AROME input to common HMG-CSSI meeting to be held on the 5th of june 2005

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Preamble:
This document will serve as an input to build a common working plan HIRLAM-ALADIN. It aims at giving the current and planned R&D actions for AROME (2005, next year 2006 and indications for 2006-2010). As there are other documents required in thematic areas that are also part of AROME, we will not cover here assimilation and predictability part (see C. Fischer and H. Horanyi inputs) , neither dynamics issues (see R. Brozkova input). This document is giving additional elements to the one of F. Bouttier (AROME recommendations) on the forecast AROME activities with focus on technical and physics issues.

1) Current AROME 2005-2006 working plan

Arome development: "towards operations"

- Experimental environment: The aim is to have a clean and "ea   sy-to-use" environment for AROME. All the environmental aspects have to be improved: the preparation of files, the treatment of the results (also graphical aspects).
- Code evolution and maintenance: The code should enter the operational process and in the same time should keep the same evolution as the one of MNH for the physics. The code should also evolved in order to take into account ALARO needs (physical-dynamical interface and surface issues).
- Validation
  - o Case studies: The validation of AROME at this time should demonstrate the capability to give the same results as the ones of MNH (convective cases-MAP cases) and also the capability of the numerical stability of the NH-dynamical kernel (routine forecasts).
  - o Diagnosis: Development of diagnosis for Arome based on reference equations and ARPEGE/ALADIN diagnosis software.
  - o 1D-model: As the 1D-model is absolutely needed to test and validate physical package and as there exist several versions (ARPEGE, AROME, …) some harmonization and development work will be done to have a common 1D platform.
  - o Identified problems (new issues detected by validation processes to be covered by subsequent working plans)

        Coupling: unrealistic wind convergence and thus precipitation inside coupling zone.
        Orography ?: Review of database if needed.
        Plumes: precipitations have elongated structures which seem related to orography.

Arome applications: "towards end users"
- Chemistry in Arome
- Coastal forecast

Research:
- Reference equations for Arome: This part is the first needed contribution to the more transversal subject known as physical-dynamical interface that does concern not only AROME but ALADIN/ARPEGE/ALARO. The aim is to obtain a reference set of equations with a multiphasic air-parcel and to apply it to AROME. This will imply to add missing terms in MNH-AROME code (heat transport by the falling species …) and to review part of the ALADIN code ("delta m" option) to adapt it to the barycentric system of equations.
- Physics:
  - Microphysics: tuning of the current MNH-AROME microphysics scheme ICE3 (autoconversion ice-snow). The method uses satellite imagery in combination with model-to-satellite tool.
  - Subgrid condensation and link with shallow convection and turbulence: The aim is a better representation of small cumulus clouds for dry boundary layer conditions. (1)The work is to evaluate the fraction of mesh that condensates both from the turbulence scheme and from the shallow condensation scheme. (2)Another area of research is also evaluated by putting a new scheme instead of the one currently used in MNH-AROME for shallow convection that will also aimed at improving small cumulus clouds.
  - Surface: sea-surface improvements. New bulk-parametrisation of the sea-fluxes.

2) AROME medium-term scientific plan (2006-2010)

This time table covers the date of the put-in-operation of Arome in Météo-France. There is no doubt that this will highly influence the work of people involved in AROME at Météo-France.

Arome development:
- Experimental environment: The experimental environment should evolve to the one currently used by other operational models (ARPEGE/ALADIN i.e. Olive system or its evolution). This environment should also include the AROME assimilation.
- Code evolution and maintenance: Same constraints as before plus the ones of the operations, so the code will have to be ported to the new calculator (not know yet) and optimized.
- Validation: An optimal configuration for Arome over France should be design taking into account the model cost, the computer resources and optimal resolution to benefit from the physics. The validation should enter the operational process (e-suite)…

Research:
- Physics:

- o <u>Microphysics:</u> (1)Improvement on Cirrus description (2 ice species to integrate into ICE3 MNH-AROME current microphysics scheme). (2) ICE4 (new hail variable) to be evaluated for AROME.
- o <u>Turbulence scheme:</u> (1)Improvement of the current scheme (1D) by adding the counter-gradient for convective boundary layer to solve the problem of dry convective boundary layers that are known to be too unstable. (2) Introduction of the water phase into BL89.(3) Evaluation of the need and the possibilities to introduce the 3D turbulence scheme in AROME.
- o <u>Surface:</u> Sea-surface: (1)Introduction of a 1D ocean superficial mixed layer model, (2)evaluation of an interactive coupling with a coastal ocean model.
- o <u>Fog</u>: Evaluation for AROME. The fog should be introduced into MNH soon (sedimentation of fog droplets into microphysics scheme) then the opportunity in AROME might be evaluated.