Summary of WG3 activities
Physical Aspects

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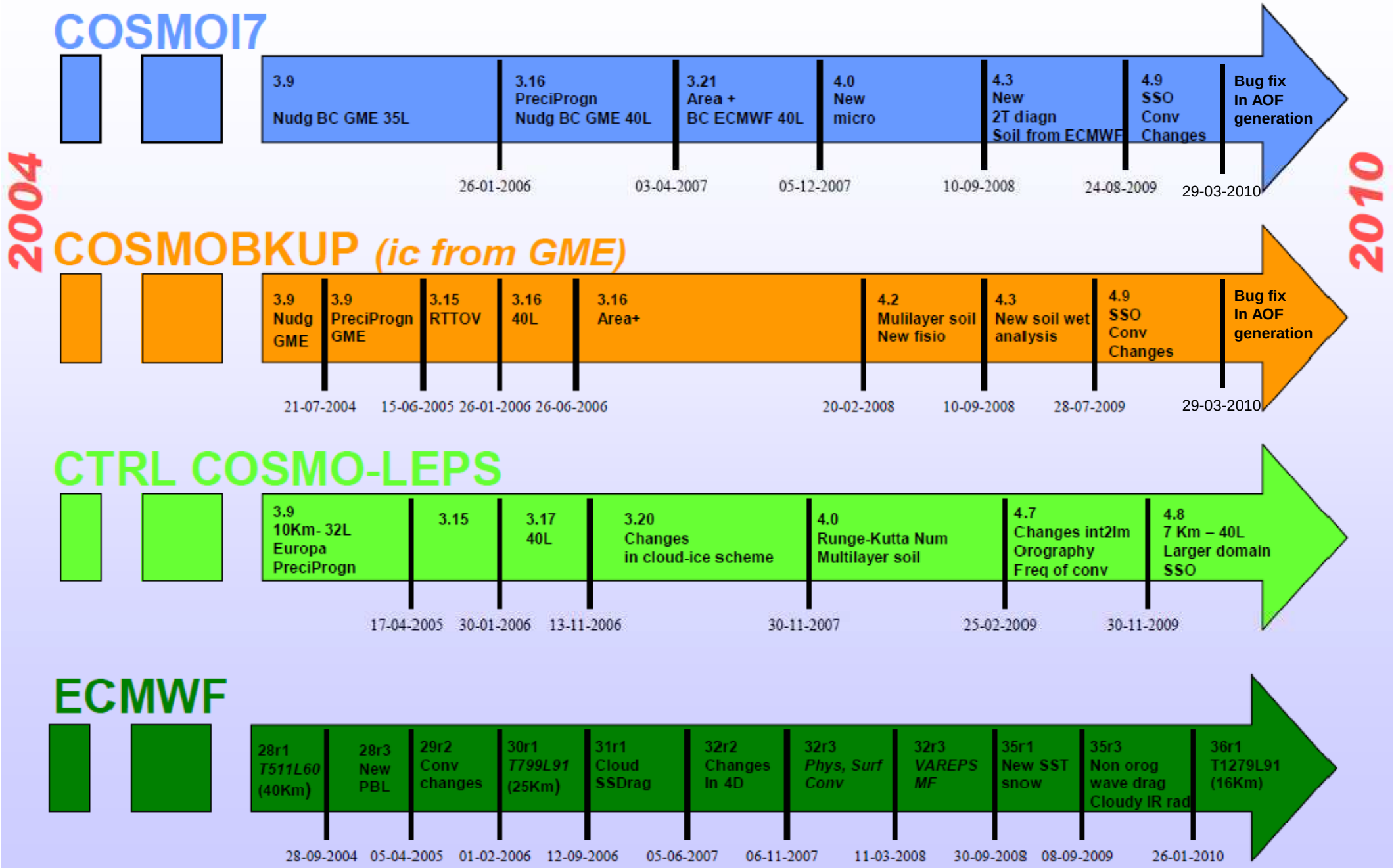
…….with many contributions from WG3 people

