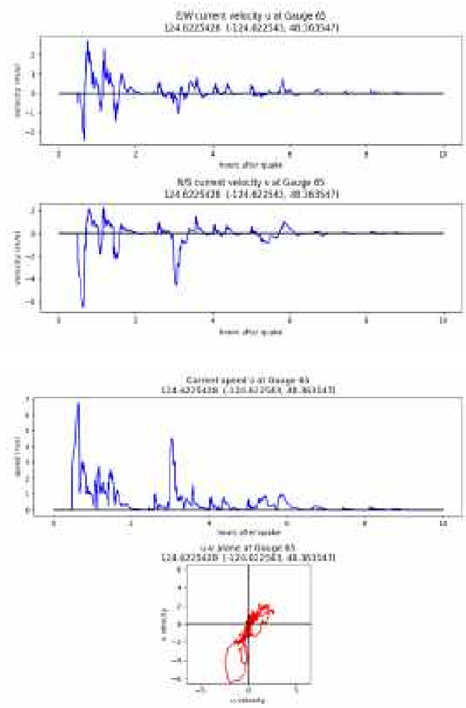
## Alaska-Aleutian subduction zone scenario, MLW:



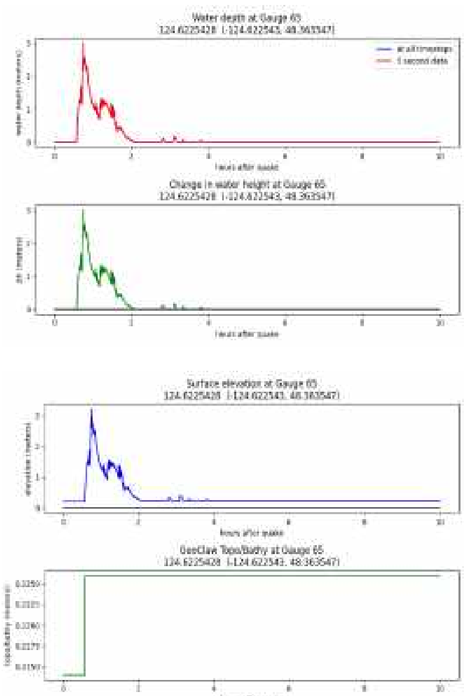
## Gauge 65: Neah Bay Middle School

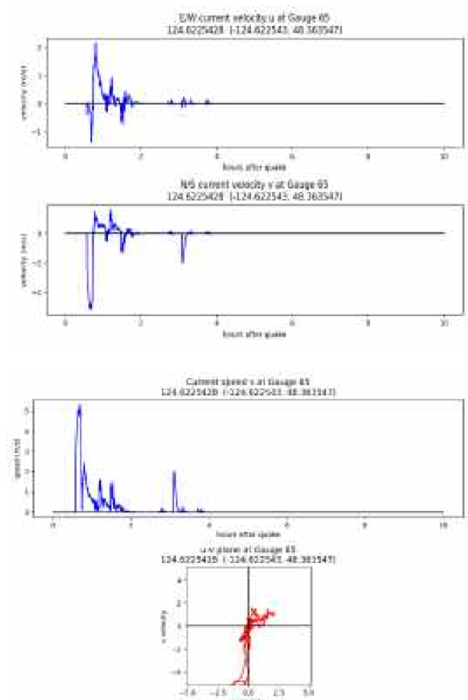
### Cascadia subduction zone scenario, MHW:



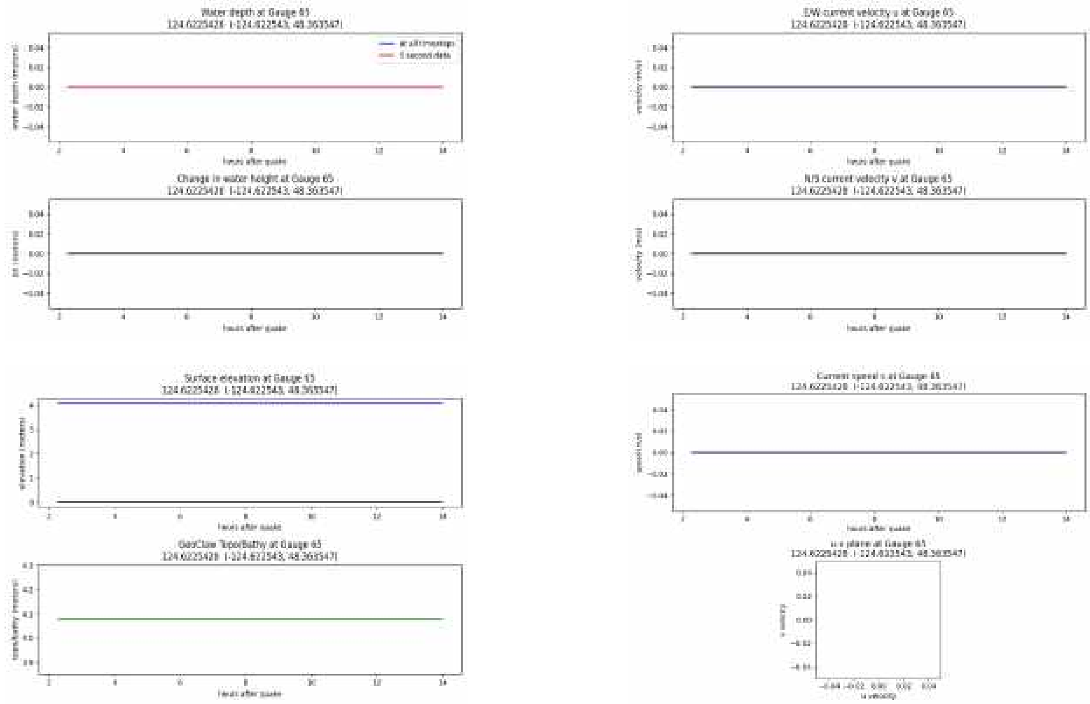


### Cascadia subduction zone scenario, MLW:

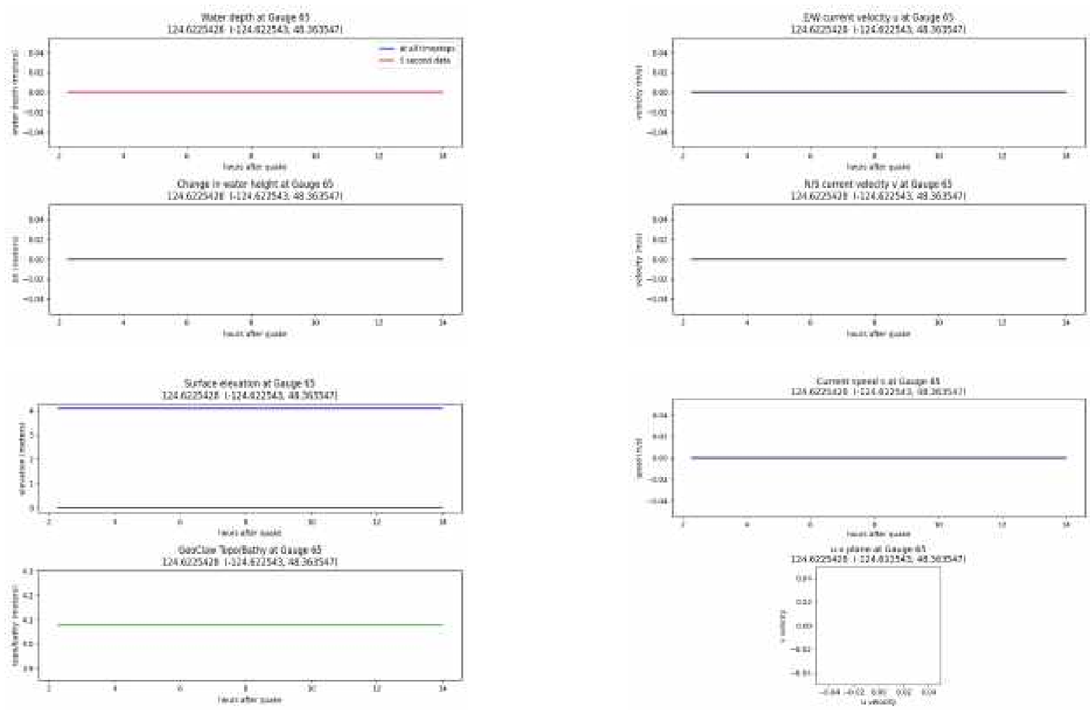




Alaska-Aleutian subduction zone scenario, MHW:

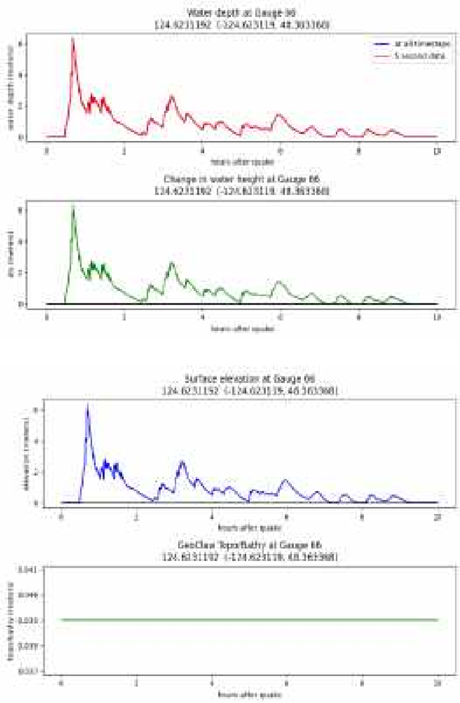


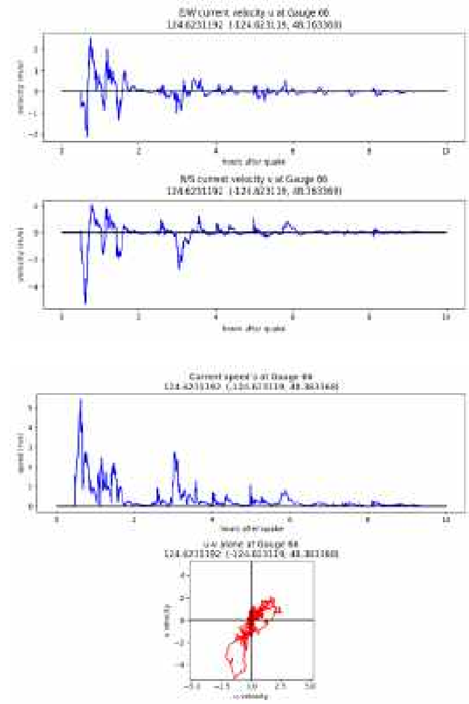

Alaska-Aleutian subduction zone scenario, MLW:



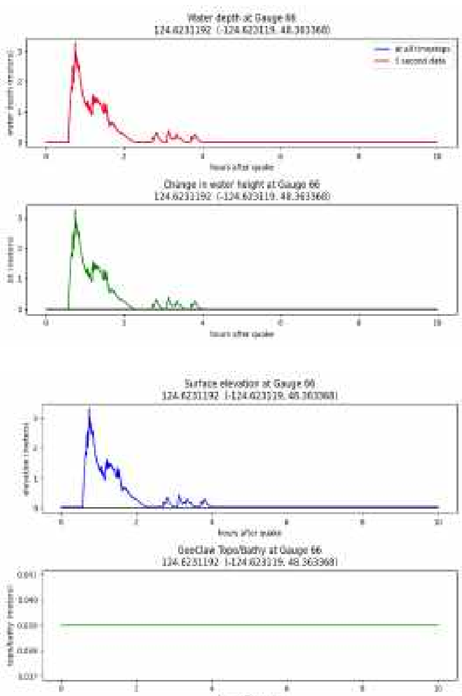
## Gauge 66: Neah Bay High School

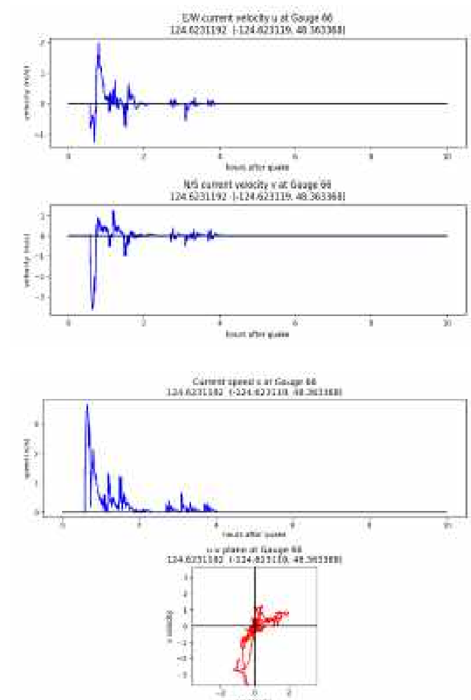
### Cascadia subduction zone scenario, MHW:



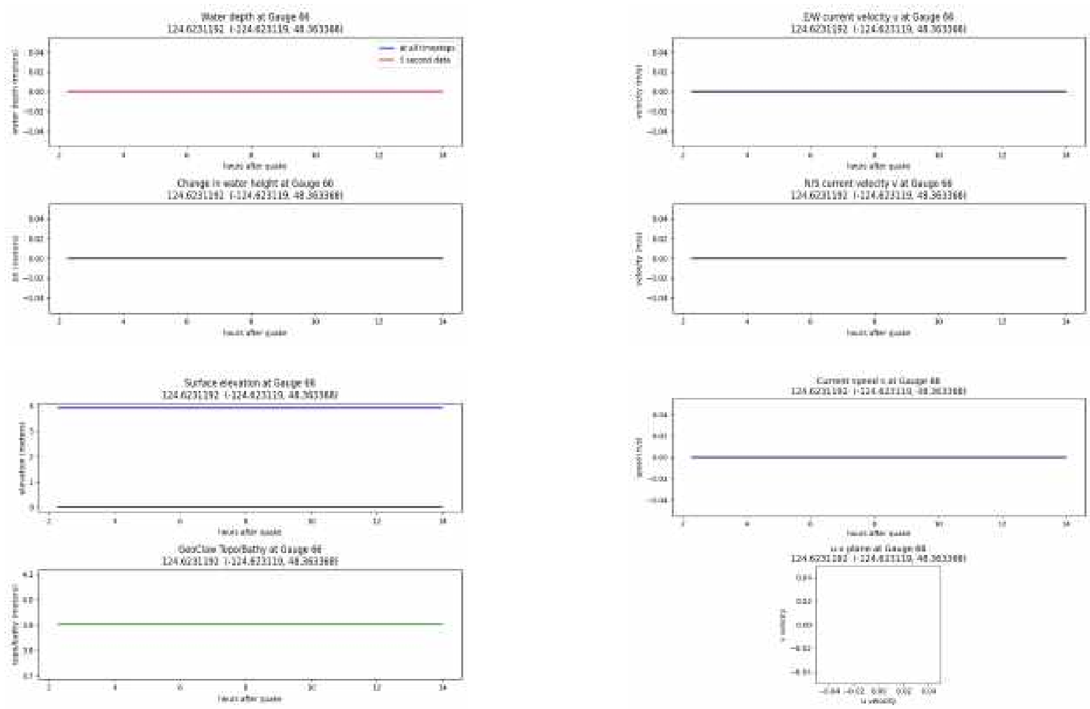




### Cascadia subduction zone scenario, MLW:

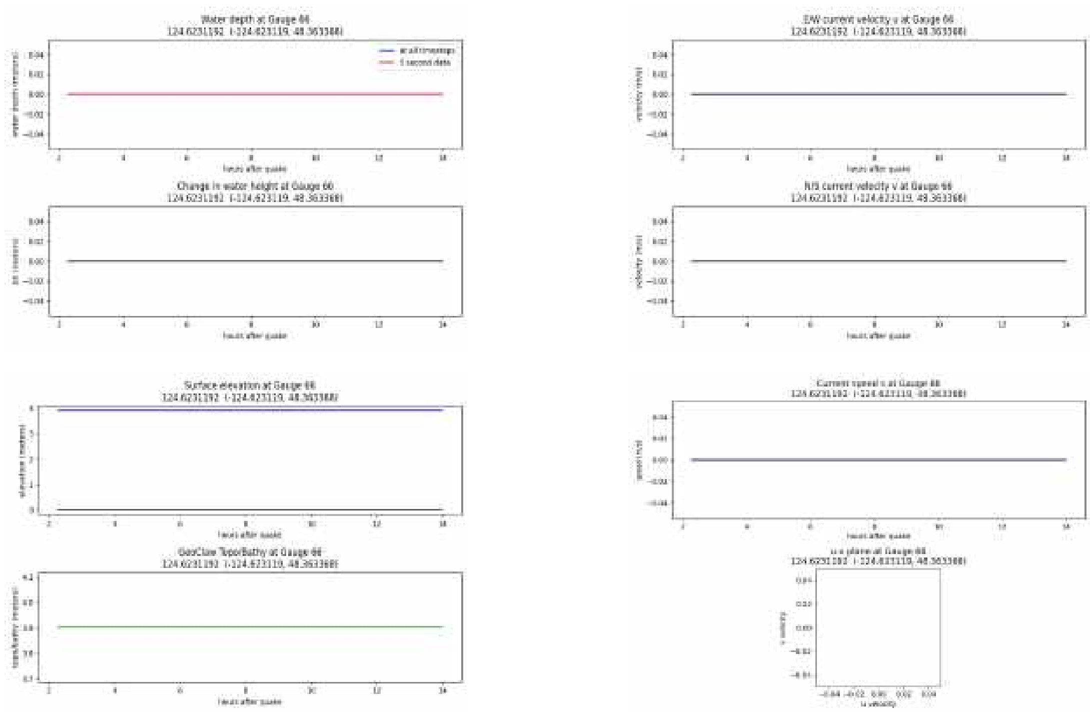


## Alaska-Aleutian subduction zone scenario, MHW:

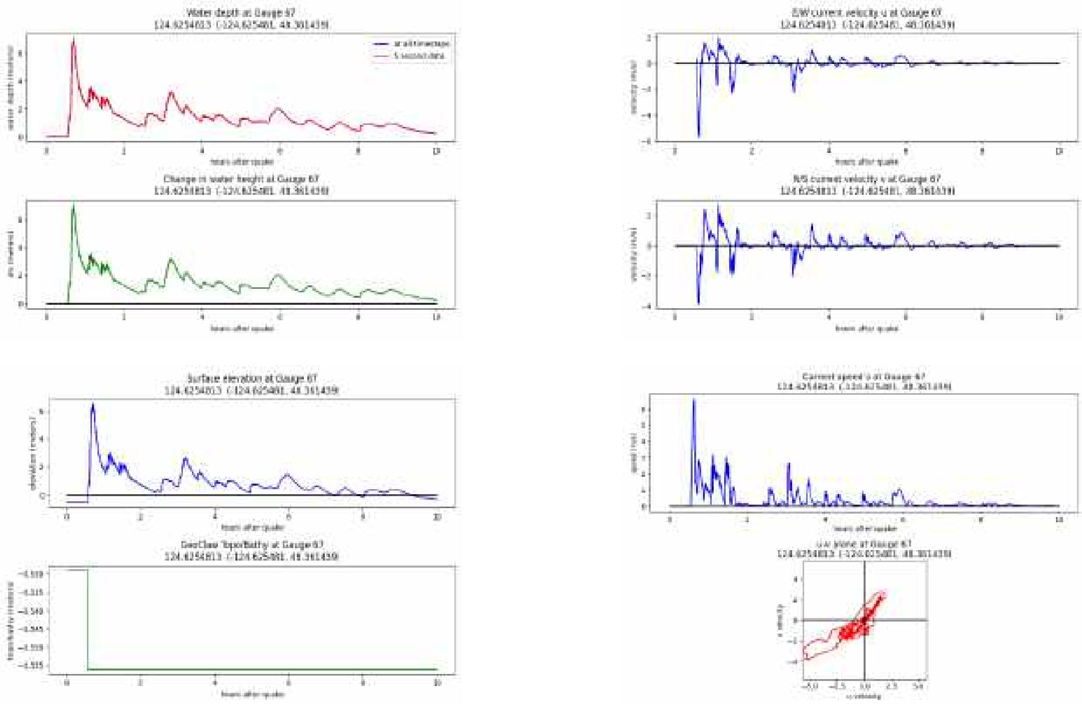


## Alaska-Aleutian subduction zone scenario, MLW:

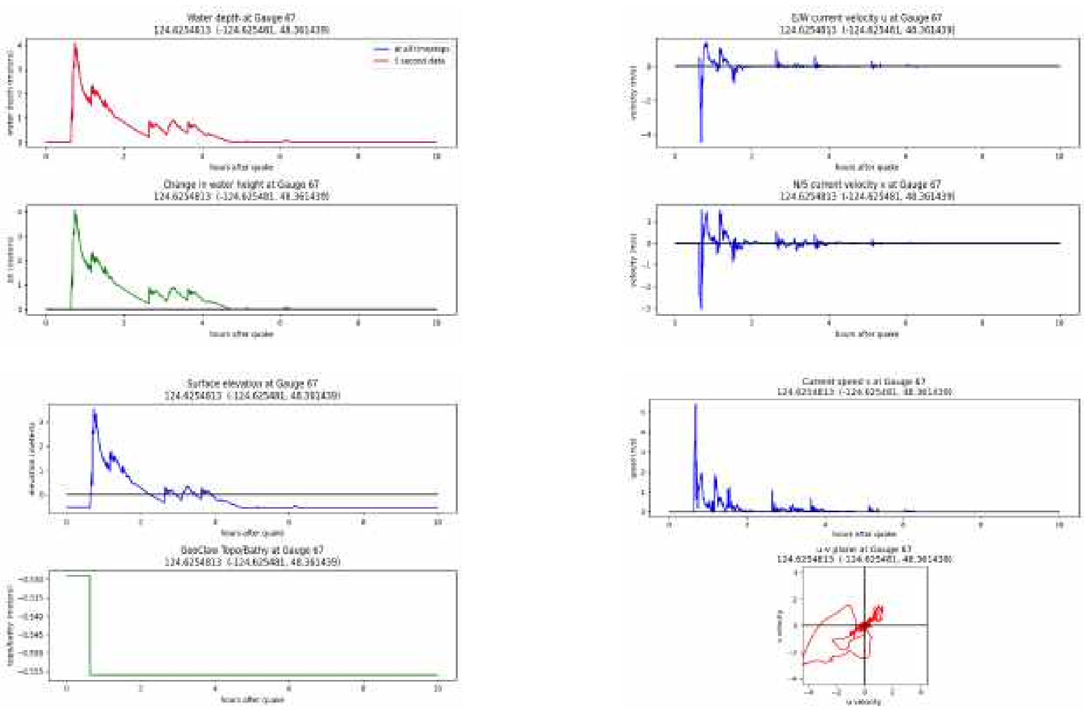


## Gauge 67: Neah Bay water treatment

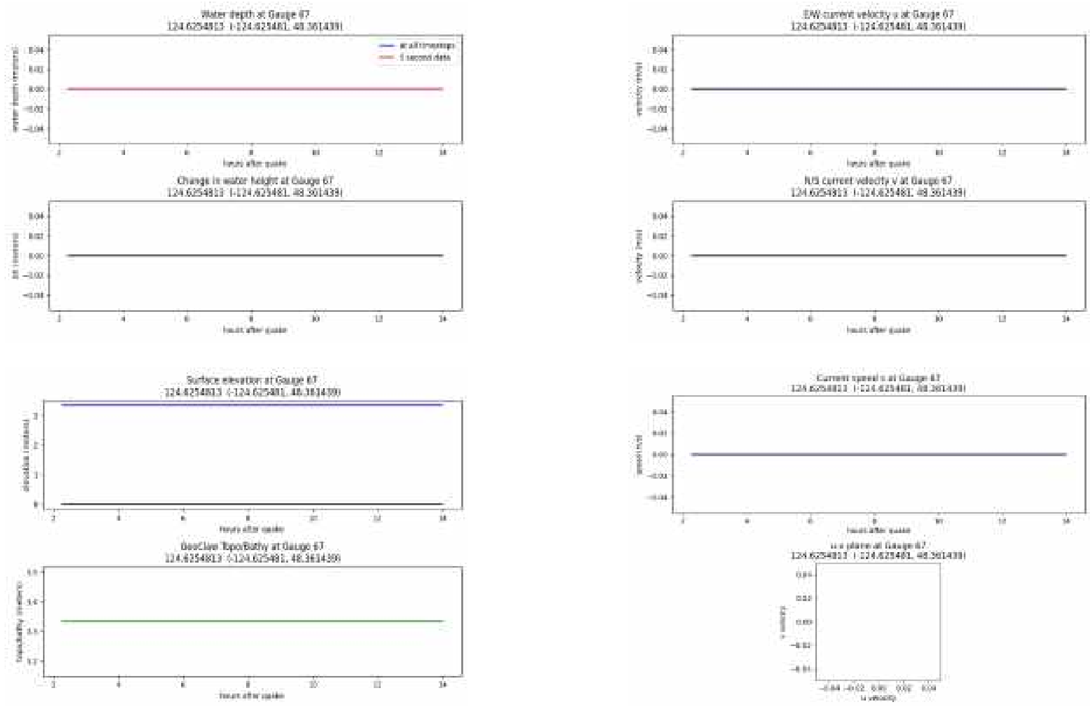
### Cascadia subduction zone scenario, MHW:



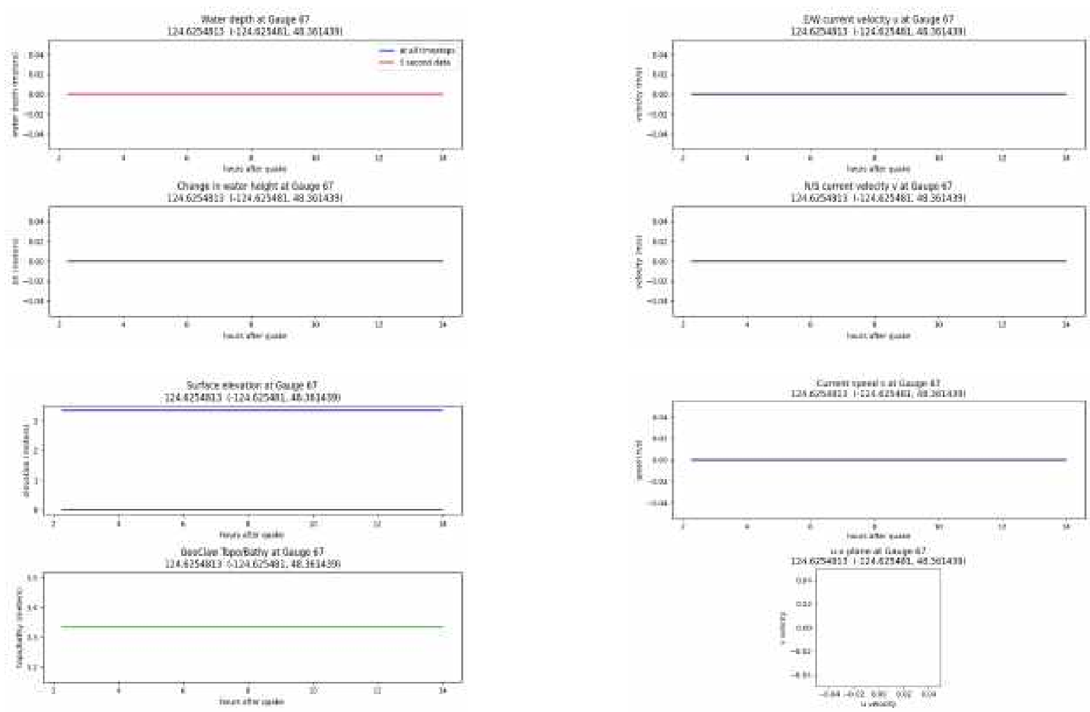

### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

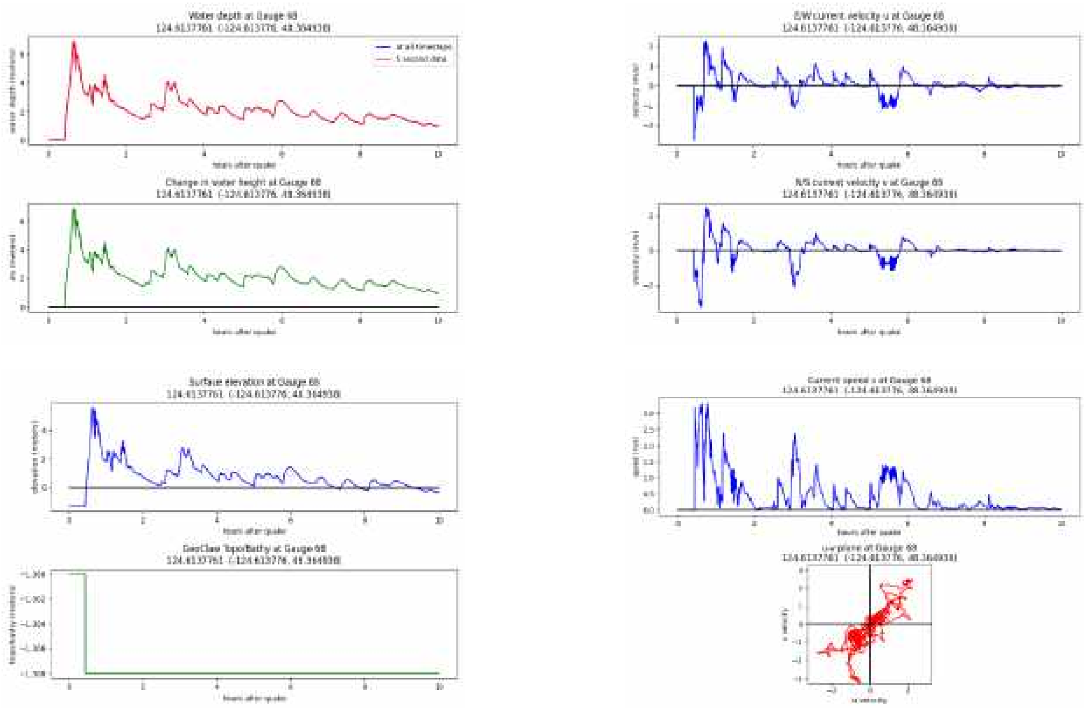



## Alaska-Aleutian subduction zone scenario, MLW:

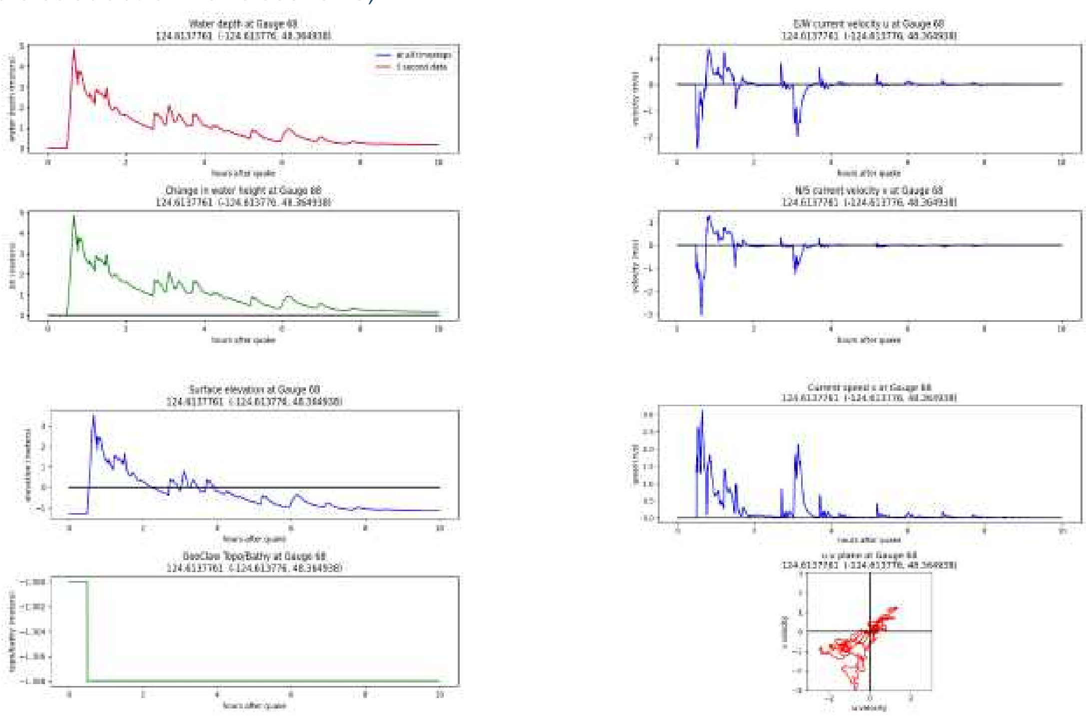


## Gauge 68: Makah Tribal Fire Department

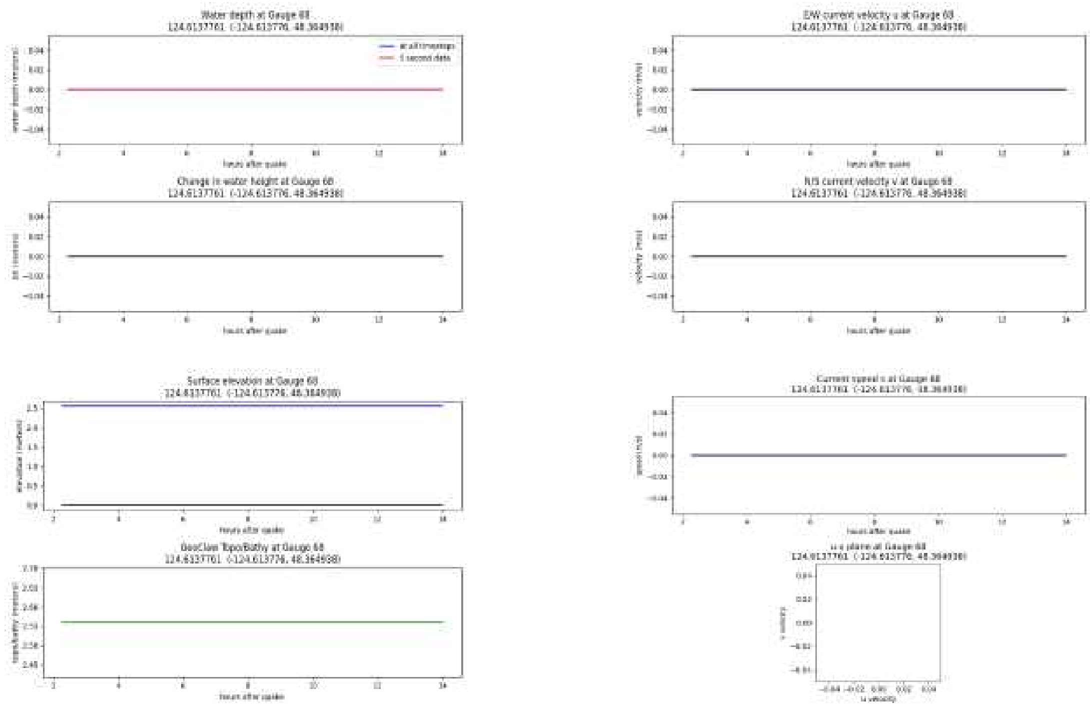
### Cascadia subduction zone scenario, MHW:



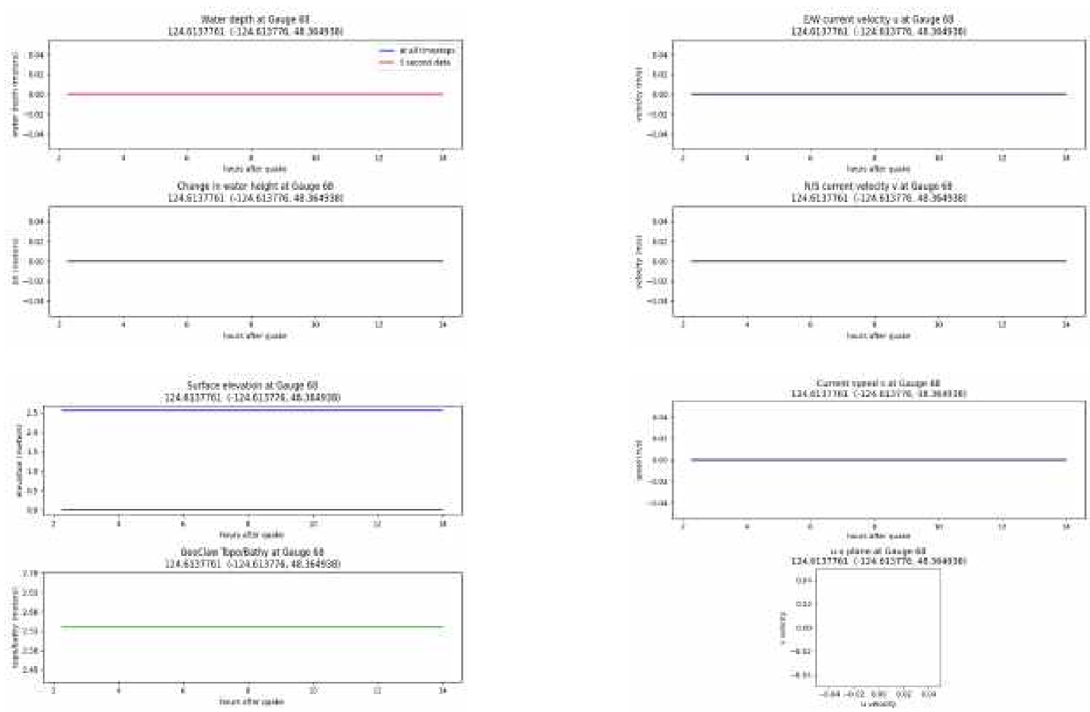
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

