ICE3 ‘physics’ in ALARO’s algorithmics

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Content of the talk

- Recalling the challenge
- Steps concluded
- New problems identified
- Plans
- Conclusion

The challenge

- **Using the algorithmic structure of APLMPHYS (i.e. mostly: PDF-based sedimentation & accounting of the geometry of clouds and precipitations) to 'host' microphysical computations 'extracted' (at unchanged scientific content) from the Meso-NH 'ICE3' code.**
- **The produced routines (in the extraction process) must be able to be called from the Meso-NH code, in the original order.**
- **The ALARO-oriented insersion may be performed via an option common to all extracted routines. The internal algorithmics may be changed to fit the APLMPHYS constraints, but the results must remain the same when using vanishing time steps lengths.**

Remarks

- There is no obligation to reproduce the ICE3 (rather rudimentary) sedimentation computation.
- The current stand-alone character of ACACON, ACCOLL and ACEVMEL, if one may ‘find it back’ in ICE3, is a guarantee that the ‘extraction’ + ‘reuse’ strategy will work. However, this implies independency of the processes.
- There is a structural difference in the way to apply ‘securities’ on the results:
  - Fully sequentially in ICE3;
  - Sequentially between ACACON, ACCOLL and ACEVMEL in ALARO, but parallelly inside each of these routines.

Steps completed

- Extraction, sometimes via a split with respect to the original ICE3 decomposition (for diagnostics), of 28 ‘processes’.
- Adaptation to the ALARO-0 syntax.
- Internal duplication of the created routines (the [future ALARO] second part is yet quasi-untouched).
- Testing that the code works in a mode where graupel is desactivated. In fact, this limits quite strongly the testing possibilities.

New problems identified

- There are internal communications (outside via amount of species) in ICE3. To make things worse, they happen between ‘processes’ that shall be separated in the ACACON, ACCOLL and ACEVMEL.
- There are ‘processes’ involving three species at the same time.
- The distinctions between cloud and falling species is not as clear-cut in ICE3 than assumed in the APLMPHYS logic.
- Some ‘processes’ seem to be directly of the ‘positive feedback inducing’ kind.

Plans (1/2)

- The graupel issue has clearly been underestimated. Rather than an ‘empty’ prognostic-graupel hosting structure, we need an application of the latter to a case with minimum ICE3 interaction (as back-up and control).
- Hence the idea of a ‘fake’ code:
  - Optional prognostic graupel;
  - Related processes are alike those in ICE3, but they fall within 3 categories:
    - A carbon-copy of the current diagnostic graupel situation;
    - An ‘injection’ of an ICE3 process without yet any equivalent;
    - The ‘invention’ of a mixed type algorithm (like we did with the work of Lopez (2000) for the ALARO-0 microphysics).

Plans (2/2)

- We need to get independent from the ‘sequential rigidity’ of the ICE3 code.
- Hence the duplicated parts of the ‘process routines’ to be used in the ALARO spirit shall not have internally activated securities.
- The output of the routines will be buffered into ACACON, ACCOLL and ACEVMEL (with ‘protected’ input for their computation or not, on a case to case basis) before a specific ‘merging’ algorithm happens right at the end of each of the three routines. There (and only there) sequentiality will become ‘effective’ at the ALARO level.

Conclusion

- We probably have not yet completely analysed the consequences of what was called earlier in this presentation ‘new problems’.
- We however hope that the two key-instruments we have chosen (‘fake’ solution for the prognostic grauple and ‘buffering’ the I/O at the level of ACACON, ACCOLL & ACEVMEL) will help coping with all the induced difficulties.
- Still, there is surely some interesting work to look ahead to. APLMPHYS might however become a rather complicated code.
- The possible further extension to ICE4 was intentionally not taken into account (already too much to do at the ICE3 level).