

Convergence on MICROPHYSICS between AROME and ALARO-0

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METEO FRANCE
Toujours un temps d'avance

AROME/Meso-NH microphysics **ICE3** – Main differences with ALARO microphysics **APLMPHYS**

GENERALITIES on ICE3: A classical bulk mixed microphysical scheme developed in Meso-NH with 3 ice categories by J.-P.Pinty (LA).

Analogous schemes are in MM5 (based on Lin et al.,1983), WRF, RAMS (Walko et al.,1995) up to 5 ice species

Developped mainly upon tropical squall lines (Caniaux et al., 1994), largely validated on Cevenol flood events (Ducrocq et al., 1999,2000), MAP orographic precipitation (Stein et al.,2004; Asencio et al. 2005; Lascaux et al.,2006) : **A long time validation.**

MAIN DIFFERENCIES BETWEEN ICE3 and APLMPHYS :

- Mainly adapted to **β -mesoscales (<5km)** : **Resolved** variables : grid-mean values (no account for subgrid-scale variability except for the autoconversion) and small Δt (up to 60s) due to local calculations \neq Subgrid approach with 3MT, adapted to long Δt (400s in ALARO)
- Includes prognostic graupel hydrometeor with a large number of processes (30) (without the possibility to switch off the graupel) \neq Diagnostic graupel and 8 processes (up to 11 if graupel becomes pronostic)
- Sequential treatment of the processes in a bulk mode over all levels with an indirect dependence to the order \neq Specific treatment of the processes (according to the subgrid zone) level by level

ALARO Proposal

Objective for AROME microphysics : To integrate an interoperable system including 3MT

Main implications for AROME microphysics:

- Splitting of the bulk routine into individual microphysical routines
- Pushing reshaping functions upward, leading to single level subroutines
- Introduction of converters : tendencies to fluxes, reverse order of vertical levels indexing, mixing ratio to specific humidity ...

Main difficulty (beyond the development) : the **reproducibility of the results** (due to the specificities of each scheme) : due to the different number of microphysical processes and the status of graupel, the dependance to the order of processes, the subgrid approach embedded in 3MT

Workforce: At least 3 persons x month, not including the validation (long)
With the huge difficulty to compare consistently the old and new schemes (pb already met between ACPLUIZ and APLMPHYS, in a simpler context, see Y.Bouteloup note)



Our Position

- **Actual tendency in the international microphysics community** : Towards a more sophisticated microphysics : Especially the 2-moment mixed microphysical schemes (ex: WRF, LM with ...) for all the range of clouds.

Plan for Meso-NH: To implement and validate the Grabowski and Morrison (2008) 2-moment mixed scheme (currently tested in WRF) :

→ **The ALARO proposal is not a priority of development for Meso-NH**

2. The proposal, if **developed by ALARO with the help of Meso-NH/AROME**, will be evaluated in Meso-NH/AROME if :

- The compatibility with the Meso-NH environment is preserved
- Results are reproducible
- The computational efficiency is not reduced

3. **Questions** : How to deal with an added prognostic variable (e.g. Hail)?

Shall we have to **recode a future microphysical scheme in AROME** to keep interoperability ? i.e. an existed 2-moment scheme, with new scientific difficulties : **New strong constraints**

Summary : Very interesting to collaborate (intercomparisons ...) but difficult to merge the 2 systems