NWP at the Italian Meteorological Service

(Italian Met. Service – CNMCA Rome, Italy)

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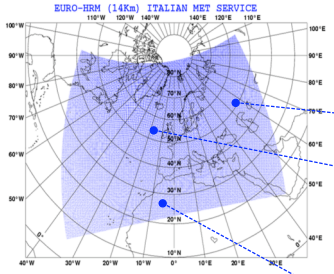
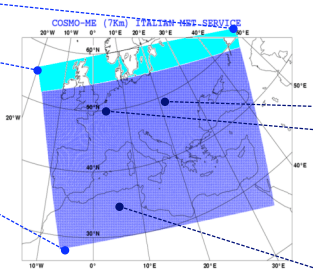
LOCAL AREA MODELING

14 km



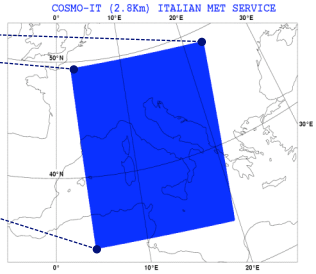
- Prognostic model: **HRM** (DWD hydrostatic model)
- Intermittent (3h) data assimilation cycle with IFS boundary conditions
- Parameterized convection
- Conventional OBS + AIRCRAFTS, Wind Profilers, AMSUA (NOAAxx + METOP), AMV (MET9/7), MODIS, ERS2/QSCAT/ASCAT scatt. winds

- Non-hydrostatic limited area modelling COSMO
- Parameterized convection
- Input for forecast products, EUMETSAT H-SAF programme and WAM
- Further domain extension



7 km

	EURO-HRM	COSMO-ME	COSMO-IT
Domain size	769x513	641 x 401	542 x 604
Grid spacing	0.125° (14 Km)	0.0625 (7 km)	0.025 (2.8 km)
Number of layers	40/10hPa	40/ ~22 km	50 / ~22 km
Time step	75 s	40 s	25 s / RK3/5
Forecast range	72 hrs	72 hrs	24 hrs
Initial time	00/03/…/18/21 UTC	00/12 UTC	00/12 UTC
Lateral boundaries	IFS	IFS	COSMO-ME (7km)
L.B.C. update freq.	3 hrs	3 hrs	1 hr
Initial state	3D-VAR FGAT	Interp 3D-VAR FGAT	6h Nudging
Initialization	Incremental D.F.I.	D.F.I.	None
External analysis	T,u,v,q,ps,w_soil	None	None
Special features	None	Filtered topography	Filtered topography
Status	Operational	Operational	Operational
Hardware	IBM P4+ (ECMWF)	IBM P4+ (ECMWF)	IBM P4+ (ECMWF)
N° of processors	64	192	352



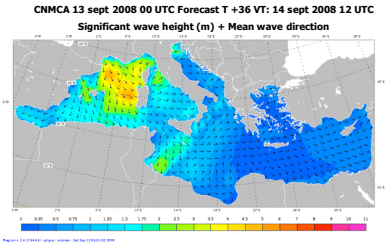
2.8 km

- Compressible equations
- Explicit convection

MEDITERRANEAN SEA FORECASTING USING COSMO-ME (*NETTUNO*)

(in collaboration with ISMAR-CNR)

- Lat lon regular grid (3')
- Spectral discretization with 30 frequencies and 36 directions
- Initial state from previous run
- Initial time of model run 00/12 UTC
- Forecast range to 72 h
- OUTPUT: Significant wave height, Mean wave direction, mean wave period



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

FUTURE DEVELOPMENTS

- Run at higher resolution (1') over the Italian basins with atmosferic forcing from COSMO-IT surface winds and boundary condition from run over Mediterranean sea
- Relocatable **SWAN** (Italian coast) for extreme events forecast over small domains

(In cooperation with CUGRI Salerno)

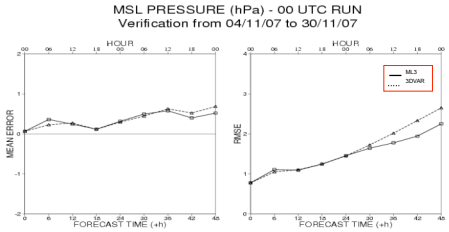
THE ENSEMBLE BASED DATA ASSIMILATION SYSTEM: TOWARDS THE OPERATIONAL CONFIGURATION

CNMCA Implementation

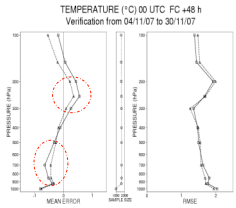
Bonavita et al.,Q.J.R.Meteorol.Soc. 134, 2008

- *LETKF FORMULATION (Hunt et al,2007)*
- 30 ensemble members at 0.25° (~28Km) grid spacing (EURO-HRM), 40 hybrid p-sigma vertical levels (top at 10 hPa)
- Boundary conditions from IFS for all members (not perturbed)
- LOCALIZATION: 800 km circular local patches (observation weight smoothly decay $\propto r^{-1}$)
- (T,u,v,qv,ps) set of control variables
- Observations: RAOB (Tuv), SYNOP(ps), SHIP(ps), BUOY(ps), AIREP, AMDAR, ACAR, AMV, MODIS, WPROF
- Model error treated through a combination of 3D adaptive multiplicative inflation factor and additive inflation factor (perturbation derived from randomly selected, scaled 24-hour forecast differences)
- 6-hourly assimilation cycle

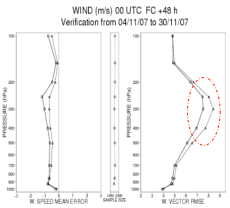
Run for 30 days (1-30° Nov 2007) - Operational 3DVar cycle run in parallel at same spatial resolution and same observation dataset



MSLP forecast scores also show better skill for the LETKF run starting around 30 hours into the forecasts and steadily increasing thereafter

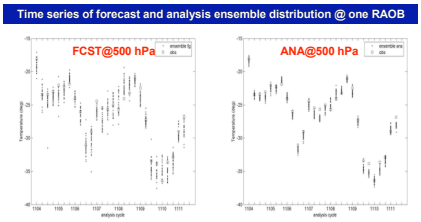


Temperature results appear neutral in terms of RMS skill and show larger LETKF biases in the lower troposphere and around jet level

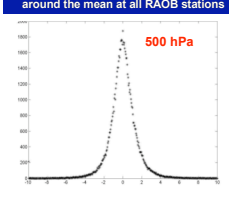


Wind vector forecasts for the LETKF cycle show a consistent decrease in RMS error, reaching ~1m/s at 48h around jet level

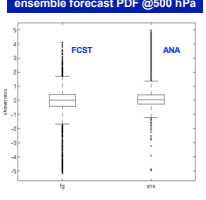
Time series of forecast and analysis ensemble distribution @ one RAOB



Forecast t+6h ensemble distribution around the mean at all RAOB stations



SKEWNESS distribution for ensemble forecast PDF @500 hPa



Gaussianity assumption has been verified in the forecast and analysis ensemble
(only distributions for Temperature have been shown, but behaviour is similar for all control variables)

FUTURE PLANS:

- Treatment of nonlinearities based on OUTER-LOOP technique
- Assimilation of radiances from AMSU-A
- Perturbation of boundary conditions
- Removal of model bias and stochastics representation of model uncertainties