INSTIITUTE OF ACCELERATING SYSTEMS AND APPLICATIONS, ATHENS, GREECE
WP10 Coordinator

MEDITERRANEAN OCEAN FORECASTING SYSTEM: TOWARD ENVIRONMENTAL PREDICTION

MFSTEP

Project Deliverable Report
D13

WP10: Atmospheric Forcing and Air-Sea Interaction Studies

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1 Introduction

This report provides information about the high-resolution non-hydrostatic model simulations that were performed under the scopes of subtask 10410 and the available meteorological fields. This WP contained the necessary activities to create and deliver the atmospheric surface fields to the WP8 and WP9 ocean modeling community, to examine the sensitivity of atmospheric response to sea surface temperatures, to study the air-sea interactions and to implement higher resolution limited area models in Mediterranean sub-regions. Moreover, its aim was to define and perform the Scientific Validation Period (SVP) inter-comparison of atmospheric models.

2 Experimental setup and implementation

The original plan of this subtask was the integration of the non-hydrostatic atmospheric model NH1 in high-resolution (4-5km) simulations for the ALERMO area. The aim was to provide the meteorological data to the ocean modelers in order to examine the potential benefits of highly resolved, topographically controlled atmospheric flow fields in regional/shelf ocean modelling.

In this task, however, it was decided to use SKIRON/Eta (LAM2) instead of NH1, because:

a) The use of a different atmospheric model with different physics and dynamics would not allow the direct comparison with the corresponding TOP forecasts of SKIRON/Eta at 10 km resolution,

b) SKIRON/Eta is a non-hydrostatic model that has already been tested extensively and used in high-resolution simulations.

Moreover, contrary to the original plan of the subtask, that suggested the use of the atmospheric model only in the ALERMO area, the computational domain was chosen to be identical to the operational one. It is reminded that the operational model domain (Figure 1) covers the whole Mediterranean basin and the Black sea. This was decided in order a) to allow the direct comparison of the ocean forecasts with those produced during

TOP, and b) to allow the ocean modelers of western Mediterranean, and not only the users of ALERMO, to utilize their models.

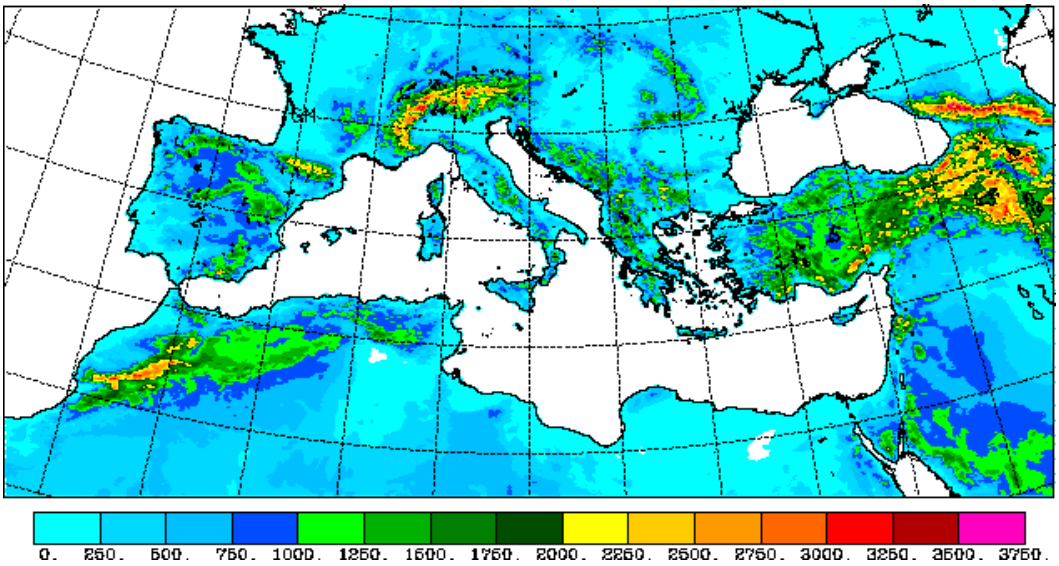

Figure 1. *Topography of the high-resolution (0.05°x0.05°) SKIRON/Eta in the computational model domain.*

SKIRON/Eta was integrated using the configuration, meteorological initial and boundary conditions (MF), SSTs (NCEP) and computational domain of the TOP period (see Deliverable WP10-D4), but with a horizontal grid-increment of 0.05x0.05 degrees (~ 5 km). The period of January 2005 was selected because it was characterized by relatively frequent cyclogenesis and strong synoptic circulations in western and eastern Mediterranean. 120-hour runs were produced from a) 0000 UTC, 29/12/04, b) 0000 UTC, 05/01/05, c) 0000 UTC, 12/01/05, d) 0000 UTC, 19/01/05 and e) 0000 UTC, 26/01/05. The high-resolution SKIRON/Eta output became available to all the interested partners by September 2005 (i.e. much before the deadline of the subtask).