CONSORTIUM FOR SMALL SCALE MODELING
COSMO

WG3 activities

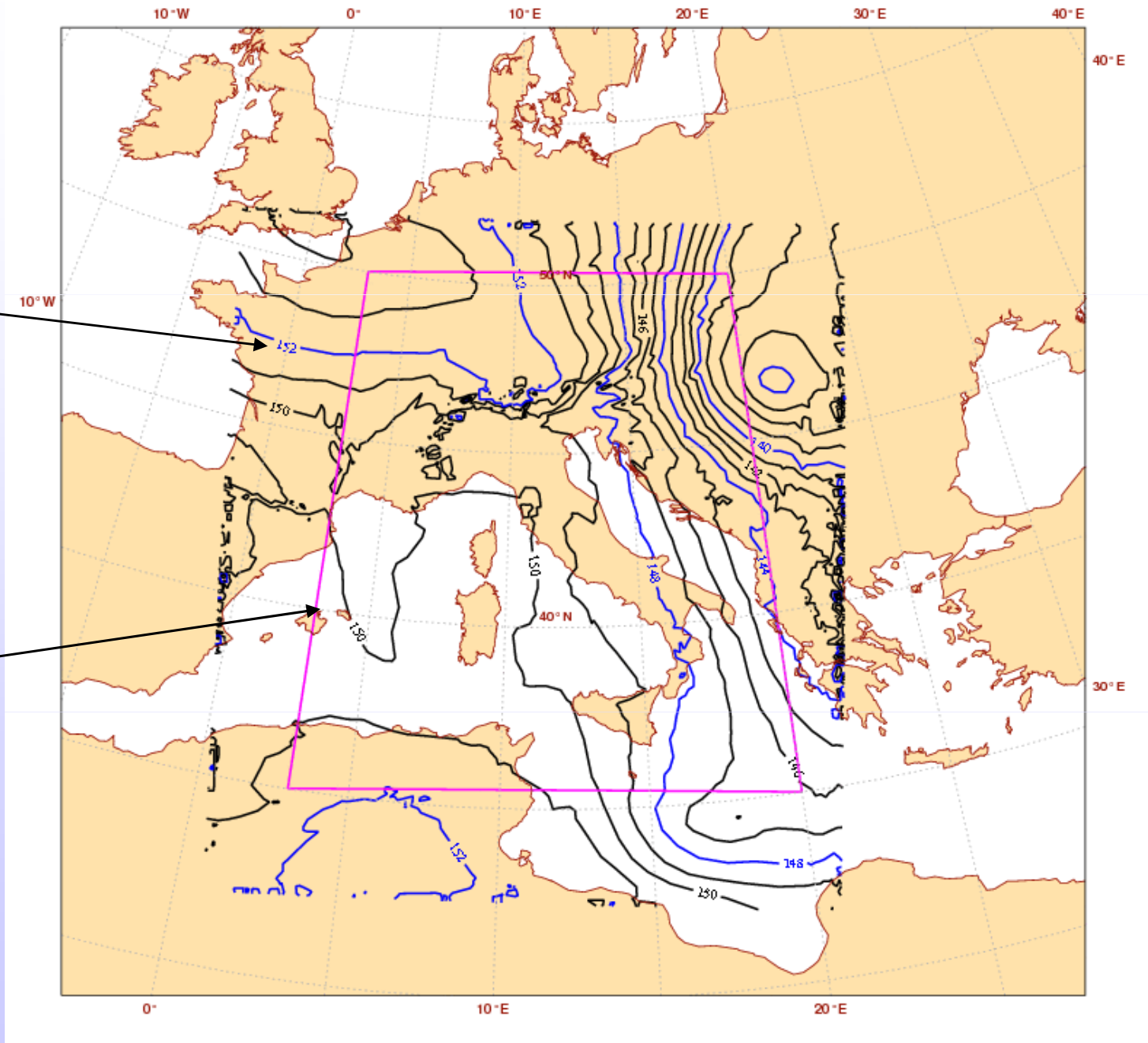
- Boundary layer
- Microphysics
- Radiation
- Deep convection and grid scale precipitation
- Diagnostic

