TMEWS project proposal – a way to fulfil all proposed activities

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The project is organized under 3 major tasks, following the call

Task 1. Investigating the causative forces and pre-cursor environmental conditions conductive to meteotsunami formations

- Action 1.1. Catalogue on historical U.S. meteotsunamis (0-2 months)
- Action 1.2. Analysis of weather and ocean conditions during historical meteotsunamis (months 0-7)
- Action 1.3. Reproduction of meteotsunami events by atmospheric and ocean numerical models (months 3-8)
- Action 1.4. Explanation of meteotsunami generation and dynamics (months 6-10)

Task 2. Defining the observational systems, communications, and processing systems necessary to forecast meteotsunamis

- Action 2.1. Definition of overall standards for real-time detection of a meteotsunami (months 7-11)
- Action 2.2. Catalogue of existing meteo and ocean platforms and observing systems, and communication routes capable for detecting a meteotsunami (months 10-15)
- Action 2.3. Assessment of U.S. observational meteo and ocean network versus the standards (months 14-17)

Task 3. Developing a protocol for issuing meteotsunami warnings

- Action 3.1. Classification of meteotsunami risk areas along the U.S. coast (months 10-13)
- Action 3.2. Identification of environmental variables necessary to raise a meteotsunami alarm (months 13-15)
- Action 3.3. Develop a meteotsunami decision matrix and protocols for U.S. coast (months 14-19)
- Action 3.4.Testing the meteotsunami warning system on historical events (months 19-21)

How to realize all actions and tasks and fulfil the expectations of the grand provider ???

Through a work of Task Force groups. Each TF will do the specific work, and report when finished in a report to be used by other TF. Each Task and Action will have its TF!!!

TF1 on Action 1.1. List on U.S. meteotsunamis (0-4 months) (**Rabinovich, Monserrat, Šepić, Vilibić**)

This action should be done as soon as possible, as other actions rely on finding of significant meteotsunami event to be investigated on the project. The work will be done on:

- assessment of the events from the **U.S. tsunami catalogues** and other material (papers, news, Internet, reports), including hurricane catalogues, which may be atmospherically generated (**Rabinovich, Monserrat, Vilibić**)

- analysis of long-term **high frequency series** (6 min or less, preferably 1 min) along the east U.S. coastline, by chosing beacon stations (of best data quality and geographical position), and **extracting** of the strongest events (**Šepić**)

The deliverable should be the list of meteotsunami events which will be investigated, in addition to the Daytona Beach (3 July 1992) and Boothbay (28 October 2008) events.

→ more fresh events (although not destructive) will allow for a better dataset to be used in analyses

TF2 on Action 1.2. Analysis of weather and ocean conditions during historical meteotsunamis (0-7 months) (**Monserrat, Marcos, Šepić, Mihanović, Strelec Mahović, Pasquet, Vilibić**)

The data collected during all or selected strongest events listed by TF1 will be investigated:

- **synoptic conditions** during a meteotsunami event (NCEP/NCAR or ECMWF reanalysis fields) (**Strelec Mahović, Šepić**)
- **vertical structure** and profiles (through the investigations of sounding data available at the University of Wyoming, http://weather.uwyo.edu/upperair/sounding.html, ground (**Mihanović**)
- meteorological stations with high-resolution observational possibilities (1 min or less) or charts of enough quality for digitizing and obtaining high-resolution data – **intensity, speed, direction and dissipation of a disturbance** (**Monserrat, Marcos, Mihanović**)
- sequential **satellite cloud images** of high-resolution (Meteosat satellites) (**Strelec Mahović**)
- meteo and ocean **data from buoys** available in the affected area (**Pasquet, Rabinovich**)
- **coastal tide gauges** and other stations in the area (**Monserrat, Marcos, Rabinovich**)

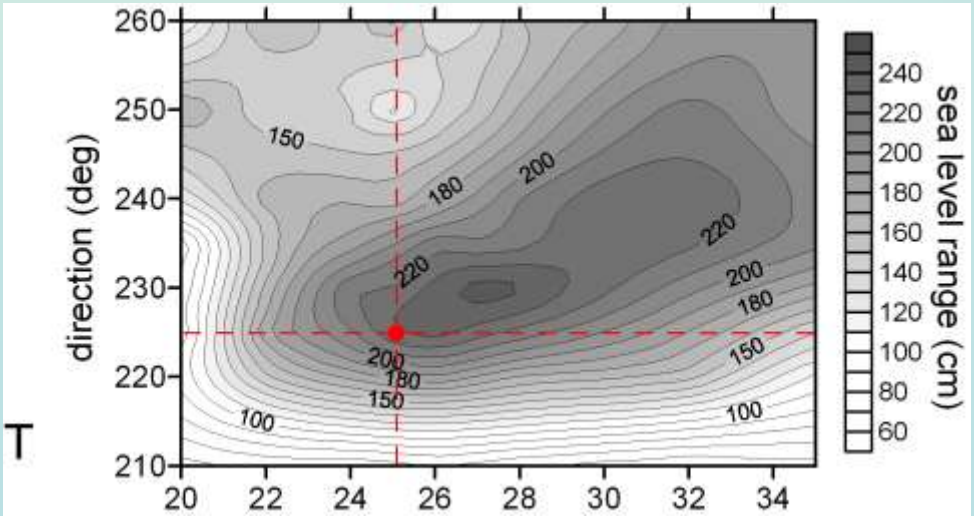
The deliverable should be a report (obviously a large one), which contain the analyses (lot of figures and tables) and preliminary interpretation of the results.

