Numerical Weather Prediction at the Italian Air Force Meteoro

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COMET - Italian Air Force Meteorological Centre
Airport of Pratica di Mare , Rome, Italy
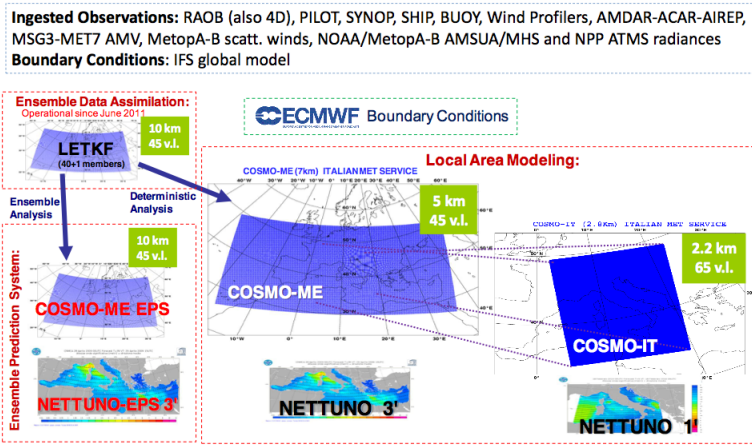*Corresponding author: antonio.vocino@aeronautica.difesa.it*

ABSTRACT: The development activities carried out at the Italian Air Force Meteorological Centre in the field of Numerical Weather Prediction are shown. First experiments with the GPU-enabled version of the COSMO model on the new hybrid CPU-GPU supercomputer of the Centre were made. Preliminary results showed a significant speedup of the forecasting model lead time, exploiting the GPU technology. The boost of computing capability allows to optimally run the new resolution at ensemble-base

KEYWORDS: Numerical Weather Prediction, atmospheric models, High Performance Computing, hybrid CPU-GF

NWP System

Ingested Observations: RAOB (also 4D), PILOT, SYNOP, SHIP, BUOY, Wind Profilers, AMDAR-ACAR-AIREP, MSG3-MET7 AMV, MetopA-B scatt. winds, NOAA/MetopA-B AMSUA/MHS and NPP ATMS radiances
Boundary Conditions: IFS global model

Operational NWP System

The Italian Air Force Meteorological Centre operates a complete NWP system, including an ensemble based data assimilation system and a set of nested, limited area atmospheric and wave models, in both deterministic and ensemble configurations, providing the high-resolution forecasting fields feeding the generation of timely and accurate meteorological products for the end users.

Data Assimilation

Ensemble Data Assimilation System (LETKF)
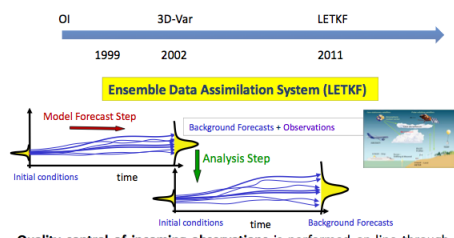
Quality control of incoming observations is performed on-line through ECMWF pre-processing tool (SAPP) and background QC in LETKF assimilation system

Mediterranean Sea Forecasting (NETTUNO)

in collaboration with ECMWF and ISMAR

Surface winds from **COSMO-ME** and **COSMO-IT** are used as atmospheric forcing in WAM 4.0 model *(Komen et al, 1994)*

CONFIGURATION:
Lat-Lon regular grid, mesh size 3' (NETTUNO-ME) / 1' (NETTUNO-IT)
Spectral discretization with 30 frequencies and 36 directions
Initial state from previous run (warm start)
Initial time of model run 00/12 UTC
Forecast range to 72 h (NETTUNO-ME) / 48 h (NETTUNO-IT)
OUTPUT FIELDS:
Significant wave height, Mean wave direction, mean wave period

HPC Facilities

- 4x AS12 1+10 w/ 40 TB
  → **160 TB RAW**
- 2x 16p 10 Gbps switches
- 4x Infiband Router2 nodes
- PANFS + NFS over Infiniband QDR
- **6.0 GB/s** sustained READ
- **6.4 GB/s** sustained WRITE
- **FULLY REDUNDANT** Configuration

- **51x DL380 G9 Computing Nodes**
- **2x DL380 G9 Management Nodes**
- **1x MSA2040 DAS**
- **6x Infiniband 36p FDR switches**
- **102x Kepler K80 GPUs**
  (204 GPU units ≈ 500K GPU cores)
- **9 TB RAM**

- **Nominal performances:**
  190 TFLOPS peak
  308 TFLOPS peak (BOOST)
- **TOP500 ranking:**
  → **#5 in Italy**
  → **#1 in Italy with GPU**

New HPC cluster

The new HPC cluster of the Italian Air Force Meteorological, released in 2016, is planned to host the major part (in terms of computational cost) of the operational NWP suites. Based on hybrid CPU-GPU architecture, coupled with very high-performance network and parallel storage, it is a state-of-art, reliable and scalable system for the next generation of computing applications.

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