Main changes of COSMO suites handled by ARPA-SIMC

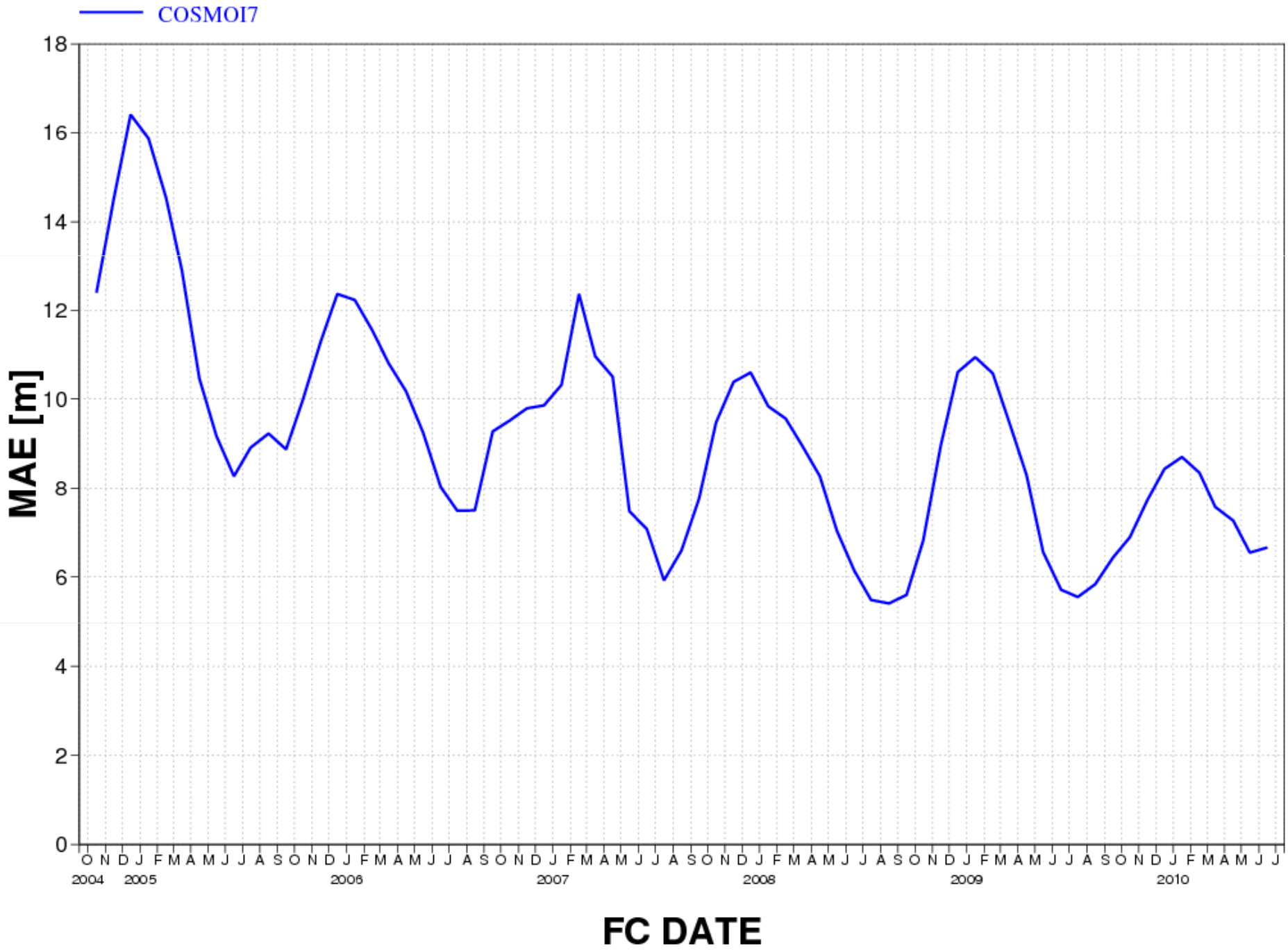