The use of the very fine horizontal resolution of 5 km provides a better distribution of land/sea and improved representation of the main topographic features than with the 10 km resolution (Figures 2, 3). These factors were expected to lead to:

- Improvement in the prediction of meso-α and β scale circulations, e.g. channel flows (Figures 4, 5)

- Improvement in the prediction of precipitation, clouds and radiative fluxes.

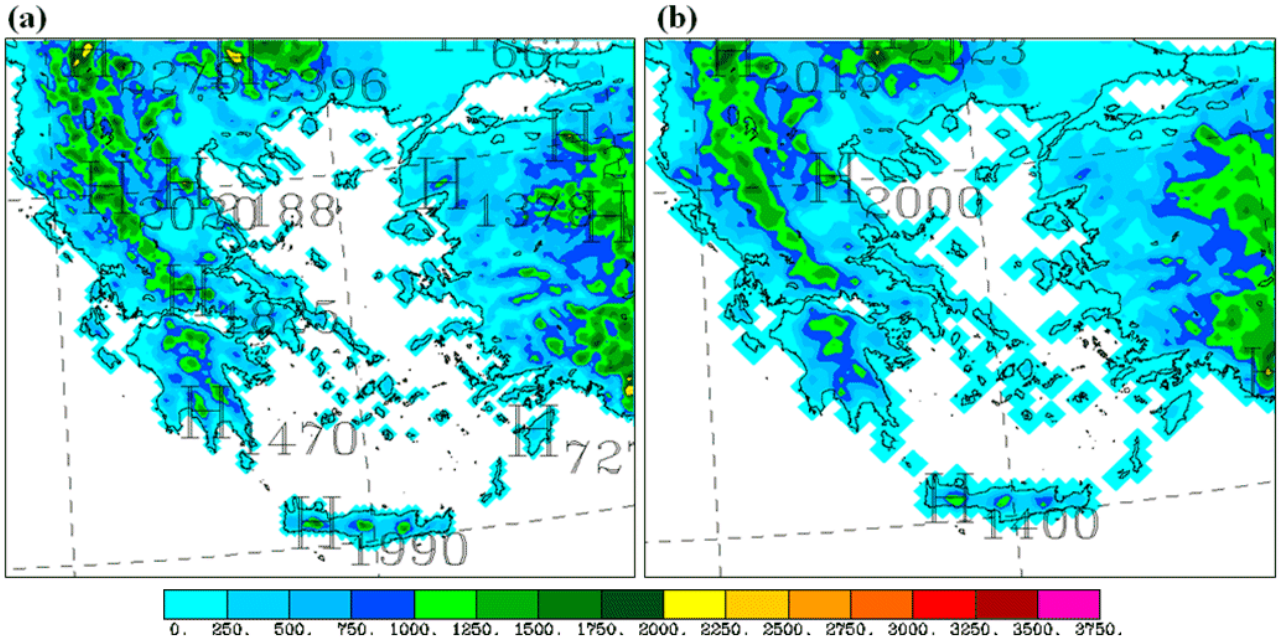

Figure 2. *Topography of SKIRON/Eta model (in m) with a horizontal grid-increment of a) 0.05 x 0.05 degrees (used in this subtask) and b) 0.1 x 0.1 degrees (used during TOP), focusing over Greece.*

