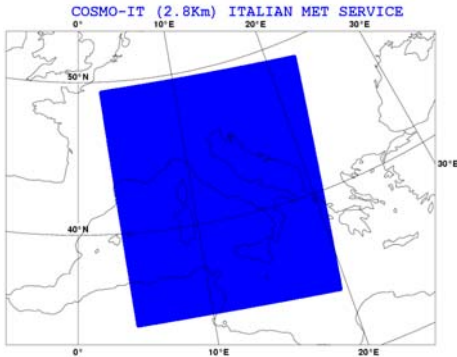# Towards convective scale NWP: tuning of the 2.8 km COSMO-IT at the Italian Met. Service
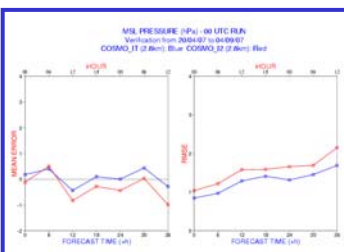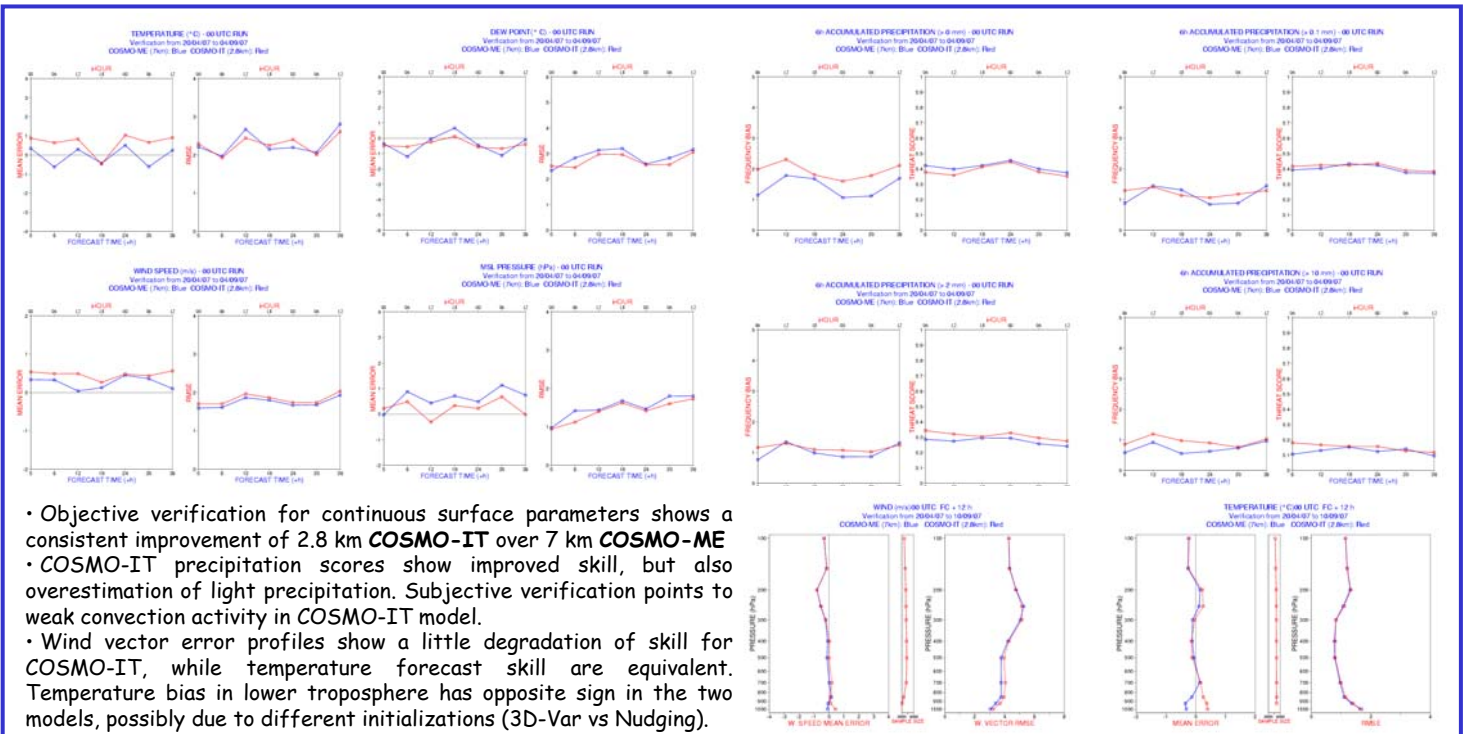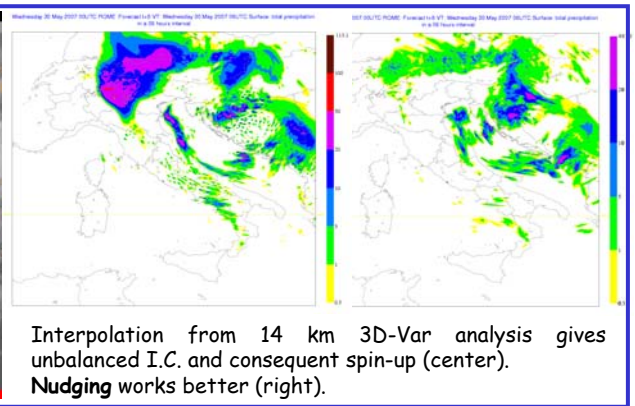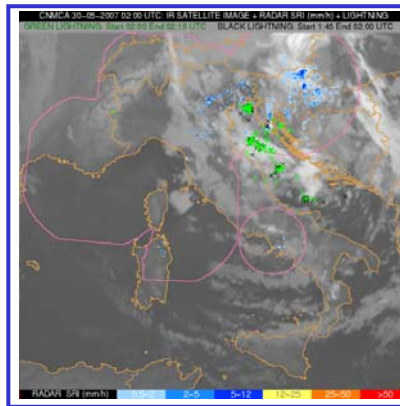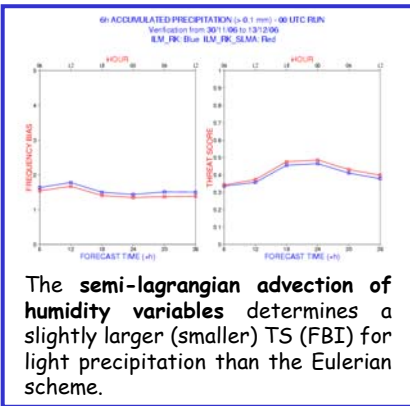
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COSMO-IT (2.8Km) ITALIAN MET SERVICE