COSMOI7 domain

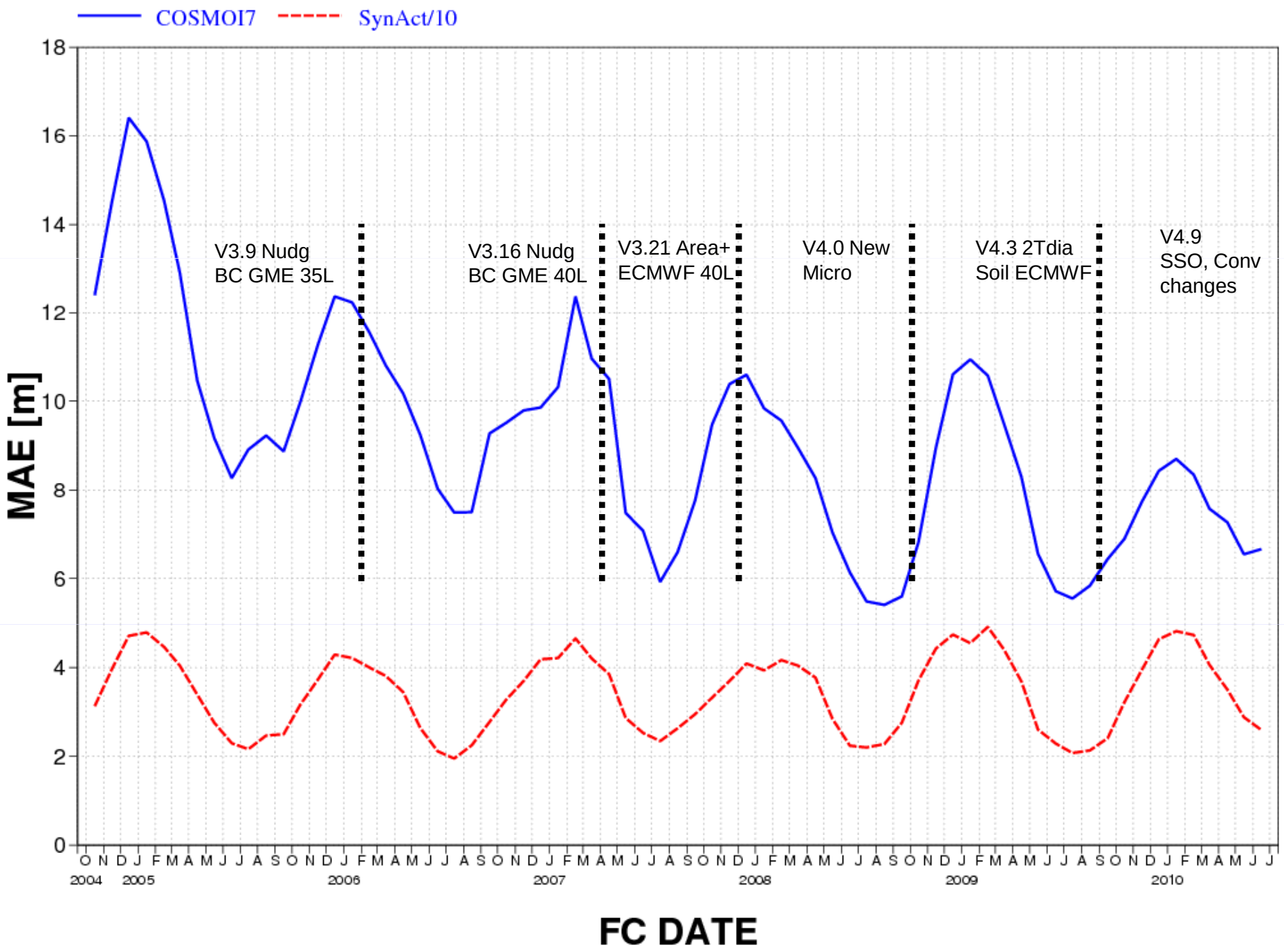
Verification area



