Minutes of the meeting of COTEKINO PP and WG7, Offenbach, 20th March 2014

Participants:
Dmitrii Alferov (RHM), Marco Arpagaus (MeteoSwiss), Riccardo Bonanno (ARPA Piemonte), Michael Buchhold (DWD), Christoph Gebhardt (DWD), Richard Keane (DWD), Daniel Leuenberger (MeteoSwiss), Nicola Loglisci (ARPA Piemonte), Francesca Marcucci (CNMCA), Chiara Marsigli (ARPA-SIMC), Andrzej Mazur (IMGW), Andrea Montani (ARPA-SIMC), Christoph Schraff (DWD), Susanne Theis (DWD).

Agenda:
9.00 – 12.00 COTEKINO Task 3
9.00 – 9.10 Introduction (Marsigli)
9.10 – 9.40 Results of the sensitivity tests (Bonanno)
9.40 – 10.00 Discussion
10.00 – 10.30 Results of the sensitivity tests (Mazur)
10.30 – 10.50 Discussion
10.50 – 11.10 coffee
11.10 – 11.40 proposal of perturbation techniques to be implemented and tested (Bonanno, Loglisci, Mazur), discussion
11.40 – 12.00 planning of future work
12.00 – 13.00 joint meeting with VERSUS/WG5 on EPS verification with VERSUS
12.00 – 12.45 information about the results of the tests of EPS verification with VERSUS (MCH, RHM, ARPA-ER), discussion
12.45 – 13.00 implementation of new scores (Celozzi, Marsigli)
13.00 – 14.00 lunch
14.00 – 15.15 WG7 meeting
14.00 – 14.30 COSMO-LEPS status and LAM-EPS BC tests (Montani)
14.30 – 14.45 discussion on COSMO-LEPS (all)
14.45 – 15.15 discussion on physics perturbations, mainly SPPT (Arpagaus, all)
15.15 – 15.45 coffee
15.45 – 17.30 joint meeting with WG3b/SOILVEG
15.45 – 16.15 short presentation of the results of the sensitivity tests (Bonanno, Mazur)
16.15 – 17.30 discussion about the results and the proposed perturbation techniques (all)

Minutes:

COTEKINO Task 3

The meeting started with two presentations, followed by discussion.
Presentations:

- Riccardo Bonanno: Sensitivity test at ARPA Piemonte and plans
- Andrzej Mazur: Sensitivity test at IMGW and plans

Riccardo Bonanno's presentation.
During the discussion which followed the presentation, several issues came out. It is suggested to plot the spread of the soil moisture at different levels in the soil, not only in the first one (especially for summer, when evapotranspiration is dominant). It is also suggested to plot the spread of atmospheric variables in the troposphere, not only at the surface (values on the first 10 levels have already been stored for this purpose) and of the fluxes. As for the proposed perturbation technique, the issue of the spatial scale and of the amplitude of the perturbations has also been discussed. It is suggested to try very different spatial scales, ranging within one order of magnitude, in order to

check how this influence the resulting perturbations and if it is needed to perturb also the small scales. It is suggested to compute spread not only as a value over the whole domain, but also on sub-areas, in order to assess at which scale is the spread mainly taking place. It is discussed if it is worth to analyze the scale of the soil moisture variations as estimated from satellite, considering that this field is at quite low resolution. The amplitude of the perturbations could be more important than their structure, this should also be addressed.
It is pointed out that spread values should be checked against error values, keeping in mind that part of the error is bias, which should not be accounted for by ensemble perturbations. Finally, it is worth reminding that soil perturbations are meant to be added also in the assimilation cycle with KENDA, which can alleviate the problem of too low spread at the beginning of the run.

Andrzej Mazur's presentation.
Sensitivity to soil related parameters has been tested. In particular it has been found a significant sensitivity to variations in the parameters c_soil (variation from 0 to 2) and czbot_w_so (variation from 0 to 5). The amount of variation is for the first parameter up to 1-2 degrees in temperature in some cases, which is regarded as too large. For the second parameter, variations are generally smaller. During the discussion it is suggested to plot also the error of the considered variables, to have a reference against which to compare the effect of the perturbation, aiming at defining a suitable perturbation amplitude. As perturbation technique, it is proposed to perturb these two parameter, independently, with values of c_soil variation reduced with respect to those applied in the test. In particular, it is proposed to perturb these parameters not homogeneously over the domain, but to perturb the value at each point of the domain, applying some spatial structure to the perturbation. Tests will be performed setting up a dedicated ensemble with IC and BCs from the GME deterministic run, driving a COSMO run at 7 km which in turn drives the 2.8 km perturbed runs.

During a previous web-conference, it was highlighted the importance of comparing the effect of the soil perturbations which are going to be developed against that of other types of perturbations (initial and boundary conditions, physics). As for the Italian domain, tests will be performed in the framework of the development of the COSMO-IT-EPS ensemble. As for the polish domain, it is not planned up to now to set-up a "full" forecasting ensemble over Poland and the area is not covered by COSMO-DE-EPS. Therefore, it is proposed to use the COSMO-LEPS ensemble, which, though running at coarser resolution, is covering Poland. The output fields forecasted by COSMO-LEPS will be provided by Andrea, for the considered variables.

Joint meeting with VERSUS/WG5 on EPS verification with VERSUS

For this part of the meeting, the colleagues of the WG5/VERSUS meeting joined WG7 ones (A. Bundel, A. Celozzi, F. Gofa, A. Iriza, P. Kaufmann, M.S. Tesini).
This meeting was aimed at checking the outcomes of the testing phase of the EPS verification tool in VERSUS. First Angela has presented the feed-backs received from the colleagues of MCH, RHM and ARPA-SIMC, who have tested the tool. Then Angela presented the actions on-going or planned to overcome the existing problems. Finally, discussion took place about the needs of the COSMO colleagues for really being able to use VERSUS for the operational verification of ensembles in their countries. The needs which have been identified are:

- RPS and RPSS computation also for non-MECE classes in input. When the tool was implemented, it was decided to do it so that all the scores (included RPS and RPSS) are computed for all the classes, exactly as they are defined by the user. In particular, they can be "open", non MECE (Mutually Exclusive Completely Exhaustive), or "close", MECE. In the case of RPS and RPSS, though, these scores are well defined only for MECE classes. Therefore it was decided to put a warning message in case the classes are non-MECE,

saying that RPS and RPSS values should be disregarded in this case. It is now required a modification, that is to compute RPS and RPSS correctly even if classes are non-MECE. This means that VERSUS should compute MECE classes out of the non-MECE ones and then compute the two scores correctly.

- Implement observation-based verification. Currently is forecast-based.
- Implement the suspect observation check. Not used for precipitation, mainly for MSPL.
- Add ROC area value in the score table.
- Produce the plots in pdf instead of png.
- Is it needed to extend the tool for upper air verification?
- Add CRPS/CRPSS and spread/skill relation.

All these requirements should first be estimated, by the VERSUS team, in terms of the time required for the implementation. Then priorities will be attributed, in collaboration with WG7.
In parallel, the performance of the verification tool for ensemble should be checked, in terms of both accuracy of the results and computing time. Andrea has offered to perform the next operational verification of COSMO-LEPS (1 season, 12h precipitation against BUFR, all domain) with VERSUS, to provide an estimation of the time required and to compare the results with those obtained with the SW presently in use at ARPA-SIMC.

WG7 meeting

COSMO-LEPS. A presentation was given by Andrea. In particular, it is shown that COSMO-LEPS is currently using COSMO version 5.0 and int2lm 2.0. Members 1-8 use Tiedtke as convection scheme, while members 9-16 uses the IFS-Bechtold one. Among the plans at ARPA-SIMC there are: the increase of vertical resolution from 40 to 50 levels, the revision of the clustering methodology and the verification of the HYBEPS suite.
SPPT. The results obtained by MeteoSwiss with the SPPT scheme have been discussed (presented in the plenary). It was highlighted that too little spread is obtained in humidity, especially at low levels. It is planned to run ensemble with and without SPPT also for one winter month and to test the effect of applying the perturbation only to selected schemes (e.g. removing the perturbation of the radiation). As for the SKEB scheme, which has also been implemented by MCH, no tests have been performed up to now but it is reported that the run becomes very slow.

Joint meeting with WG3b/SOILVEG on COTEKINO-Task 3.

For this part of the meeting, WG7 people joined WG3b colleagues (J.M. Bettems, G. Duniec, J. Helmert, J.P. Schulz). This meeting was organized for having feed-backs from WG3b about the work on soil perturbation.

First the work done was shown by ARPA Piemonte. In the discussion it was underlined the importance of checking also the perturbations applied at the lower soil levels, especially for summer cases. It was suggested to explore the effect of making the amplitude of the perturbation dependent on the season. Moreover, assuming a dependence of the spread from spatial scale (fact that has to be demonstrated with some sensitivity tests), it was suggested to guide the spatial scales of the perturbation by the scale at which precipitation occurs, as the main factor influencing soil moisture. It was suggested to perturb the LAI (leaf area index) field, to which the model exhibits great sensitivity.
Secondly, the work done by IMGW was shown. It was clarified that c_soil (described as surface area index of the evaporating soil) defines the fraction of the bare soil which can evaporate. It was introduced in the code by M. Raschendorfer, therefore it is suggested that Andrzej should better ask Matthias about its effect and the possible variations. The czbot_w_so parameter is defined as the depth of bottom of last hydrological active soil layer. It is noted that perturbations of this value are

effective only if the value is decreased (moved up), thus intercepting the root layer. This efficiently reduces the amount of soil water available for evapotranspiration, eventually leading to an enhanced drying of the active model soil, which has a high impact on the water cycle and via the latent heat flux also a high impact on the energy cycle of the model.
In general, it is suggested to consider for perturbation also the root_depth field, to which the model shows sensitivity. Jean-Marie suggests to consider also feed-backs from the CALMO project, since the methodology implemented in CALMO provides for each considered parameter a range of variability. Finally, Christoph Schraff pointed out that experience in other consortia can be also considered, referring to a work done with AROME where the model was shown to exhibit sensitivity to few fields/parameters (among which LAI, minimal stomata resistance, soil moisture).

It was concluded that further results obtained with the implementation of the proposed perturbation techniques will be again discussed with WG3b, next time at the COSMO GM.

Actions for COTEKINO-Task 3.

- Provide ensemble outputs for the case studies considered to ARPA Piemonte (COSMO-IT-EPS) and IMGW (COSMO-LEPS).
- Andrzej will check with Matthias the effect of c_soil and the suggested range of variability.
- Prepare a contribution for the COSMO Newsletter (Andrzej, Riccardo)
- Complete the analysis of the sensitivity test also following the suggestions
- Implement and test the proposed perturbation strategies