REQUEST FOR ADDITIONAL RESOURCES IN THE CURRENT YEAR FOR AN EXISTING SPECIAL PROJECT

Please email the completed form to special_projects@ecmwf.int.

MEMBER STATE: Italy

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Project title: Evaluation of coastal climate trends in the Mediterranean area by means of high-resolution and multi-model downscaling of ERA5 reanalysis

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Project account: **SPITBRAN**

Additional computer resources requested for		**2020**
High Performance Computing Facility	(units)	5 500 000
Data storage capacity (total)	(Gbytes)	4100

Continue overleaf

[1] The Principal Investigator is the contact person for this Special Project

This form is available at:
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Technical reasons and scientific justifications why additional resources are needed

Key points:

1. We produced 29 out of 35 years of the regional hindcast indicated in the Special Project Request. The period covers the years 1990-2018, while the period foreseen was 1982-2016. Only the BOLAM and MOLOCH data (that is the atmospheric data) were produced on the XC40 cca supercomputer. To save a portion of the granted SBUs, we decided to perform the WW3 simulations (wave data) on the PI's computer facilities.
2. The atmospheric data produced during the first two years of the project are currently stored on the ECFS filesystem (about 13 TB).
3. Account status report for SBUs on 06/06/2020, returns that ~95% of the yearly granted SBUs were consumed
4. After 2.5 years of the project, we assessed a better estimation of the amount of SBUs needed to perform a one-day long simulation. The key parameters to estimate the SBUs are:
    1. the number of points in the X and Y directions,
    2. the number of vertical levels in the atmosphere,
    3. the number of the soil levels
    4. the time step
    5. the length of simulation (considering the spin-up period)

    The settings for such parameters are:
    BOLAM model: number of grid points in the X direction=890, number of grid points in the Y direction=482, number of vertical levels=50, number of soil levels below ground=7, time step=45 seconds, length of simulation=30 hours (the spin-up period is 6-hour long)
    MOLOCH model:number of grid points in the X direction=506, number of grid points in the Y direction=626, number of vertical levels=50, number of soil levels below ground=7, time step=30 seconds, length of simulation=27 hours (the spin-up period is 3-hour long)
    With the above values the SBUs necessary to achieve a one-day long simulation are:
    ~400 SBUs/day for the BOLAM model
    ~800 SBUs/day for the MOLOCH model
    Consequently the BOLAM+MOLOCH numerical chain costs ~1200 SBUs/day which results in ~**438000 SBUs/year**
5. Data stored on the ECFS filesystem occupy more space than requested in the Special Project Request, but they include also some intermediate data (approximately 3 TB) needed to complete the hindcast. Such temporary data will deleted by the end of this year. One year of data occupies approximately **325 GB/year** on ECFS.

The additional SBUs and data storage capacity requested are motived by the fact that we intend to cover the period **1979-2019 plus the first six months of 2020.**

This consistently enlarge the period covered by the hindcast (total number of years is 41.5 instead of 29). Such enlarged database would allow us to draw more robust statistically sound conclusions. A long time series is essential in order to estimate reliable return times for extreme events (i.e. storm) or to support risk assessment. As part of the long-term risk assessment, in particular, we are working to link the Weather Circulation Types (WCTs) to the impact of sea storms on the coast: a research activity is underway to investigate a possible rotation of prevaling events associated with cyclonic circulation types that give origin to SE winds along the italian coasts, formerly less frequent than SW winds and with lot of potentially damaging consequences. All such effects can only be assessed by extending the series for at least 40 years.