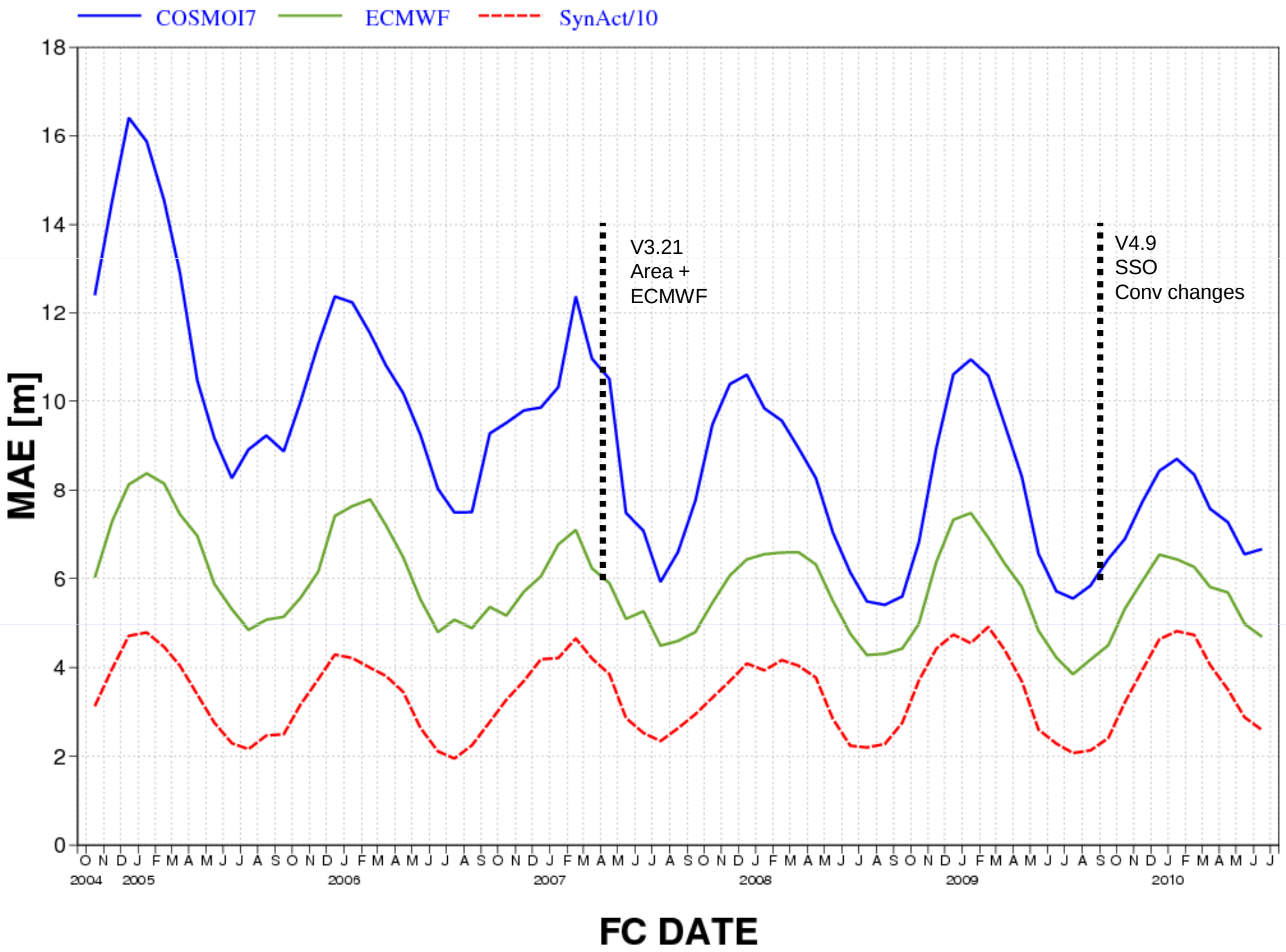
Mean Absolute Error over COSMO-I7 domain – FC+48 Z850 vs ECMWF AN



