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ASTARTE aims:

Assessment of generation mechanisms, evaluation of uncertainties, development of new numerical and experimental techniques for propagation, coastal amplification and inundation, networking in detection and warning, and building structural and social resilience against tsunamis by 26 partners from 16



Improving Tsunami Resilience

ASTARTE (Assessment, Strategy And Risk Reduction for Tsunamis in Europe), an international project on tsunamis funded by EC-FP7 (Contract No. 603839), started in November 1, 2013. Within ASTARTE, the consortium acquired new information to complete the European knowledge base, and we benefited from the strongest integration ever attempted in the field. This involved close cooperation with coastal populations, civil protection, emergency management and other local organizations.

ASTARTE final meeting - Baleares



ASTARTE final meeting took place in Mallorca, Baleares, on April 6–8. It was organized and hosted by our partner Universitat de Barcelona (UB). The meeting was a scientific workshop where all work packages showcased their progress and highlighted the most relevant contributions to tsunami science. Researchers from almost all partner institutions, including all partners outside Europe (NOAA, USC, University of Tokyo and PARI) participated in this meeting. We also had the participation of two of our external advisors, Christa von Hillebrandt-Andrade and Hitomi Murakami, and reviewer Alessandra Cavalletti, on behalf of Denis Peter, our officer in the EC. Besides the scientific oral presentations, there was also an exhibition of posters, that were informally discussed during coffee-breaks.

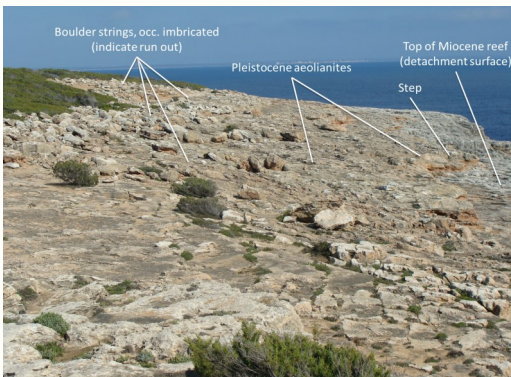
On April 8, UB, together with colleagues from the University of the Balearic Islands, organized a field trip to coastal sites on the eastern and southern shores, namely Caló d'en Serralt and Es Bancals nearby Cala Pi, where large boulder accumulations on natural rocky platforms tens of meters above present sea level evidence the action of past tsunamis.



Mallorca Island is one of the ASTARTE test sites mostly because it is directly exposed to tsunamis coming from the seismogenic Algerian continental margin, as shown by the May 2003 tsunami resulting from the Boumerdès–Zemmouri earthquake that impacted Mallorca and the rest of the Balearic Islands, with more than 200 boats sunk or severely damaged. It is also a test site because along its shores there are numerous accumulations of giant boulders, often imbricated and concentrated on natural rocky platforms tens of meters above present sea level, which are attributed to older tsunamis.

The General Direction for Emergencies and Interior (GDEI) of the Balearic Government is mandated to produce an emergency plan face to the risk of tsunamis in the Balearic Archipelago. Representatives of GDEI attended the ASTARTE final meeting in Mallorca as they were interested to have direct contact with the tsunami research community, and to obtain an improved scientific and technical background to prepare a better tsunami emergency plan. GDEI representative were also interested to keep contact in the long term.

Caló d'en Serralt and Es Bancals



Caló d'en Serralt and Es Bancals nearby Cala Pi are located along the eastern and southern cliffy shores of Mallorca Island, which are the most exposed to tsunamis coming from the nearest tsunamigenic region in the Western Mediterranean Basin, which is the Algerian margin.

Caló d'en Serralt, in the municipality of Manacor, in the eastern coast of Mallorca, displays both meter-sized, several tons in weight scattered boulders and boulder clusters atop of a seacliff locally more than 10 m in height. The boulders extend inland from the upper cliff edge up to 100 m.

Es Bancals nearby Cala Pi, in the municipality of Lluchmajor, are particularly impressive as there is a panoramic view of an abrasion and accumulation platform covered by hundreds of scattered and clustered giant boulders, frequently imbricated and also forming accumulation rings as far as 150 m inland from the edge of a seacliff that is more than 20 m in height. Most boulders correspond to Pleistocene aeolianites originally lying on top of a



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AWARDS to ASTARTE member



On the use of Paleo DEMS for Simulation of historical Tsunami Events

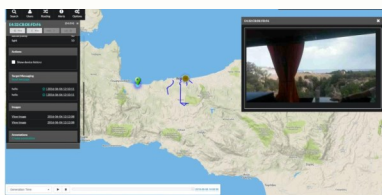
Martin Wronna ⁽¹⁾, Maria Ana Baptista ^(1,2,3), Joachim Götz ⁽⁴⁾

(1) INSTITUTO PORTUGUES DO MAR E DA ATMOSFERA, PORTUGAL, (2) INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA, PORTUGAL, (3) INSTITUTO DOM LUIZ, UNIVERSIDADE DE LISBOA, PORTUGAL, (4) DEPARTMENT OF GEOGRAPHY AND GEOLOGY, UNIVERSITY OF SALZBURG, AUSTRIA
martinwronna@gmail.com, mavbaptista@gmail.com, joachim.gotz@sbg.ac.at



The 2016 Outstanding Student Poster and PICO (OSPP) Awards is awarded to Martin Wronna for the poster entitled: On the use of Paleo DEMS for Simulation of historical Tsunami Events (Wronna, M.; Baptista, M. A.; Götz, J.). Martin Wronna is part of the ASTARTE project team where he developed a study on the Deterministic Hazard Assessment for Sines,

ASTARTE outcomes



The software system, denominated FIND (Finding Inaccessible people in Natural Disasters), and composed by automatically integrated two interactive components and two subsystems. The first component, FIND-Me, is a smartphone application targeted at the general public. It is responsible for sensing people's smartphone activity and continuously and inconspicuously gathering location and aliveness indicators. <https://www.youtube.com/watch?v=S8CM8xof8nQ> <http://www.astarte-project.eu/files/astarte/documents/deliverables/d10-35/ASTARTE%20deliverable%2010.35.pdf>

ASTARTE

- Completed a general assessment of potential tsunami sources (seismic and nonseismic) in the NEAM (NE Atlantic, the Mediterranean, and Connected Seas), including uncertainty treatment, and tsunami sensitivity to source parameter values.
- presented new methods for inverse modelling, novel forecasting techniques
- Performed Physical experiments to address the tsunami structure interaction on rubble mound breakwaters.
- Developed new methods to cover the assessment chain from tsunami hazard to tsunami vulnerability and risk, and the application to the specific test sites of the NEAM region, and, for some segments of the chain, to wide basins like the NE Atlantic and the Black Sea.
- Developed a smartphone app for disaster management FIND - Finding People in Natural Disasters, smartphone app for disaster management
- Contributed to the implementation of TEWS in the NEAM region

Announcements

International Training Courses on 'Seismology and Seismic Hazard Assessment'
 September 4-29, 2017— Potsdam, Germany

For more information: <https://www.gfz-potsdam.de/en/centre/education-and-training/seismology/2017-potsdam/>



ASTARTE Outcomes (continued)

- ASTARTE has paved the road for the ambitious implementation of the first ever probabilistic tsunami hazard curves for the NEAM Region through TSUMAPS-NEAM Project <http://www.tsumaps-neam.eu/> which produced long-term PTHA (complete hazard curves), i.e. exceedance probability curves for different runup or wave-height thresholds, at 133 points distributed along the NE-AM coasts.
- The success of the test site approach in ASTARTE has helped to (1) highlight the diversity of settings, boundary conditions and assets and risk that apply to different locations in Europe in terms of tsunami hazard; (2) make tangible, at specific locations, key concepts and approaches and their practical implementation, and (2) evidence differences in background information that is critical to address site specific analyses and propose prevention and mitigation schemes. Contributed to the implementation of TEWS in the NEAM region.
- One of the major added values of ASTARTE has been the gathering of many of the best tsunami experts, from different disciplines and viewpoints, from Europe and beyond. Tsunami science nowadays is a multidisciplinary endeavor. This gathering is by itself a major achievement and it would be highly convenient for the benefit of the European society to take action to maintain and foster it for a lively tsunami science targeting future major advances.
- All these efforts will at the end lead Europe to be more knowledgeable and better prepared against tsunamis hazard. There is no doubt that tsunamis will continue to occur in the future.
- Nothing of this would have been possible without the European funding allocated to ASTARTE.

ASTARTE Publications (November 2016-June 2017)

- Aydin, B., & Kânoğlu, U. (2017). New Analytical Solution for Nonlinear Shallow Water-Wave Equations. *Pure and Applied Geophysics*, 1-10. <https://link.springer.com/article/10.1007/s00024-017-1508-z>
- Baykal, C., Sumer, B. M., Fuhrman, D. R., Jacobsen, N. G., & Fredsøe, J. (2017). Numerical simulation of scour and backfilling processes around a circular pile in waves. *Coastal Engineering*, 122, 87-107.
- Goeldner-Gianella, L., Grancher, D., Robertsen, Ø., Anselme, B., Brunstein, D., & Lavigne, F. (2017). Perception of the risk of tsunami in a context of high-level risk assessment and management: the case of the fjord Lyngen in Norway. *Geoenvironmental Disasters*, 4(1), 7. <https://link.springer.com/article/10.1186/s40677-017-0068-y>
- Gutscher, M. A., Kopp, H., Krastel, S., Bohrmann, G., Garlan, T., Zaragosi, S., ... & San Pedro, L. (2017). Active tectonics of the Calabrian subduction revealed by new multi-beam bathymetric data and high-resolution seismic profiles in the Ionian Sea (Central Mediterranean). *Earth and Planetary Science Letters*, 461, 61-72.
- Harbitz, C. B., Nakamura, Y., Arikawa, T., Baykal, C., Dogan, G. G., Frauenfelder, R., ... & Kânoğlu, U. (2016). Risk assessment and design of prevention structures for enhanced tsunami disaster resilience (RAPSODI)-Euro-Japan collaboration. *Coastal Engineering Journal*.
- Jeschke, A., Vater, S., & Behrens, J. (2017, June). A Discontinuous Galerkin Method for Non-hydrostatic Shallow Water Flows. In *International Conference on Finite Volumes for Complex Applications* (pp. 247-255). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-319-57394-6_27
- Paparo, M. A., Armigliato, A., Pagnoni, G., Zaniboni, F., & Tinti, S. (2017). Earthquake-triggered landslides along the Hyblean-Malta Escarpment (off Augusta, eastern Sicily, Italy)-assessment of the related tsunamigenic potential. *Advances in Geosciences*, 44, 1. <http://search.proquest.com/openview/cb938eacbc87e818882b4ce5858f729b/1?pq-origsite=gscholar&cbl=105749>
- Paris, R., Bravo, J. J. C., González, M. E. M., Kelfoun, K., & Nauret, F. (2017). Explosive eruption, flank collapse and megatsunami at Tenerife ca. 170 ka. *Nature communications*, 8, 15246.
- Salmanidou, D. M., Guillas, S., Georgiopolou, A., & Dias, F. (2017, April). Statistical emulation of landslide-induced tsunamis at the Rockall Bank, NE Atlantic. In *Proc. R. Soc. A* (Vol. 473, No. 2200, p. 20170026). The Royal Society. http://rspa.royalsocietypublishing.org/content/473/2200/20170026?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Proceedings_A_TrendMD_0#sec-15 <http://dx.doi.org/10.1098/rspa.2017.0026>
- Wronna, M., Baptista, M. A., & Götz, J. (2017). On the construction and use of a Paleo-DEM to reproduce tsunami inundation in a historical urban environment-the case of the 1755 Lisbon tsunami in Cascais. *Geomatics, Natural Hazards and Risk*, 1-22.
- A. Zaytsev, V. Belyakov, P. Beresnev, V. Filatov, V. Makarov, D. Tyugin, D. Zeziulin, E. Pelinovsky, A. Yalciner, B. Yalciner, O. Oshmarina and A. Kurkin, (2017), Coastal Monitoring of the Okhotsk sea using an Autonomous Mobile Robot, *Science of Tsunami Hazards*, *Journal of Tsunami Society International*, Vol. 36, No: 1, pp:1-11

What is going on?

March 17-21, 2017 CARIBE WAVE 17 Exercise Caribe Wave (http://ioc-unesco.org/index.php?option=com_oe&task=viewEventRecord&eventID=1912)

Aug 21-25, 2017 13International Tsunami Symposium (ITS 2017) in Bali-Flores, Indonesia ([Link](#))

Upcoming Events

Sept 4-8, 2017 5th International Tsunami Field Symposium in Lisbon, Portugal (<http://ifts.campus.ciencias.ulisboa.pt/node/11>)

Dec 11-15, 2017 American Geosciences Union Fall Meeting, in New Orleans, USA (<http://fallmeeting.agu.org/2017/>)

April 8-13, 2018 European Geosciences Union (EGU) General Assembly 2018, in Vienna, Austria (<http://www.egu2018.eu/>)

Project deliverables

Deliverable No	Deliverable title	WP	Delivery date	Partner in charge

CONTACT US:



Project Administrative Officer

Maria Ana Baptista
 Instituto Português do Mar e da
 Atmosfera, IPMA
 Tel.: +351 218 447 073
 Email: mavbaptista@gmail.com

Project Secretariat

Inês Moura Martins
 Instituto Português do Mar e da
 Atmosfera, IPMA
 Tel.: +351 218 447 073
 Email: ines.martins@ipma.pt

IPMA

Instituto Português do Mar e da
 Atmosfera, piso 7
 Rua C do Aeroporto
 1749-077 Lisboa, Portugal
 Tel.: +351 218 447 073
 Email: astarte@ipma.pt

"Judging someone without knowing anything about the person is like predicting a tsunami in the Sahara desert."
 — Anonymous