We list below some results achieved thanks to the database produced so far (publications and posters):

- "Extreme value analysis of wave induced forcing along a complex-shaped coastline". Paper in preparation
- Brandini et al, 2020. "Coastal climatology of the North-Western Mediterranean area for long-term and short-term risk assessment". Abstract in EGU General Assembly 2020. https://doi.org/10.5194/egusphere-egu2020-19382
- Taddei et al, 2019. "Downscaling ERA-5 reanalysis data for coastal short-term and long-term risk assessment in the NorthWestern Mediterranean Sea." Abstract in EGU General Assembly 2019. Geophysical Research Abstracts, Vol. 21, EGU2019-18262, 2019
- Brandini et al, 2019. "Coastal short term and long term risk assessment in the North Western Mediterranean Sea through downscaling ERA 5 reanalysis data". Poster at ANYWHERE project final conference
- Brandini et al, 2019. "Changes on the wind-wave regime and short-term risk assessment of coastal hazards in the North-Western Mediterranean." Abstract and poster at the 8th MONGOOS Annual Meeting, Trieste 3-5 December 2019
- "Downscaling ERA-5 reanalysis data for evaluation of coastal climate trends in the Mediterranean Sea". Paper under preparation and to be submitted to the Special Issue "Waves and Wave Climate Analysis and Modeling" - Atmosphere/MDPI

The database produced in the framework of the SPITBRAN Special Project constitutes a vital asset for the following INTERREG Italy-France Maritime 2014-2020 projects:

1. **MAREGOT project** (Interreg IT-FR "maritime" program). The project intends to launch a shared action plan which, thanks to a better knowledge of erosion and coastal dynamics, could identify optimal intervention solutions to land management in relation to morphological and hydrodynamic characteristics of the coast. Presentations during the project conferences:

- Brandini et al, 2019. "Il ruolo dei cambiamenti climatici nella previsione del rischio a breve e lungo termine (Climate change role in the short and long term risk assessment)".
- Brandini et al, 2019. "Modellistica e scenari di rischio (Models and risk scenarios)"

A project to capitalize the results of the MAREGOT project is currently under preparation for submission within November 2020: these evaluations will be fundamental to set up the study activity on the potential consequences of the change in the meteo-marine climate in the North-Western Mediterranean area.

2. **IMPACT project** (Interreg IT-FR "maritime" program). It tackles the challenge of managing protected marine areas (PMA) near port zones. The objective is to define cross-border sustainable management plans for the effective protection of PMAs in harmony with the development requirements of ports, fundamental elements of Blue Growth.

3. **GIAS project** (Interreg IT-FR "maritime" program). It aims to increase navigation safety in the cross-border area, continuing from the SICOMAR PLUS strategic project. It has three additional goals, as follows: - minimising the risk of accidents to boats due to bad weather and large obstacles at sea; - emergency management of pollution spills; - increased seafarer awareness of collision and navigation risks in the open sea. In particular, the database created through this SP is essential for the study of dangerous meteo-marine conditions along ship routes. The analysis of past data, through the realization of sea states (defined as wave spectra) allows to evaluate the probability of occurrence of freak waves for specific past events (accidents).

4. **SINAPSI project** (Interreg IT-FR "maritime" program). It aims to develop and promote decision support tools to increase navigation safety near commercial ports in the maritime area in order to reduce the risk of accidents and increase the safety and efficiency of port operations.

5. **SHAREMED project**: an Interreg-MED project, managed by OGS, created to increase the ability of managing authorities and the scientific community to assess and address the risks related to environmental threats, by: 1) providing models for the collection, comparison, integration, harmonization of existing experiences and increasing the possibility of finding, accessing and using

existing information; 2) study and test procedures and protocols to create a shared database and products to be used to assess health and environmental risks.

6. Finally, such database constitutes a vital asset for many study activities and future initiatives. In particular, the H2020 SCORE (call: H2020-LC-CLA-2018-2019-2020) project has been submitted in September 2020 in which the most important part concerns the assessment of the risks deriving from climate change for coastal cities, and the creation of coastal laboratories to study and assess possible mitigation strategies. The SP was mentioned in the submission phase of the proposal that passed the first evaluation phase (pending the final decision by the end of this year).

To achieve this goal we need the resources to perform and store 12.5 years of simulations, that is:

HPC facility (SBUs): 438000 X 12.5 approximately **5 500 000**

ECFS data storage (GB): 325 X 12.5 approximately **4100**