Mean Absolute Error over COSMO-I7 domain – FC+48 Z850 vs ECMWF AN



Mean Absolute Error over COSMO-I7 domain – FC+48 Z850 vs ECMWF AN



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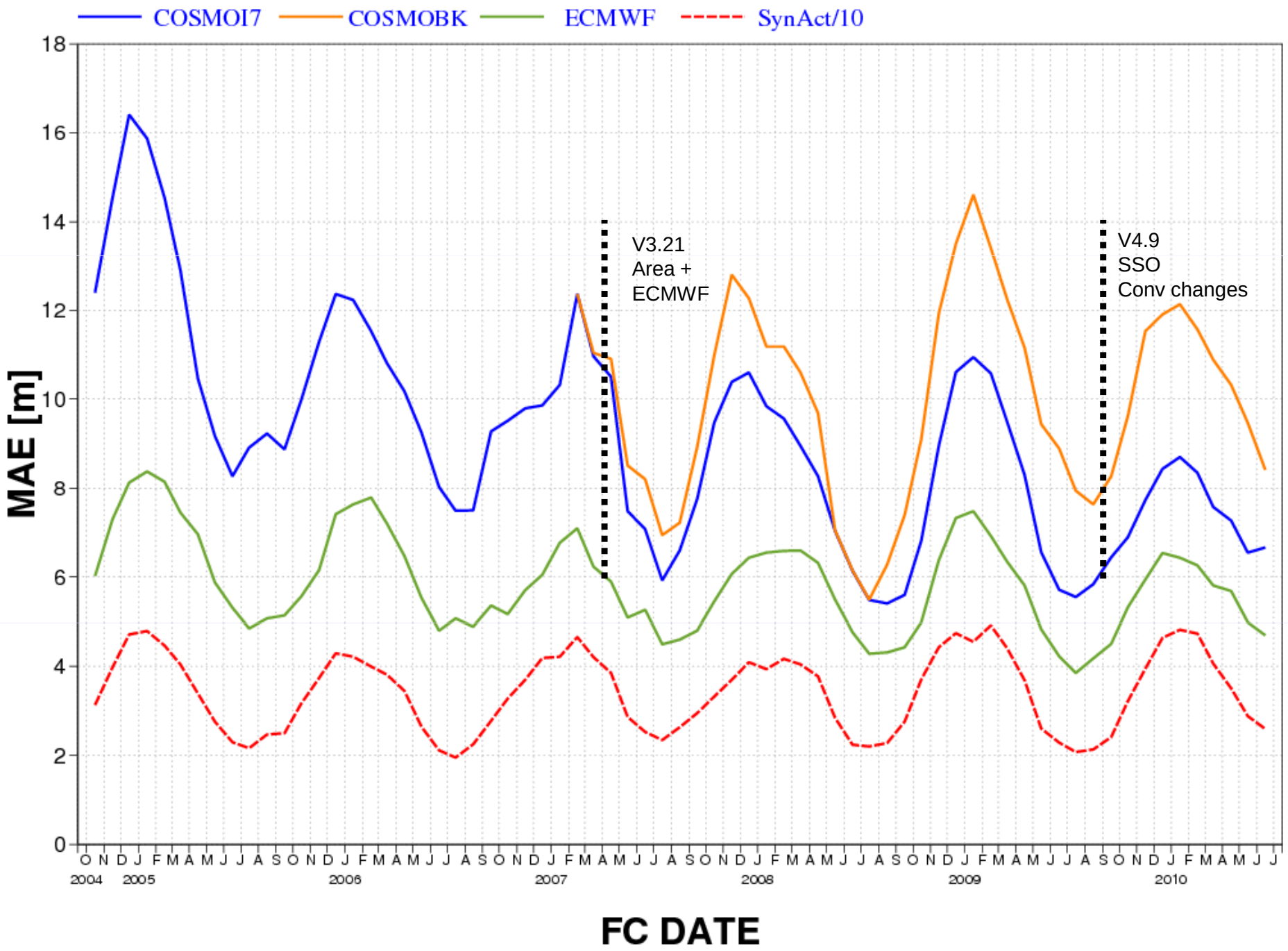
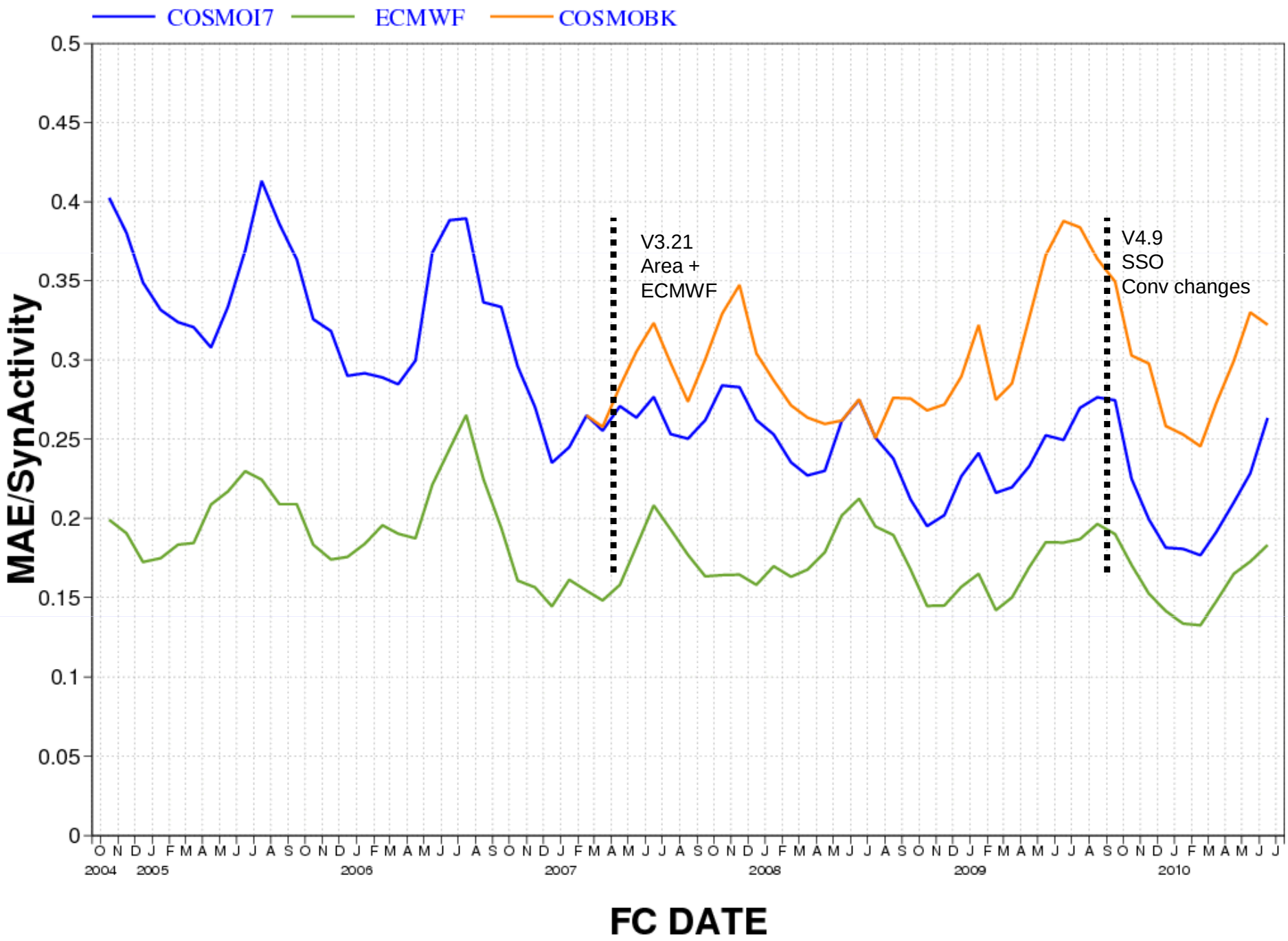
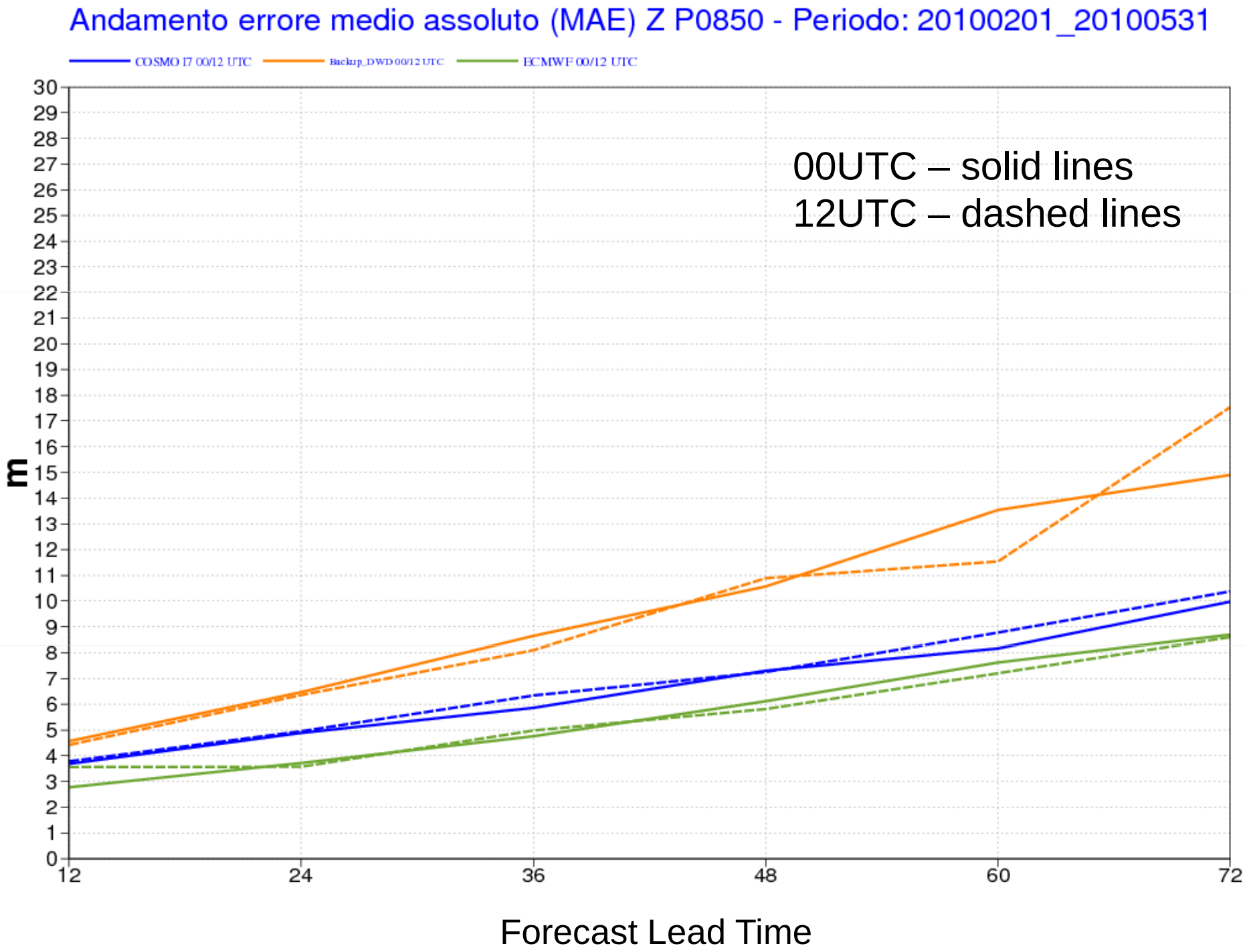


