SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year	2021
Project Title:	ASIM-CPL - Air-Sea Interactions on the Mediterranean basin, using "atmosphere-ocean-waves" CouPLed numerical models
Computer Project Account:	…………………………………………………………….……
Principal Investigator(s):	Dr. Antonio Ricchi
Affiliation:	CETEMPS – Department of Physical and Chemical sciences, University of L'Aquila
Name of ECMWF scientist(s) collaborating to the project (if applicable)	…………………………………………………………….…… …………………………………………………………….……
Start date of the project:	4 January 2021
Expected end date:	2 January 2022

Computer resources allocated/used for the current year and the previous one

(if applicable)
Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)			10000000.00	578921.63
Data storage capacity	(Gbytes)			10000	100

Summary of project objectives (10 lines max)

The complex energetic feedbacks that appear between air-sea interface, play a fundamental role in atmospheric dynamics both on a meteorological and climatological scale. In this work we take advantage of coupled atmosphere-ocean-wave numerical models to investigate physical interactions and processes at the air-sea interface in extreme atmospheric events. Air-see interactions will be characterized according to two temporal horizons, short-term (weather time scale) and mid-term (seasonal time scale). Hence, project's purpose is performing a two-fold investigation. (i) an assessment of the impacts of atmosphere-ocean-wave coupling and air-sea interactions in extreme atmospheric events (short-term) focusing on triggering and intensification mechanisms. (ii) the cumulative modulation introduced by coupling ocean and waves components on seasonal climate predictability. In this project it will be employed the coupled numerical model COAWST (Coupled Ocean Atmosphere Waves Modeling System; Warner et al., 2010) at a convection permitting scale (<= 4 km).

Summary of problems encountered (10 lines max)

We had trouble identifying the most suitable domain decomposition configuration for our seasonal simulations. We identified an optimal solution for seasonal simulations with a convection permitting approach using two nested domains at a resolution of 20-4 km. Another issue concerns the 800 gb allocation space. The numerical model will save the output files at hourly temporal resolution each daily file can as large as ~40 GB. This size can be relatively reduced adjusting temporal output time step and reducing variables number through dedicated postprocessing, but the bottleneck of original output size will likely remain. By performing seasonal time scale simulations, we risk not being able to complete a simulation (of about 10 ensembles per season) without copying the files during the run. We solved this issue changing configuration of model. The total amount of SBUs shown in the table is not accurate due to account overlap problems during the creation phase. These problems (which we are trying to solve) have affected the distribution of the SBUs used by the users of the project.

Summary of plans for the continuation of the project (10 lines max)

After having identified best numerical configuration to optimize computing and space resources, we will implement the COAWST coupled forecasting system.
Based on the chosen configuration we will carry out seasonal simulations for the year 2009 (winter season) based on the ensemble simulations both with the standalone uncoupled approach (WRF only, UNC case) and for the coupled atmosphere-ocean (AO) and atmosphere-ocean-waves AOW) approach, in order to evaluate the impact of the wave (and therefore of the surface roughness) on stationary forecasts. In parallel, short-term simulations will be performed, at a resolution of 1 km, in which extreme atmospheric events (10 selected events) will be simulated, with the same approaches (uncoupled, coupled, fully coupled). Both experiments aim at investigating dynamics of genesis and intensification mechanisms of severe-to-extreme events according to different numerical approaches and related impacts on events predictability.

List of publications/reports from the project with complete references

Based on the preliminary results for short-term events (3 Tropical-Like Cyclones) we submitted an abstract to the EMS 2021 congress EMS2021-424
On the Ocean Mixed Layer influence on the genesis of Mediterranean Tropical-Like cyclones by Antonio Ricchi et al. accepted in UP1.3

Summary of results

During the first half of the year, we focused on optimizing the model's performance and on the scalability of the numerical grids. Furthermore, some of the most common parameterizations were tested in order to validate a "control" approach. A seasonal forecast experiment is being carried out considering winter of 2009 as the reference year. In fact this winter season was characterized by frequent baroclinic waves and Mediterranean cyclogenesis, more intense compared to the climatological mean.
The best computational performances were obtained with a calculation grid of 20 km of resolution for the external domain and 4 km (convection permitting approach) for the internal domain.