Data assimilation Sessions &
Plan for cooperation in ACCORD DA area

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Thanks to: Benedikt Strajnar and Loïk Berre

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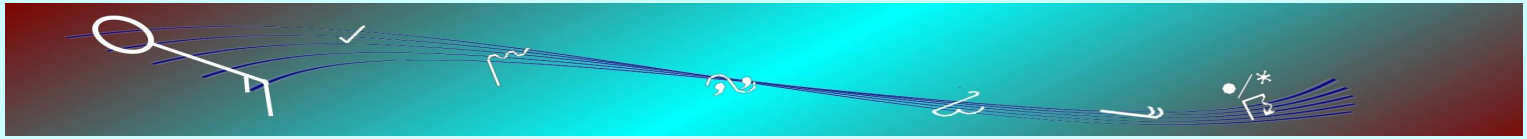
Outline

- **Working strategy within ACCORD DA area**
- **Outcome of the 1rst ACCORD workshop**
  - Few points from the DA sessions
  - Few points from the discussions



Working strategy within ACCORD DA area

- **After consultation with Benedikt Strajnar and Loïk Berre**
- **Until now:**
  - **In LACE**:
    - well organised stays/scientific visits
    - working days (once a year)
      - exchange of developments/achievements. Direct interaction with developers
  - **In HIRLAM**:
    - working weeks
      - exchange of developments/achievements. Direct interaction with developers
      - Solve together concrete problems (hands in)
  - **Video meetings**:
    - Five groups of topics (Conv obs; radiances, retrievals, radar data, algorithm)
- **We would like to try**
  - Stays will be planned further when both host and visitor have maximized working time.
  - **working days/week**:
    - Roger will collect in advance all the achievements to be known preferably prior to the meeting
    - The information about 1) needed settings, 2) short description of lesson learned, and 3) scientific documentation or presentation.
    - Minimum two of "DA1/DA3 meetings "-- guaranteeing the blue points above will be organised.

Working strategy within ACCORD DA area

➢ Formation of teams

- **Research teams (DA2, DA4, DA5, DA6)**:
  - Teams will be formed to deal with some high priority tasks from the rolling work plan
    - Reasonable number of research teams
    - Face to face meetings will be organised in order to solve together concrete problems
    - Regular video meetings will be organised
- **Support teams (DA1, DA3, DA7)**:
  - can be as many as needed and can define regular or by demand video meetings
  - meet at working weeks
    - exchange of developments/achievements. Direct interaction with developers

➢ Avoid repetition of development works

- **Porting of developments**:
  - CSC leaders are responsible for the implementation of the new developments
  - All developments/achievements should be ready to be used in each CSC
  - All developments will be delivered in form of “pluggable” functions into all three CSC DA system
    - Function: comprises all needed manipulation of input data, namelist setup and takes care files naming conventions
  - Developers are responsible for the “functions”, short how-to describing the implementation process, changed source codes, and scientific documentation if appropriate
  - Little by little we build a common and modular DA system
  - The functions will be prepared to be called in Bator, Canari, Screening, or minimisation

Working strategy within ACCORD DA area

➢ Avoid repetition of development works

- **Transparent developments**:
  - In long term we will have transparent development throughout all CSCs
  - Use of Davaï for testing all developments

➢ Co-leading the teams:

- The teams work will be co-lead with one or two members from the teams

Outcome of the 1rst workshop

➢ DA1: Further development of 3D-Var (alg. Settings)

- Accounting for low resolution observations using supermodding approach (Máté Mile PhD): https://doi.org/10.1002/qj.3979
- Accounting for large scale information:
  - *Variational assimilation without J_k term but using $B^{\sim}$ and $x_b^{\sim}$* (Ole Vignes)
  - *Need of new strategy to construct EDA-based LAM EPS* (Ulf Andrae)
  - Variational constraint scheme was proposed (Carlos Geijo)
- Need for tuning of B error covariance when increasing the model resolution (Viktoria Homonnai)
- weak coupling between surface and upper-air DA: concept proved (Jostein/Yurii/Trygve)

➢ DA2: Development of flow-dependent algorithms

- *Multi-incremental 4D-Var and improved use of observations in Harmonie-AROME* (Jan Barkmeijer)
- *Hybrid EnVar in Harmonie-AROME* (Jelena Bojarova)
- *3D/4DEnVar in AROME-France* (Pierre Brousseau)
  - 3D-Var in and outside OOPS are identical
  - OOPS_3DEnVar considered for e-suite in 2022
  - *size of the EDA ?*
- *Variational constraint (tested with field alignment) in Harmonie-AROME* (Carlos Geijo)