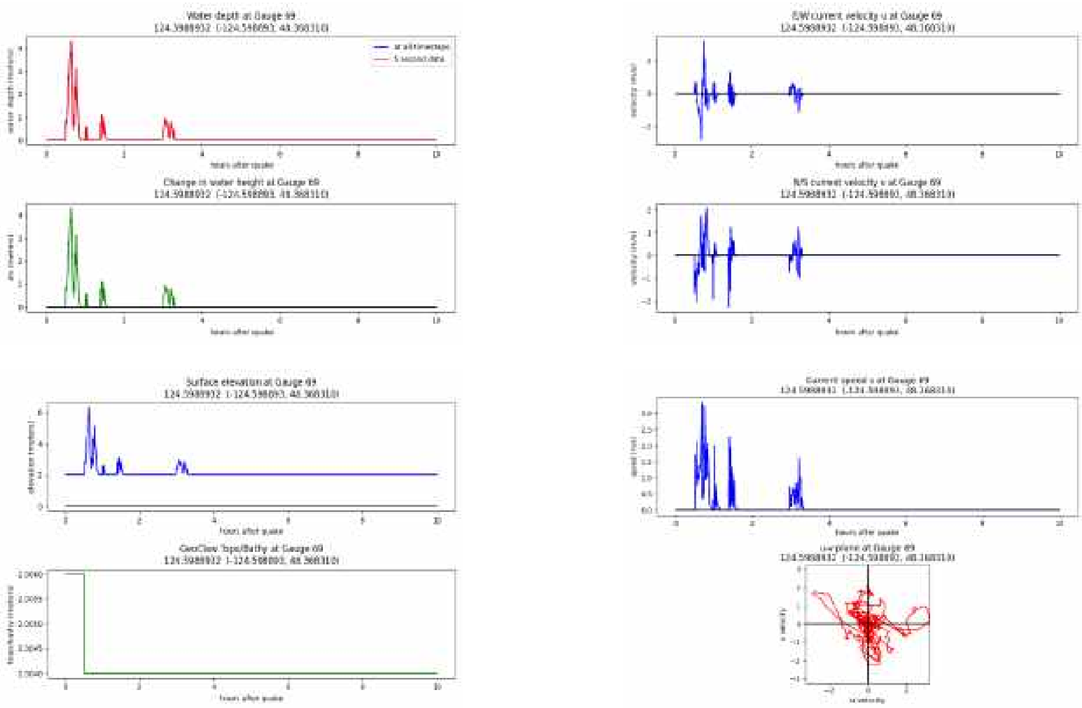


## Alaska-Aleutian subduction zone scenario, MLW:

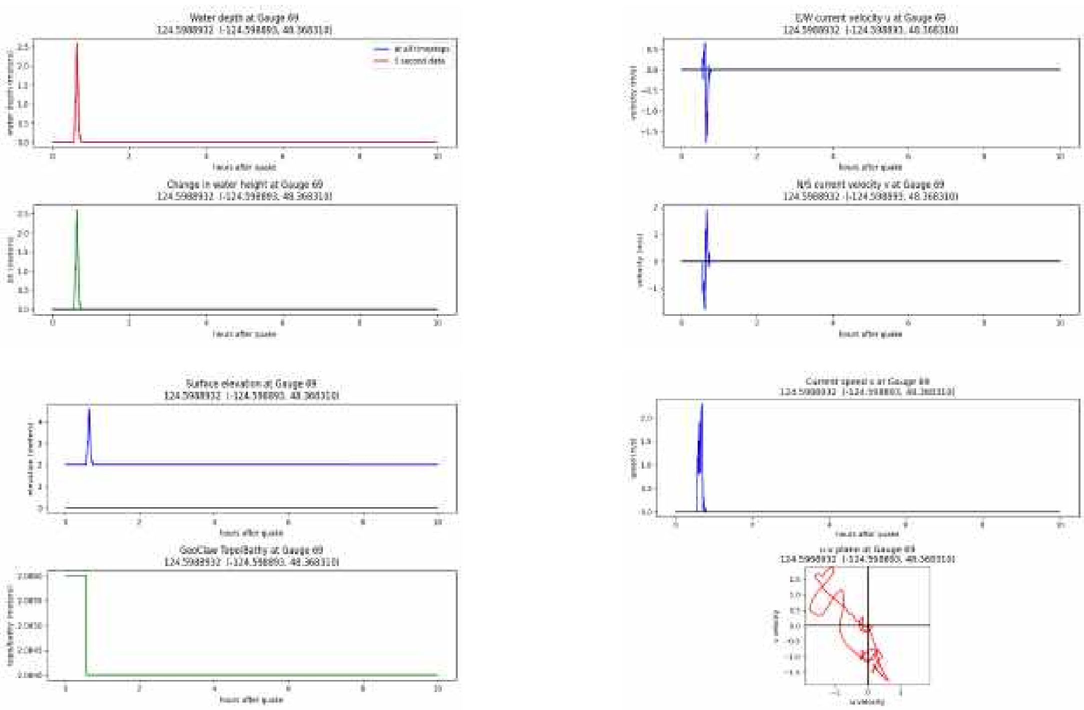


## Gauge 69: Makah Cultural & Research Center Museum

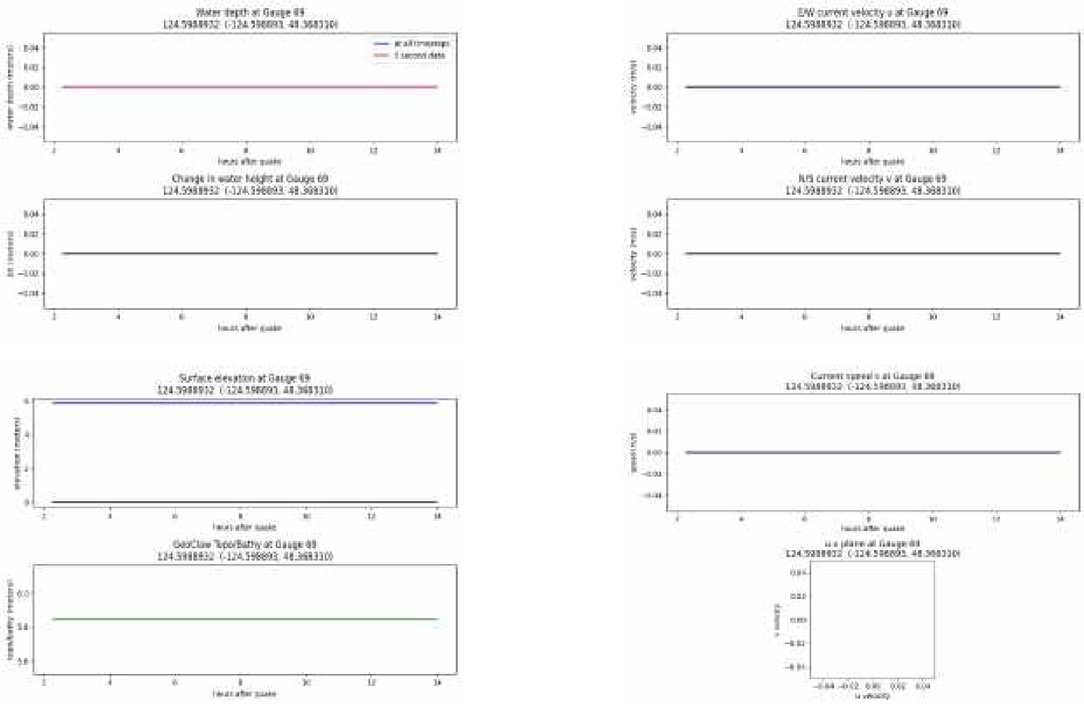
### Cascadia subduction zone scenario, MHW:



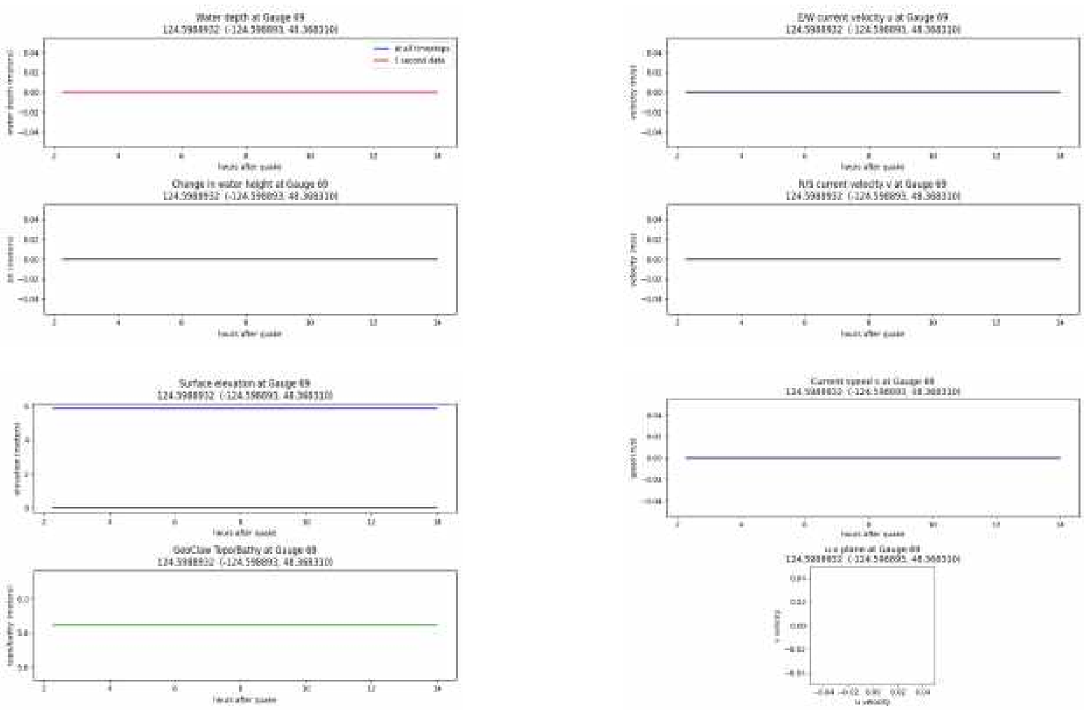
### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:

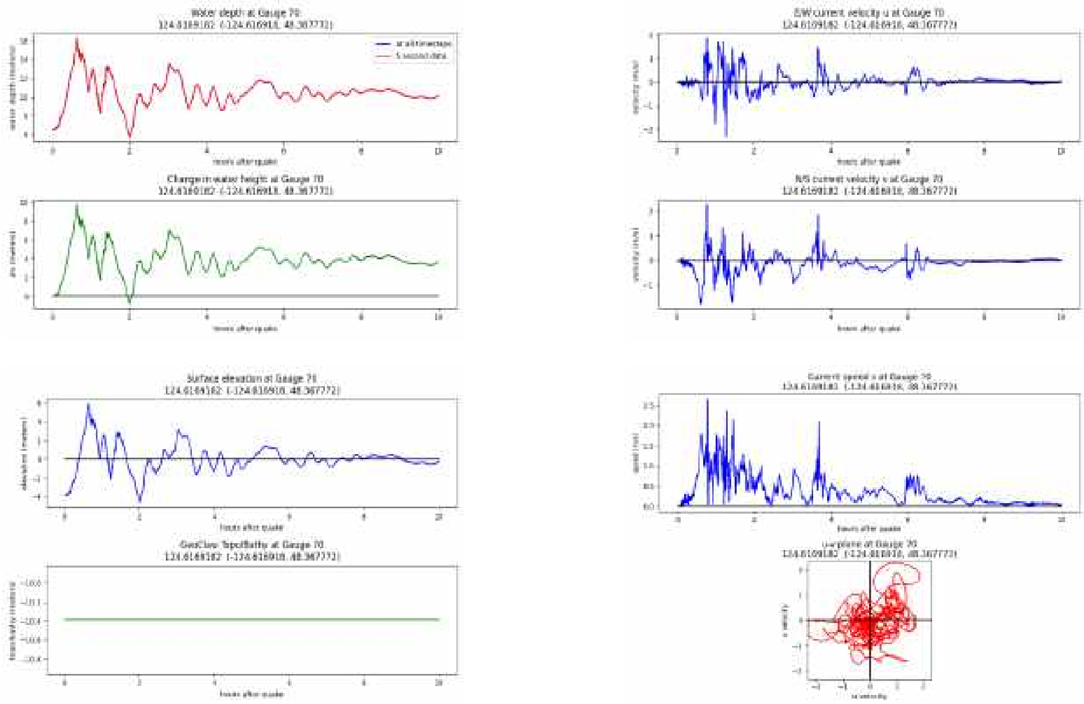


## Alaska-Aleutian subduction zone scenario, MLW:

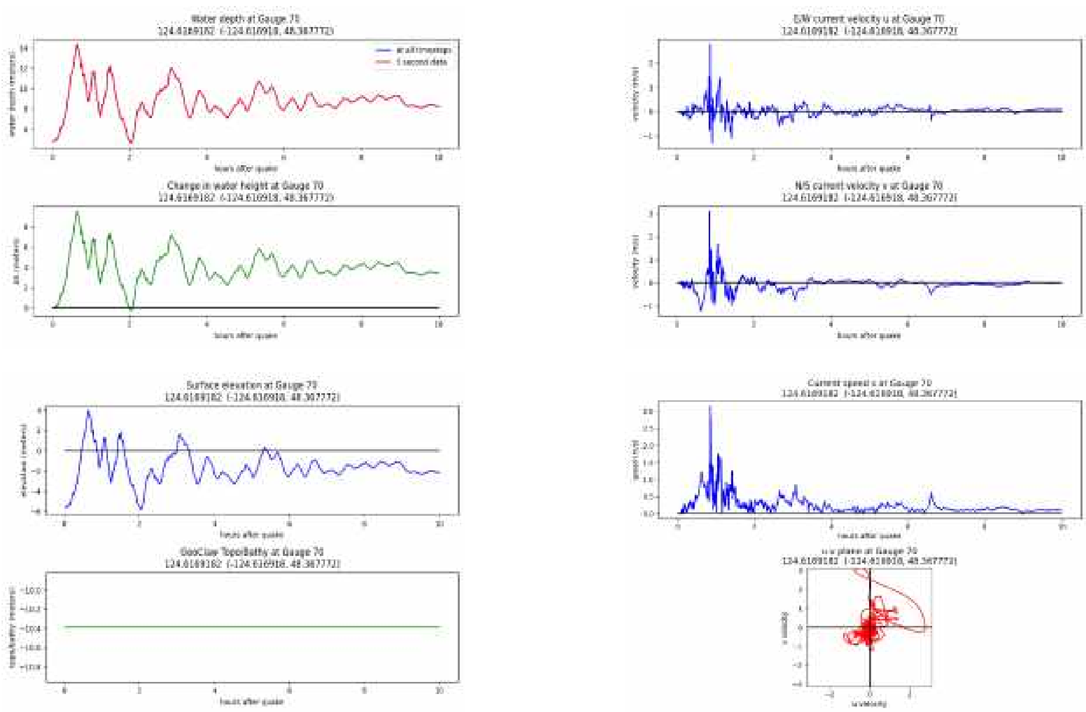


## Gauge 70: Neah Bay Fuel Station

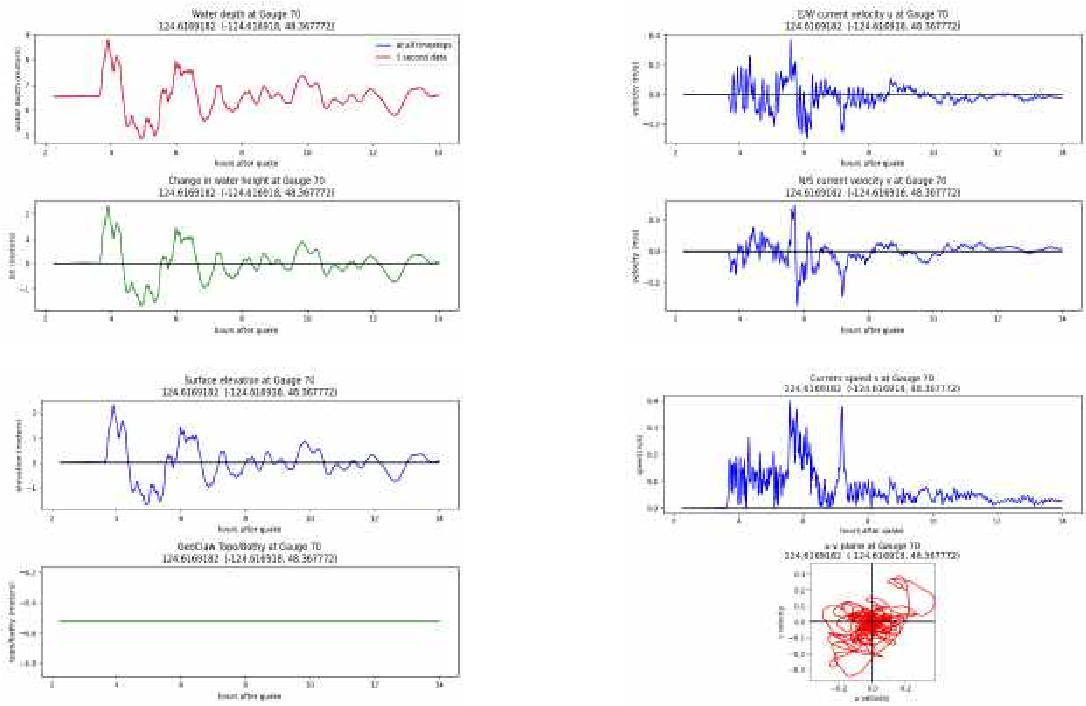
### Cascadia subduction zone scenario, MHW:



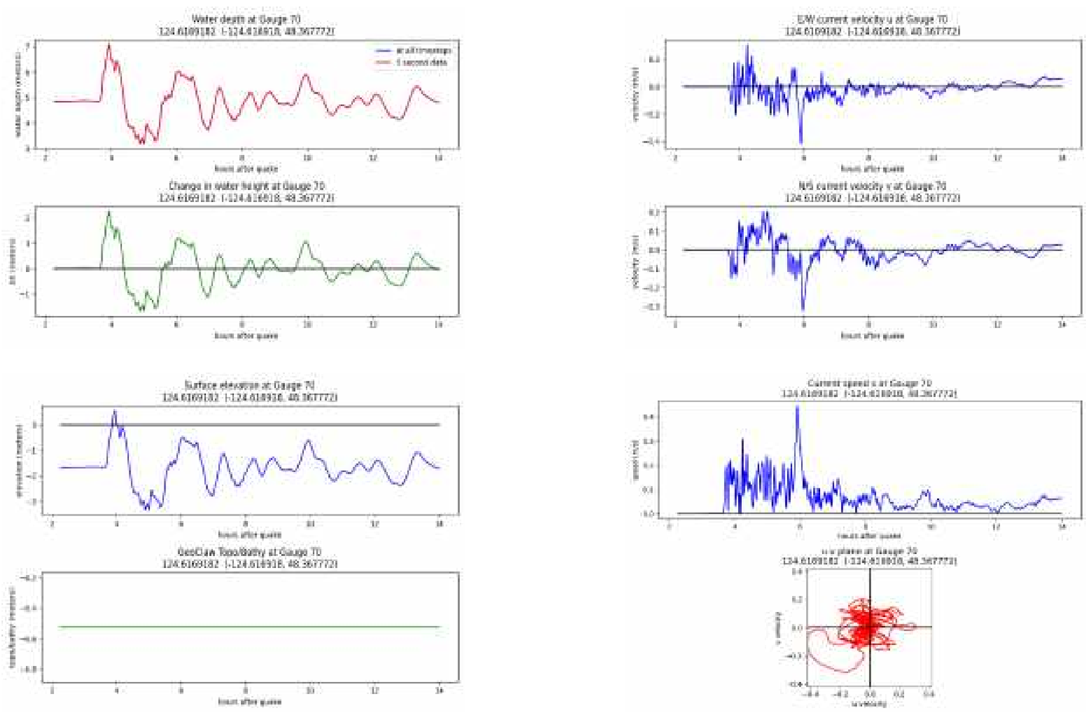

### Cascadia subduction zone scenario, MLW:



Alaska-Aleutian subduction zone scenario, MHW:

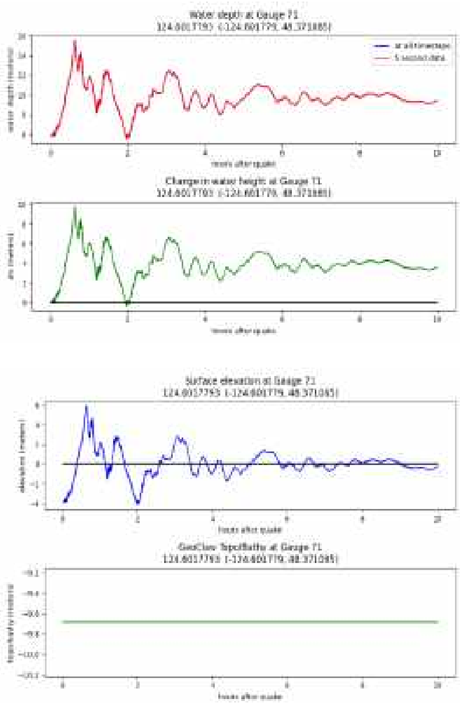


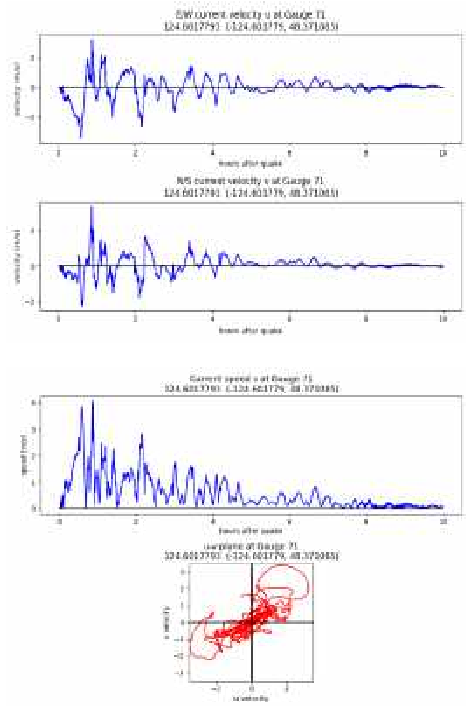
Alaska-Aleutian subduction zone scenario, MLW:



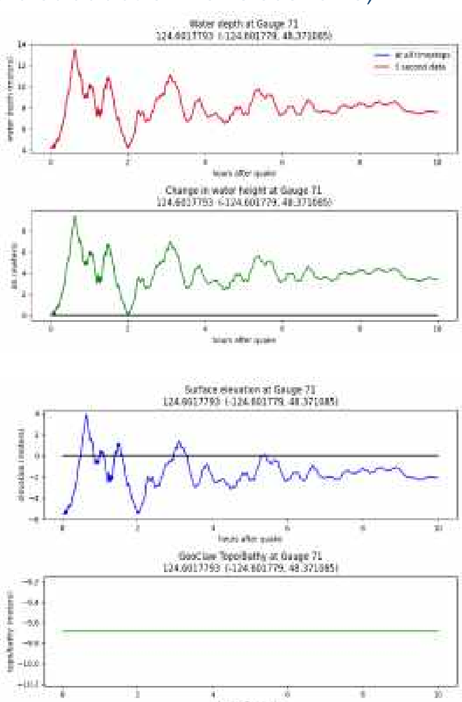
## Gauge 71: Coast Guard Station dock

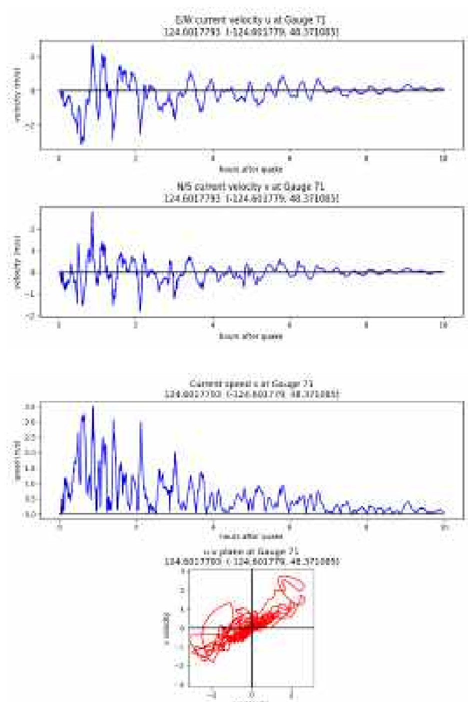
### Cascadia subduction zone scenario, MHW:



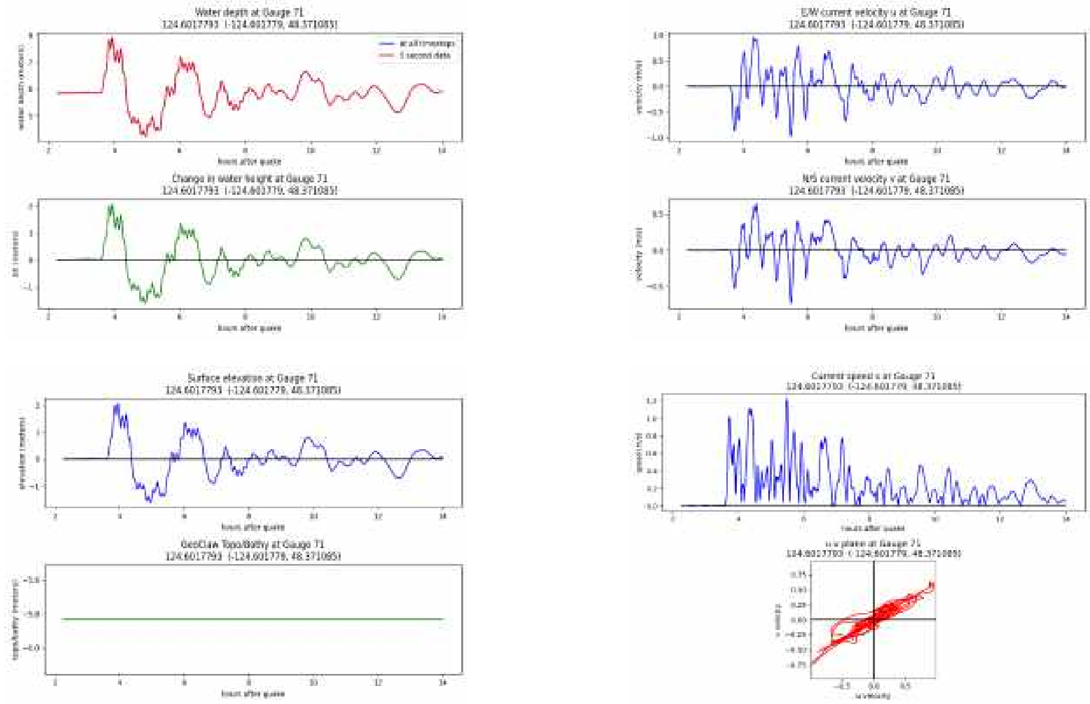




### Cascadia subduction zone scenario, MLW:

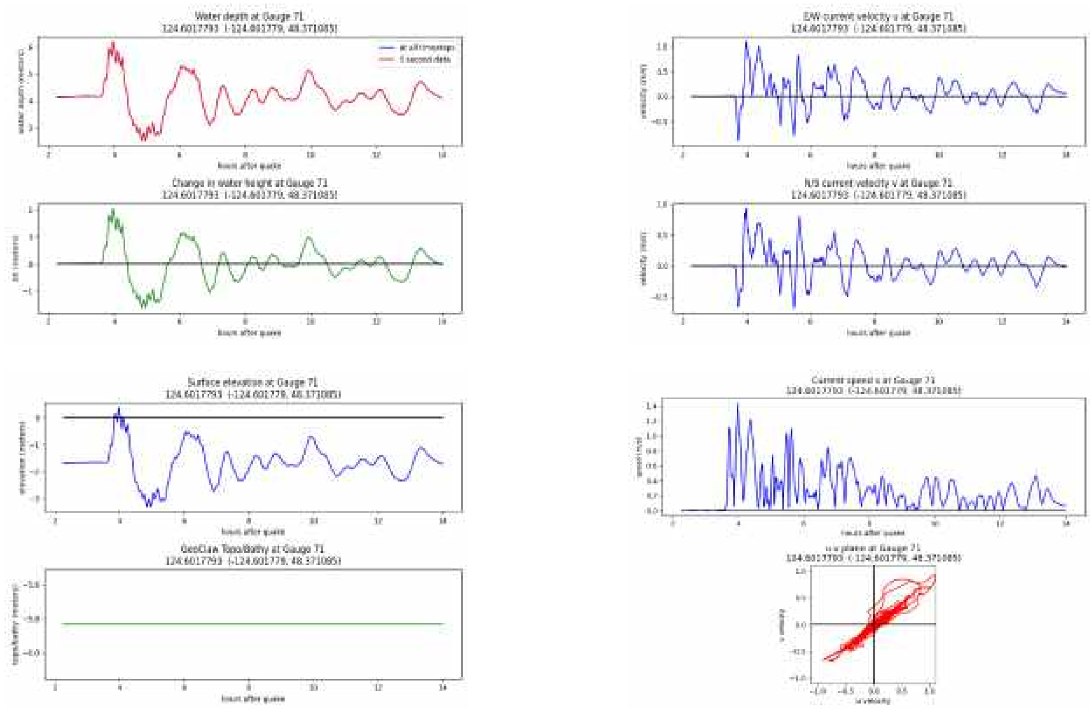


## Alaska-Aleutian subduction zone scenario, MHW:

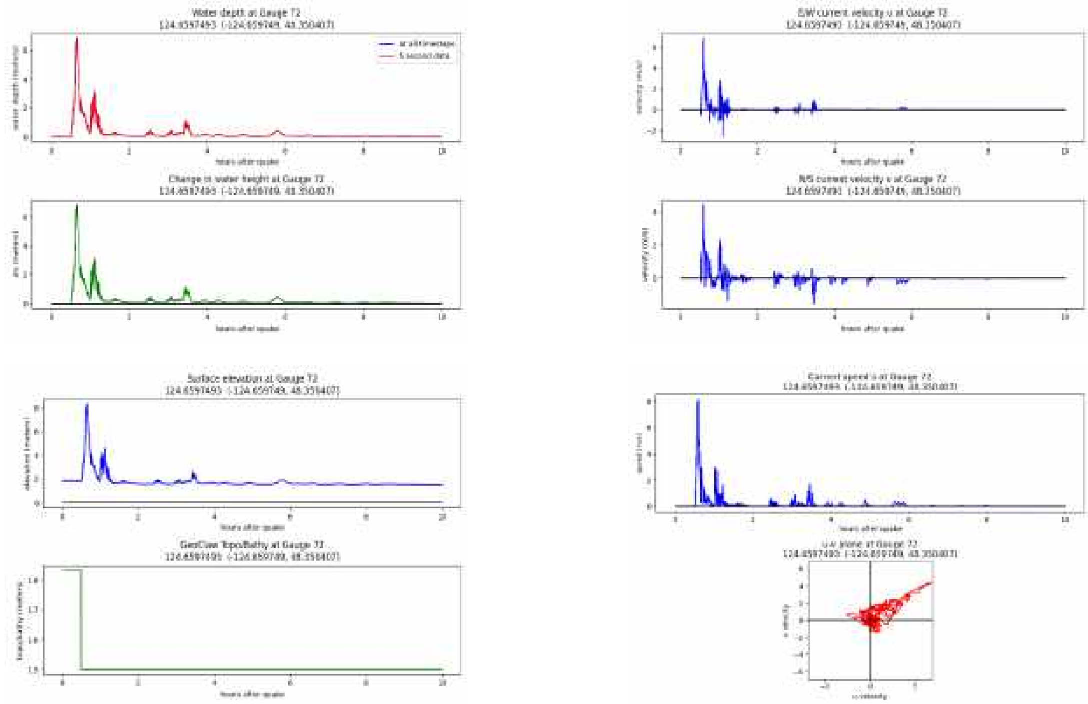



## Alaska-Aleutian subduction zone scenario, MLW:

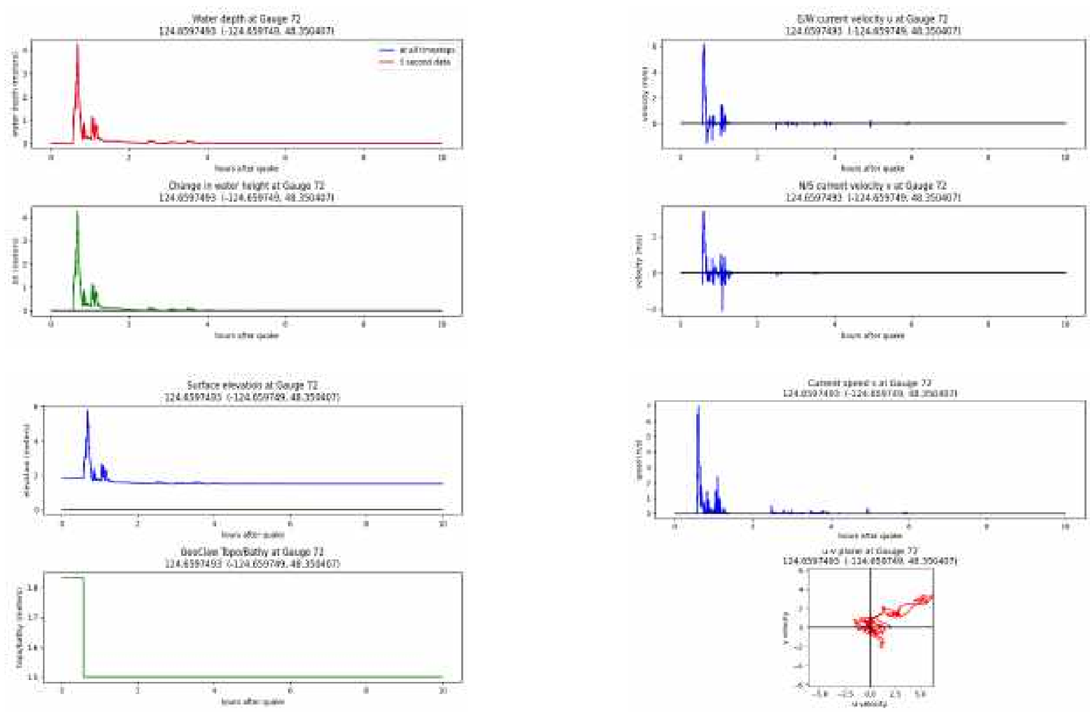


## Gauge 72: Waste Water Treatment Center

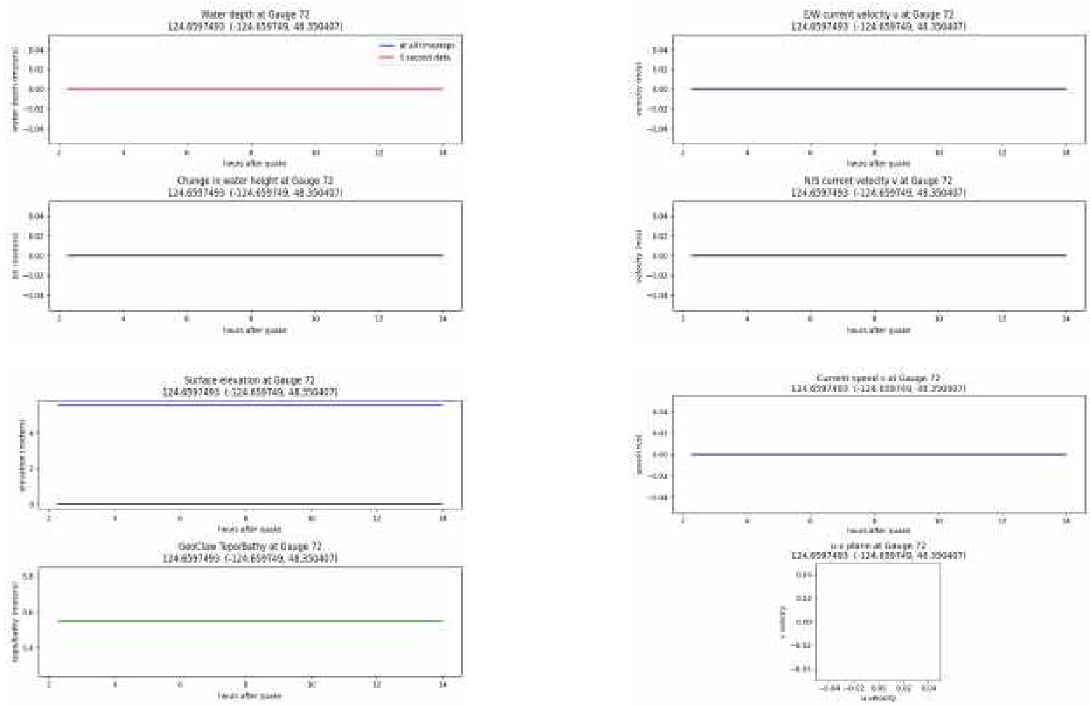
### Cascadia subduction zone scenario, MHW:




### Cascadia subduction zone scenario, MLW:



## Alaska-Aleutian subduction zone scenario, MHW:



## Alaska-Aleutian subduction zone scenario, MLW: