

Geo-INQUIRE Transnational Access Project Report: Black SEa Tsunami MODelliNg

Geo-INQUIRE installation: [HySEA - Earthquake and landslide generated tsunami simulations \(TA2-531-3\)](#)

Project title: Black SEa Tsunami MODelliNg

Transnational access principal investigator: Partheniu Raluca (National Institute for Earth Physics, Romania)

Project acronym: BETON

Project report ID: C1-TA2-531-3

Transnational access team: Prof. Jorge Macías Sánchez, Prof. Jose Manuel Gonzalez Vida (Universidad de Málaga (UMA), Spain)

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Geo-INQUIRE Virtual Access:

Data/Products:

A scientific paper based on this work and two presentations (both poster and oral) to different conferences are being prepared.

Project report:

The main objective of the Black SEa Tsunami MODelliNg (BETON) project is to improve tsunami modeling for the Black Sea area, after using other tools (TAT - Tsunami Analysis Tool, TRIDEC Cloud) in the past, which are not available anymore, generating simulations, extracting and processing the results of the Tsunami-HySEA (Hyperbolic Systems and Efficient Algorithms) software.

During his visit to the University of Malaga (UMA), Raluca Partheniu (researcher at the National Institute for Earth Physics - NIEP) had a training course on how to use the Tsunami-HySEA model and to run multiple simulations with it on the **Leonardo** supercomputer at **CINECA**. There are few areas of interest in the Black Sea, with past evidences of tsunami generation (Papadopoulos G.A. et al, 2011, Yalciner A. et al, 2004, Altinok Y., 1999), such as Shabla from Bulgaria, very close to the Romanian shore, but also Turkey or Crimea regions. We have accomplished multiple scenarios for each area, for two different resolutions (30 and 15) in

order to set maximum possible wave heights for different scenarios of various earthquake parameters (depth of 5 to 10, 20 and 30 km and also various fault plane solutions - Strike, Dip, Rake). The bathymetry used for the simulations is GEBCO 2020 Grid.

Some of the results are presented bellow, for Shabla area, as a comparison between a simulation for resolution 30 and 15, for the following earthquake parameters: Latitude 44.02, Longitude 34.5, Depth 5 km, Fault Length 66 km, Fault Width 18 km, Displacement 2.61, Strike 211, Dip 65, Rake 171), resulting in 1.32 m maximum wave height and 2.29 m respectively - see Figure 1.

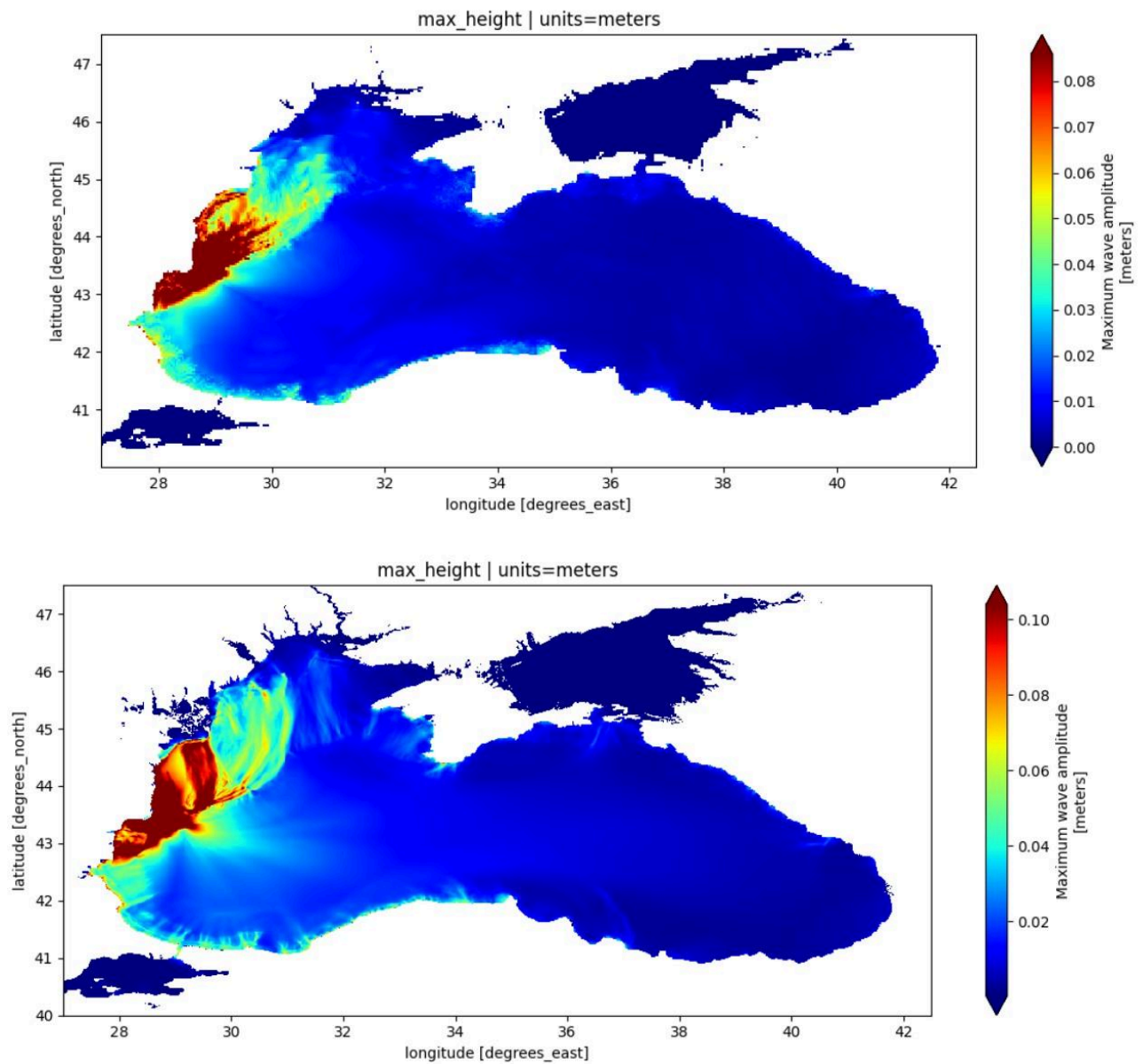


Figure 1: Maximum wave height for two tsunami simulations with resolution 30 (upper image) and 15 (lower image), for an earthquake with the specific parameters described above (Shabla area), using HySEA software.

A more detailed map of the maximum wave height for a refined resolution (15) was accomplished and is displayed below, in Figure 3. Moreover, a difference between the 30 and 15 resolutions was evidenced, for the above described Shabla scenario case (Figure 2).

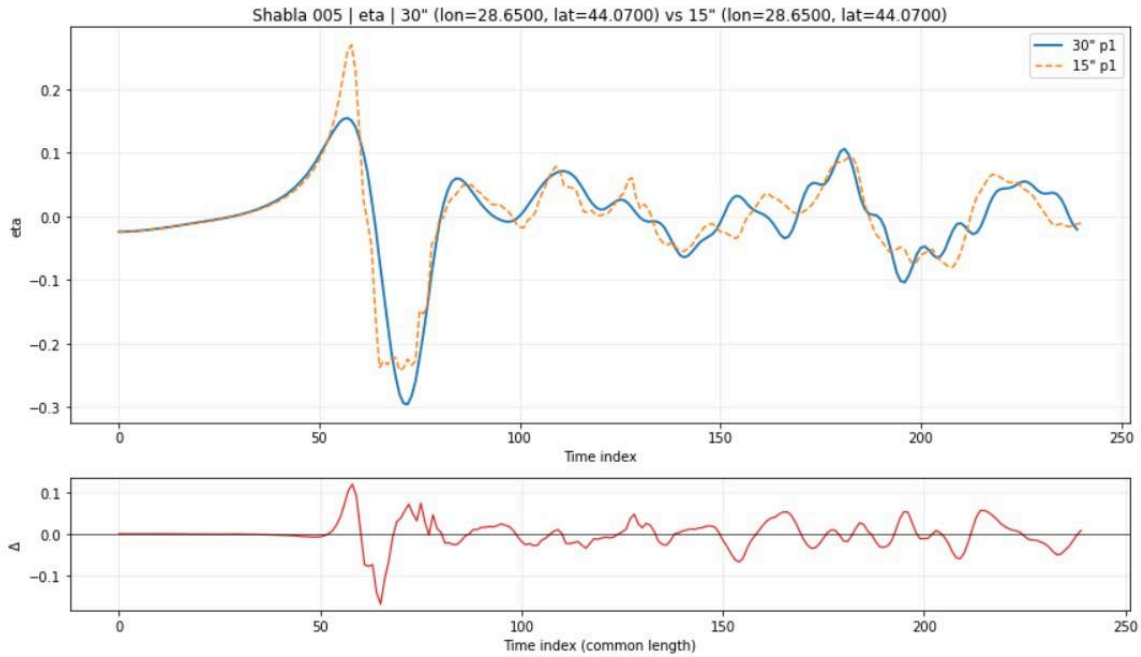


Figure 2: Comparison between resolution 30 and resolution 15 for the Shabla scenario described and displayed above.

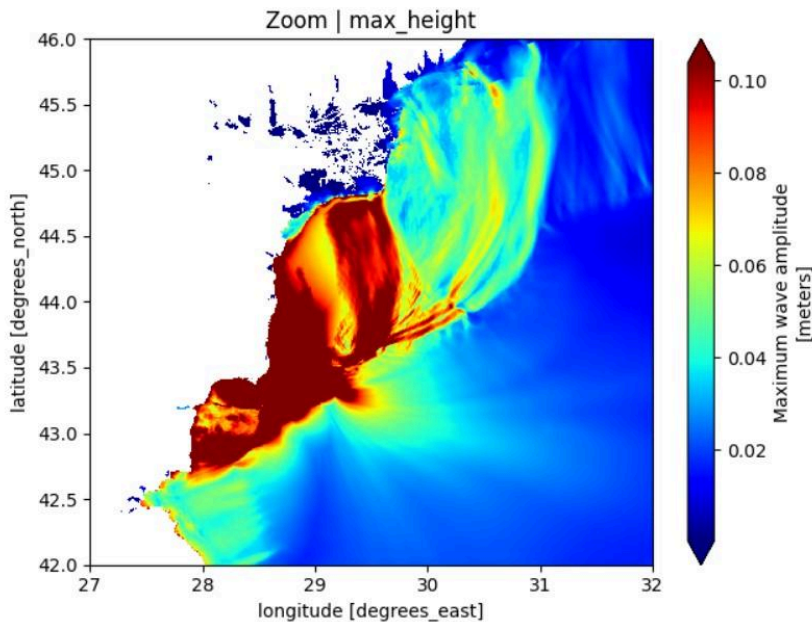


Figure 3: Maximum wave height (detailed map) for a tsunami simulation with a resolution of 15, for an earthquake with the specific parameters described above (Shabla area), using HySEA software.

Other results of the tsunami simulations accomplished with HySEA for Turkey region, known for a past earthquake of Mw 6.3 on 3rd of September 1968 (Bartın Earthquake), with the following input earthquake parameters: Latitude 41.81, Longitude 32.3, Depth 5 km, Fault Length 26 km, Fault Width 12.5 km, Displacement 0.43, Strike 28, Dip 38, Rake 80, are displayed in Figure 4 and show maximum waves of 0.46 m.

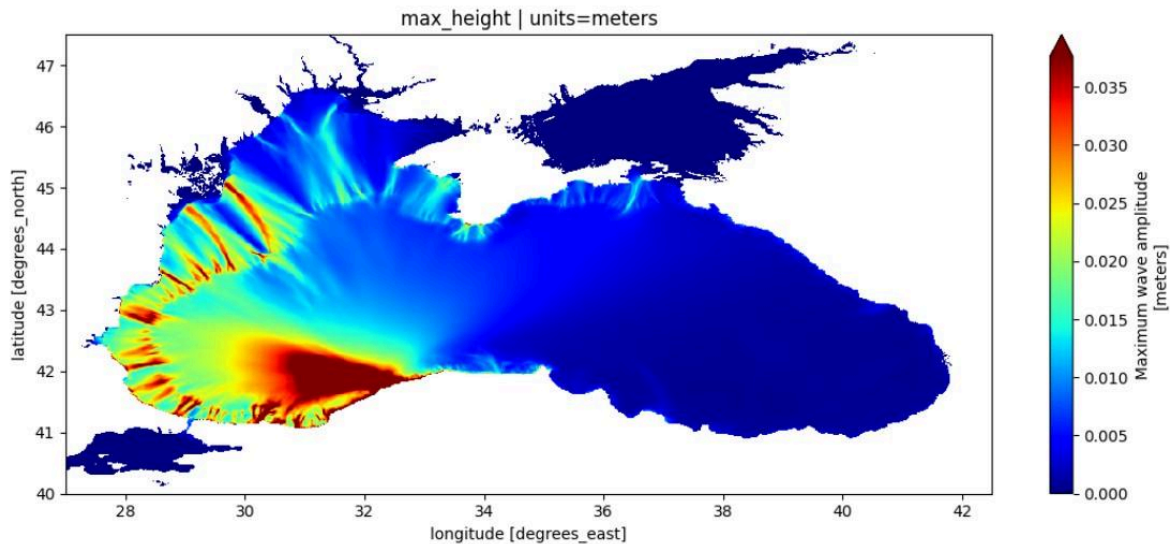


Figure 4: Maximum wave height for a tsunami simulation with a resolution of 15, for an earthquake with the specific parameters described above for the Turkey area, using HySEA software.

Different other seismic sources were studied, such as smaller seas connected to the Black Sea (Azov and Marmara Seas), and also a past inland earthquake from Turkey was simulated, known as Erzincan earthquake, generated on 26th of December 1939, 60 km away from the coast, of Mw 7.8m, but all these study cases had very low results for maximum wave height (0.18 m) or no results at all.

We have shown only few examples above, but numerous simulations were accomplished using past earthquake parameters, and along with other tsunami related research already presented at different conferences, we are planning to disseminate tsunami information along the Romanian touristic coastal area and to inform the population on the potential hazard and danger of tsunamis on the Black Sea coast. We also intend to present our results as both oral and poster presentations at two different international scientific conferences. Moreover, we are planning to acknowledge the challenges of tsunami modelling by writing an article that will structure a comparison between past results from TAT (Tsunami Analysis Tool) and TRIDEC Cloud software with the HySEA outcome.

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Yalciner, A., Pelinovsky, E., Talipova, T., Kurlin, A., Kozelkov, A. and Zaitsev, A. [2004] Tsunamis in the Black Sea: Comparison of the historical, instrumental and numerical data. *Journal of Geophysical Research*, 109, C12023, 1-13.

Web references:

<https://www.usgs.gov/> - United States Geological Survey (USGS) earthquake database

<http://www.ngdc.noaa.gov/hazard/earthqk.shtml> - National Oceanic and Atmospheric Administration NOAA tsunami database

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