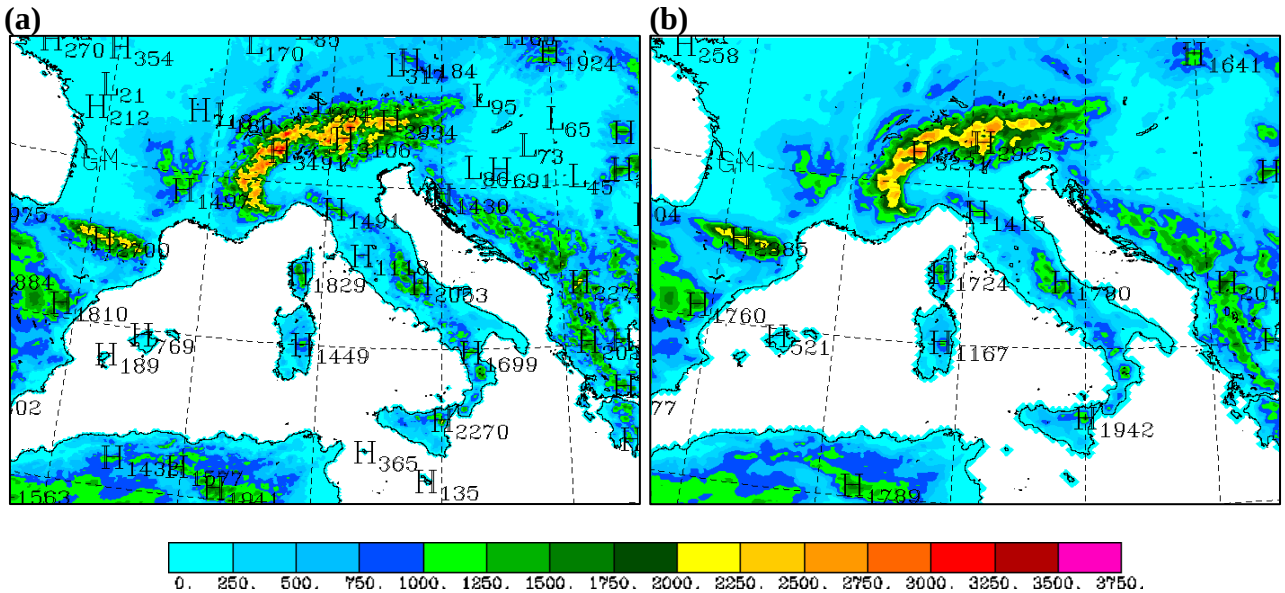

Figure 3. *Topography of SKIRON/Eta model (in m) with a horizontal grid-increment of a) 0.05 x 0.05 degrees (used in this subtask) and b) 0.1 x 0.1 degrees (used during TOP), focusing western Mediterranean.*

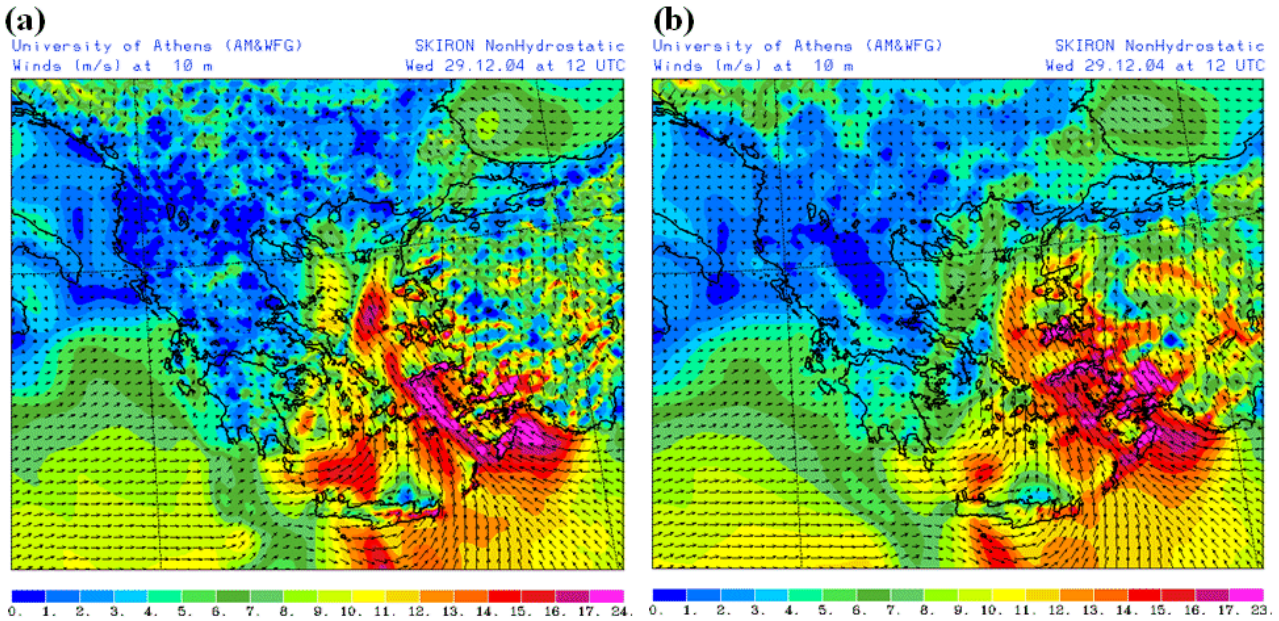

Figure 4. *Horizontal section of predicted wind speed at 10m (m/s) over Greece at T+12 from 0000 UTC, 29/12/04, using SKIRON/Eta with a horizontal grid-increment of a) 0.05 x 0.05 degrees and b) 0.1 x 0.1 degrees.*