Domain size	542 x 604
Grid spacing	0.025 (2.8 km)
Number of layers / top	50 / ~22 km
Time step and scheme	25 s / RK3/5
Forecast range	36 hrs
Initial time of model run	00 UTC
Lateral bound. condit.	COSMO-ME (7km)
L.B.C. update frequency	1 hr
Initial state	Nudging
Initialization	None
External analysis	None
Special features	Filtered topography
Convection parameter.	Shallow convection
Status	Pre-operational
Hardware	IBM P690 (ECMWF)

The 2.8 km **COSMO-IT** has been running at the Italian Met. Service since October 2006. During this period an intensive verification and tuning of the model has been performed in order to reach an operational level of skill. Some of the most significant steps of this process have been:

- Multi-layer soil (Schrodin e Heise, 2001)
- Semi-lagrangian advection of humidity variables (Baldauf, 2005)
- Time integration step tuning (winter storms)
- Introduction of observation nudging for model initialization

The **semi-lagrangian advection of humidity variables** determines a slightly larger (smaller) TS (FBI) for light precipitation than the Eulerian scheme.

Interpolation from 14 km 3D-Var analysis gives unbalanced I.C. and consequent spin-up (center). **Nudging** works better (right).

- Objective verification for continuous surface parameters shows a consistent improvement of 2.8 km **COSMO-IT** over 7 km **COSMO-ME**
- COSMO-IT precipitation scores show improved skill, but also overestimation of light precipitation. Subjective verification points to weak convection activity in COSMO-IT model.
- Wind vector error profiles show a little degradation of skill for COSMO-IT, while temperature forecast skill are equivalent. Temperature bias in lower troposphere has opposite sign in the two models, possibly due to different initializations (3D-Var vs Nudging).

The impact of the initial conditions and lateral boundaries is evident in MSLP skill scores of two 2.8 km COSMO model implementations: COSMO-IT (see above) and COSMO-I2 (in cooperation with ARPA-Emilia Romagna and ARPA-Piemonte) which is nested in COSMO-I7.

Current **development activities** are focussed on:
➤ Implementation of Digital Filter Initialization (DFI) in both 14 km 3D-Var cycle (Incremental DFI) and COSMO-IT run
➤ Improvement of the Runge-Kutta dynamical core
➤Tuning of the soil model initialization

Considering the general tendency of the COSMO-IT to underpredict convection, it would be benificial to look for improvements in the treatment of turbulent diffusion and possibly microphysics parameterizations.