Error normalized by SynActivity over COSMO-I7 domain – FC+48 Z850 vs ECMWF AN

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12UTC – dashed lines
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Forecast Lead Time

Cosmo model is improving……

……..but how can we make it better

PBL issues

Problems

- *Too strong outgoing surface fluxes, lack of low level clouds and excessive mixing in strongly stratified conditions.*

- 2m Temperature diurnal cycle problem, with a warm bias of minimum temperature over low-land and stable conditions

Research

Re-tuning of minimal diffusion coefficient. *Patrick Volkert, DWD*

Increase interaction and exchange of kinetic energy from of other sub-grid scale phenomena and resolved termo-dynamics with the turbulence scheme (scale interaction terms). *Matthias Raschendorfer, DWD*

Revision of the surface transfer scheme to started soon.

Ongoing work on the Unified Turbolence Shallow Convection Scheme (UTCS), based on a unique closure assumption for the whole sub-grid scale spectrum of phenomena. *UTCS PP*

Surface Parametrization

Problems

- *the lack of parametrization of peat land (boggy area) might be a source of large errors in near surface parameters in regions with tundra.*

Research

ROSHYDROMET has developed a parametrization for global model, to be tested in COSMO model. Alla Yurova

Microphysics and precipitation issues (1)

Problems

- The current one-moment schemes have limitations: e.g. evaporation of raindrop is dominated by the drop size, which is not a prognostic variable or weaknesses, e.g. melting of snow is often too fast.

- The two-moment scheme even after vectorization, it is too expensive for operational use and maybe overly complicated for most NWP applications.

Research

New intermediate schemes of different complexity have been developed for the COSMO model. For example adding a second moment only to liquid species (nuber of raindrops) to the actual Graupel-Scheme. New melting scheme is still under development, and has to potential to improve forecasts of precipitation phase. *Axel Seifert, DWD*

Microphysics and precipitation issues (2)

Problems

- saturation adjustment is formulated as an isobaric process and does not conserve mass. There is more condensation than evaporation with a net sink of mass (liquid water and total mass).

Research

Use of volume conserved formulation: Isochoric processes. Implications: Change of thermodynamic, adding pressure diagnosis after adjustment (→ let the model deal with the introduced pressure perturbation)

Isochoric saturation adjustment does conserve mass and seems to increase precipitation for both EU and DE.

Also influence on precipitation structure

Preliminary results seems encouraging.

Blahak and Seifert, DWD

Microphysics and precipitation issues (3)

Problems

COSMO-DE and COSMO-I2:

➢Lack or underestimation of deep convection, non sufficient interaction between deep convective systems

Research

Some convective case studies were investigated, were COSMO-I2 performed poorly, running at 1km resol. A moderate sensitivity to resolution was observed showing potential benefit. Some parametrization retuning might be required. Antonella Morgillo, ARPA-SIMC

Comparison of verification results from Tidke, IFS and Kain-Fritsch convection schemes. *MeteoSwiss*

RADIATION

Problems

- RTE contains severe approximations and limitations mostly due to computing time restrictions.The most critical issue in this context originates from the need to integrate solutions of the RTE over all energetically relevant wavelengths

Research

Monte Carlo Spectral Integration provides an opportunity to overcome some shortcomings of classical approaches, with a high frequency random sampling of wavelengths.

Applying the MCSI approach in the framework of the COSMO NWP model demonstrated:

the introduction as a variation of the RG92 radiation scheme poses no major problem

no evidence of significant deterioration of critical forecast products was found in a forecast experiment. Bodo Ritter, DWD