TF3 on Action 1.3. Reproduction of meteotsunami events by atmospheric and ocean numerical models (3-8 months) (**Fain, Horvath, Pasquet**)

Atmospheric dynamics during all or selected strongest events will be reproduced by using **WRF mesoscale atmospheric model**, including verification on the available data. That includes an analysis of the model simulations, and detection of common meteotsunami source processes. (**Horvath, Pasquet**)

Ocean dynamics during all or selected strongest events will be reproduced by using **meteotsunami numerical model**, applied on the bathymetry with sufficient coastal resolution. Forcing may use travelling of pressure-line created or computed from the atmospheric data (including the WRF model output). Sensitivity studies of an area may include modelling of variations in disturbance speed and direction. (**Fain, Pasquet**)

The deliverable should be a report, which will contain the modelling results and its preliminary interpretation.



TF4 on Action 1.4. Explanation of meteotsunami generation and dynamics (6-12 months) (**Vilibić, all**)

From all investigated events, a plausible explanation of meteotsunami generating processes in the atmosphere, energy transfer to the ocean and ocean dynamics should be reached.

(i) assessment of **common characteristics** of the synoptic conditions observed during the U.S. meteotsunamis (**Vilibić, all**)

(ii) estimation of atmospheric disturbance **intensity, dissipativeness, speed, direction and coverage** from the ground and satellite data, and atmosphere modeling results (**Vilibić, all**)

The deliverable should be a report containing the detailed explanation on the generating processes, atmosphere-to-ocean energy transfer and inundation of meteotsunami waves. A preliminary list of parameters (basic and derived) which can be used in rapid meteotsunami assessment should be accompanied.

TF5 on Action 2.1. Definition of overall standards for real-time detection of a meteotsunami (8-13 months) (**Marcos, Monserrat, Vilibić, Šepić, Dadić, Ivanković, Muslim**)

Based on the outcome of Action 1.4, i.e., on the common atmospheric and ocean characteristics observed during U.S. historical meteotsunamis, overall standards and protocols for the real-time detection of a meteotsunami will be defined:

- **complete list of atmospheric and ocean parameters** (e.g., ground air pressure and wind measurements, satellite measurements) **and derived variables** which are capable for detection of a meteotsunami, including the recommendations for their temporal and spatial sampling resolution and properties (**Monserrat, Marcos, Vilibić**)

- the list of the **maximum latency** in processing different environmental parameters (e.g., latency in estimation of a strength, velocity and direction of a traveling atmospheric disturbance) based on the analyses of historical meteotsunamis (**Vilibić, Dadić**)

- the **list of communication lines** (e.g., GPRS, VHF, satellites) and processing capacities to be used for data acquisition, processing and detecting of a meteotsunami, which will allow for timely decision on eventual rising of a meteotsunami alert to the affected population and relevant agencies (**Dadić, Ivanković, Muslim**)

The deliverable should be a report on overall standards for real-time detection of a meteotsunami, as achieved from Task 1 results and world meteotsunami research.

TF6 on Action 2.2. Catalogue of existing meteo and ocean platforms and observing systems, and communication routes capable for detecting a meteotsunami (10-15 months) (**Pasquet, Mihanović, Dadić, Ivanković**)

Together with the NWS and NOAA researchers and facilities, project team will make **the catalogue of all available U.S. measuring systems**, their capacities, regional distribution, measured parameters, communication properties, data latency, etc., **which may fulfill the requirements** given in Action 2.1. This will include (i) ground meteorological stations in coastal areas, (ii) vertical sounding stations, (iii) coastal meteorological and oceanographic stations, (iv) meteo-ocean coastal and open-ocean buoys, (v) satellite facilities, (vi) operational forecasting products (both on synoptic and local scales), and other. Special attention will be given to the availability of operational observing systems in the area where meteotsunamis have been registered.

The deliverable should be a catalogue on the available MTWS systems, displayed graphically and in a table or sheet.

TF7 on Action 2.3. Assessment of U.S. observational meteo and ocean network versus the standards (months 14-17) (**Pasquet, Mihanović**)

TF8 on Action 3.1. Classification of meteotsunami risk areas along the U.S. coast (months 10-13) (**Vilibić, Pasquet, Mihanović, Monserrat, Marcos, Rabinovich, Horvath**)

TF9 on Action 3.2. Identification of environmental variables necessary to raise a meteotsunami alarm (months 13-15) (**Vilibić, Monserrat, Marcos, Rabinovich, Horvath**)

TF10 on Action 3.3. Develop a meteotsunami decision matrix and protocols for U.S. coast (months 14-19) (**Šepić, Pasquet, Rabinovich, Vilibić**)

TF11 on Action 3.4. Testing the meteotsunami warning system on historical events (months 19-21) (**Vilibić, all**)