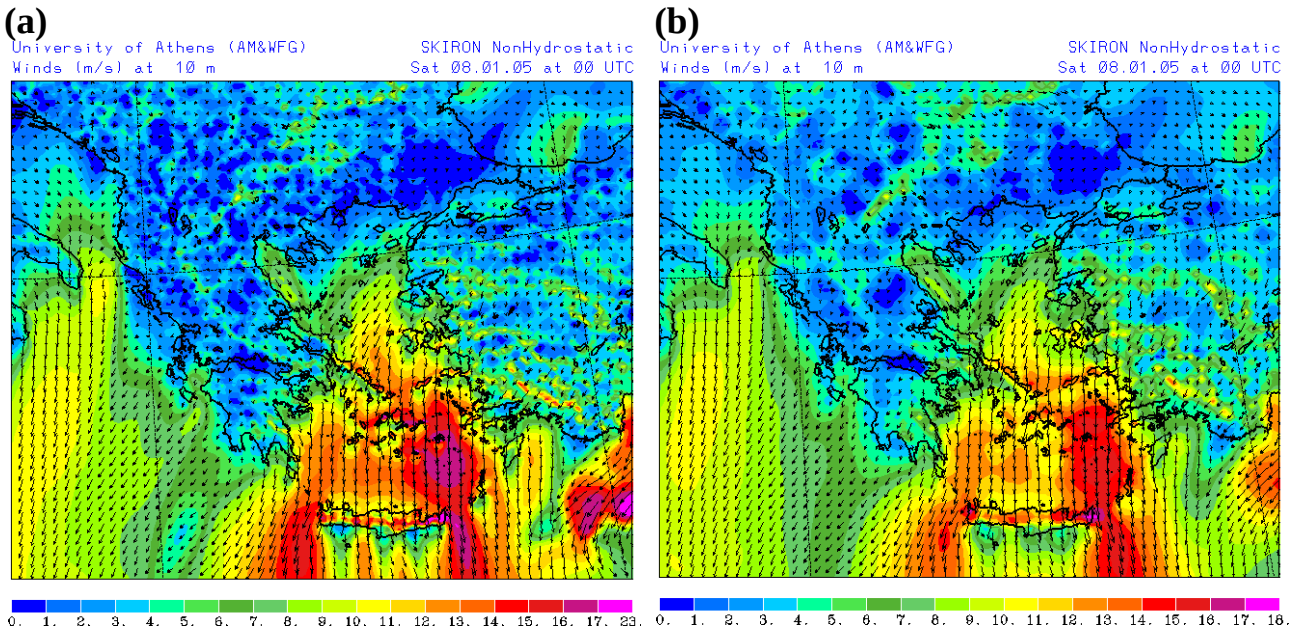

Figure 5. *Horizontal section of predicted wind speed at 10m (m/s) over Greece at T+72 from 0000 UTC, 5/1/05, using SKIRON/Eta with a horizontal grid-increment of a) 0.05 x 0.05 degrees and b) 0.1 x 0.1 degrees.*

3 High-resolution atmospheric model output

In the framework of subtask 10410, the raw data became available only to the project partners in GRIB format. The outputs were provided in a regular 0.05°x0.05° latitude-longitude grid in any desired sub-domain, and not in the full dissemination domain, because of the very large volume of the output. This procedure allowed the faster and easier transfer and storage of the output by the partners. The meteorological fields that became available to the interested partners and were used to force the ocean models appear in Table 1.

Meteorological Variables	**Grib Code**
u component of the 10m wind (m/s)	33
v component of the 10m wind (m/s)	34
2m Air temperature (ºK)	11
2m specific humidity (kg/kg)	51
cloud fraction (%)	71
mean sea-level pressure (Pa)	2
Total Hourly accumulated precipitation (kg/m^2)	61
downward shortwave radiation flux (W/m^2)	204
upward shortwave radiation flux (W/m^2)	211
downward longwave radiation flux (W/m^2)	205
upward longwave radiation flux (W/m^2)	212
Evaporation (Kg/m^2)	57
surface latent heat flux (W/m^2)	121
surface sensible heat flux (W/m^2)	122
land-sea mask (land=1, sea=0)	81
sea-surface temperature (ºK) (only analysis)	11

Table 1*. Description of the included fields in the IASA GRIB files.*

These fields became available every hour up to 120 hours. The accumulated precipitation was also accumulated in hourly increments. The SST field should be used in combination with the land-sea mask field (code 81) because it is not valid over the land.

The high-resolution SKIRON/Eta outputs produced in subtask 10410 were disseminated through ftp procedures and the MFSTEP-WP10 web page. Standard GRIB encoding for the model output was adopted (Table 1). The address of the ftp server is:

ftp.mg.uoa.gr (IP: 195.134.91.103)

and the interested partners utilized the provided username and password.

The filename convention of the grib files was:

MFSTEP_IASA_TTDDMMYY_XXX.grb

where TT, DD, MM and YY are the time, date, month and year (respectively) of the initial time and XXX is the forecast time (in hours). For example, the file **MFSTEP_IASA_00050105_060.grb** corresponds to the 60 hours forecast of IASA from 0000 UTC, 5 January 2005. Its valid time is 1200 UTC, 7 January 2005. All the high-resolution forecasts of IASA have been archived.