Outcome of the 1rst workshop

➢ DA3: Use of existing observations

- **Radar data**:
  - There is room for improvement in AROME for both DOW (Jana Sanchez) and REFL (Maud Martet)
  - Reflectivity DA tested in high res ALARO (Benedikt Strajnar)
- **Aircraft-based observations**:
  - Mode-S EHS EMADDC (Alena Trojáková) and MRAR (Gabriella Tóth)
- **Scatterometer**:
  - Impact of ASCAT in 3D/4D-Var (CY43) and testing of HY-2B in CY46 (Isabel Monteiro)
- **Atmospheric Motion Vectors**:
  - adding data from middle level clouds (Zsofia Kocsis)
- **Clear sky radiances**:
  - adding ATMS, MWHS2, CrIS, IASI: (M Lindskog, R Eresmaa, J Campins, E Whelan)
  - *consider updating the VarBC coefficients differently, e.g when we have full coverage of instrument* (R. Eresmaa)
- **High resolution radiosonde**:
  - Descent data (Roger Randriamampianina, Eoin Whelan)
  - *vertical interpolation was questioned* (Reima Eresmaa)
- **GNSS ZTD**:
  - applied also in RUC from fixed (B Strajnar) and *moving (train) platforms* (Phillip Scheffknecht)
- **Netatmo surface pressure**:
  - (see next slide)

Outcome of the 1rst workshop

DA4: Use of new observations types

- **Surface pressure from Netatmo**:
  - *quality control (machine learning) and bias correction under investigation* (iOBS project)
- **Surface pressure from smartphones**:
  - *data are out of personal ID but collected with reduced location accuracy*
  - *quality control and bias correction need to be worked out*
- **High resolution T2m and Hu2m from Netatmo**:
  - promising results in nowcasting in MetCoOp and at ZAMG
- **Commercial microwave links**:
  - work in progress (Phillip Scheffknecht)
  - need a suitable observation operator for "rain rate" type of observation
- **MTG lightning**:
  - pseudo observations tested successfully in AROME-France (Felix Erdmann)
  - *potential observation operators based on microphysics and regression models were shown* (Pauline COMBARNOUS)
- **All-sky radiance**:
  - work in progress (Alertness project, Roohollah Azad)
- **Aeolus HLOS data**:
  - successfully tested with 3D/4D-Var in Harmonie-AROME (Susanna Hagelin)
  - rather neutral impact on analyses and forecasts

Outcome of the 1rst workshop

➢ DA5: Development of assimilation setups suited for nowcasting

- **Radar reflectivity**:
  - tested in AROME RUC (Florian Meier)
- **High resolution T2m and Hu2m from Netatmo**:
  - promising results in nowcasting in MetCoOp and at ZAMG
- **Atmospheric motion vectors**:
  - added in MetCoOp nowcasting (David Schönach)
- **Field alignment and Variational constraint schemes**:
  - *successfully tested in OSSE framework* (Carlos Geijo)

➢ DA6: Participation in OOPS (Pierre Brousseau)

- **Testing 3D-Var in AROME-France**:
  - MASTERODB and OOVAR analysis identical in CY46
- **Testing 3D-Var in ALARO**:
  - tested technically with 3D-Var and ALARO in MF machine
- **Adding hydrometeors variables**:
  - tested in AROME-France with direct assimilation of radar data (Maud Martet)
- **Adding NH variables**:
  - tested with single observations

Outcome of the 1rst workshop

➢ DA7: Observation pre-processing and diagnostic tools

- **Obsmon**:
  - Many new features (Paulo Medeiros)
- **MTEN**:
  - New presentation of the results (Zheng Qi Wang)
- **SAPP**:
  - Well presented by Yelis Cengiz. *Exchange of settings and setup seems to be required.*

➢ DA8: Basic data assimilation setup (Maria Monteiro)

- **Bator with conventional observation**:
  - All ready
- **Surface assimilation**:
  - All tested cycling
- **Background error statistics**:
  - 6 out of 8 have the downscaled version
- **Upper-air DA**:
  - cycling available in 3 out 8
- **Modular scheduler**:
  - good progress

Outcome of the 1rst workshop

More thoughts from the discussions

- **Sub-hourly data assimilation**:
  - Roger plans to organise a dedicated team to discuss this issue
- **Experience with single precision (Filip Vana)**:
  - SP will be used for trajectory runs and observation handling in ODB
  - no speed-up on Cray because of hacked Lapack library which uses double precision internally
- **Need for non-hydrostatic EnVar (Pierre Brousseau)**:
  - studied only in one case with severe convection
  - OOPS_EnVar is a good environment to add and evaluate different variables in the control vector
- **Surface pressure vs. geopotential assimilation**:
  - it is preferable to use pressure in combination with bias correction
  - The development is available but not yet in the common/export codes.
- **Tuning observation errors**:
  - Desrozier's approach is not enough. More diagnostic tools or evaluation approaches are needed
- **Correlated observations errors**:
  - changing the thinning distance and inflation of the observation error was shown to provide similar results