MF’s view on the “outflow problem” (aka as “fireworks”)

- Sub-optimal namelists and code versions: support for cross-check with MF versions is guaranteed by CNRM
- At least one “robust” case (KNMI) reproduced with Arome-France settings and with Méso-NH (even if with different detailed structure, intensity or timing)
- Possible causes (open list):
  - Phys/dyn interface in Arome: may be one cause of the problem, but not the only one.
  - Arome model version exhibits more cases of too strong outflow than other versions => Arome-specific causes are likely (or exacerbate the problem in this model design)
  - Other tracks (than PDI) need to be followed: eg. The work with simplified NH 3D models undertaken at ECMWF (S. Malardel) => this must remain an axis of collaboration between modelers
  - Diagnostic work on outflow has started (eg. Hirlam) but their interpretation remains complex. Such cooperative work should however be further encouraged.
- Low-level divergence & cooling are genuine processes in strong convection: we lack observations in order to measure their real strength satisfactorily
- Over-damping such processes may lead to a general deterioration of the model in real severe cases.
- The clearest weakness noticed in Arome is the over-prediction of strong RR => this may be linked with the outflow issue

2010 work in relation with the outflow problem

- Non-conservation of humidity by Arome's semi-Lagrangian advection scheme: specification then coding; collaboration with ECMWF
- Flow-dependent horizontal diffusion operator (SLHD) and its extension to mimic a 3D turbulence: cooperation CNRM/CHMI; will definitely be tested once ready
- Assess the impact of a modified PDI (CPTEND_NEW): once ready, will be tested in Arome
- Test 3MT in Aladin-France at Arome-type resolutions: will tell whether a "grey-zone" designed scheme can be beneficial