Report on HARMONIE/ALADIN surface assimilation working days *NetFAM workshop*

Met.No, Oslo, 16-20 March 2009

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12 May 2009

Objectives of this NetFAM workshop

- Validate the present HARMONIE surface and soil assimilation based on CANARI (ensure that everything is carried out correctly).
- Learn the CANARI coding structure (in order for HIRLAM staff to make real contributions in the field of land soil temperature and moisture, SST, sea ice, lake and snow assimilations).
- Report on progress and make a detailed plan for HIRLAM staff contributions in HARMONIE/ALADIN surface and soil assimilation (using CANARI and SURFEX)
- Discuss and start to develop techniques for a proper conversion of soil and surface variables from the ECMWF model to the soil and surface and soil variables in HARMONIE/SURFEX model (ISBA to start with).

Organization

- 26 Participants from ALADIN, LACE and HIRLAM consortia (10 countries) + NILU (private research institute collaborating with Met.No)
- General presentations on various aspects of surface assimilation
- Working groups on :
  - Conversion of soil variables between ECMWF, SURFEX and HIRLAM models
  - Developments around the CANARI spatial interpolation tool
  - Longer term developments for spatial interpolation tools
  - Observations for HARMONIE data assimilation
- Hands-on exercise with the SURFEX EKF

CANARI developments

Technical details on the set-up and performance of the current version of CANARI in HARMONIE have been carefully examined thanks to the presence of Françoise Taillefer (MF)

Recommendations :

- New ODB for CANARI (for improved observation selection)
- Tune error statistics (evaluate SPAN set-ups)
- Implement the SPAN vertical correction for orography differences in CANARI
- Introduce vertical correlation in the statistical model of CANARI
- Reduce the weight of non representative coastal stations
- Evaluate the SURFEX OI in HARMONIE
- Examine the behaviour of the snow analysis available in CANARI (working week planned in Toulouse - October 2009)

Towards a future spatial interpolation tool

Status : Soil assimilation is performed locally on spatialized observations (currently T2m and RH2m). There is a need for having a spatial interpolation tool for such application and also for SST, sea-ice and snow analyses. New tools should account for heterogeneities and anisotropies of the surface.

Methods discussed :

- Wavelets
- EnKF
- Recursive filters

Other items discussed : bias corrections and tuning of observation and model errors, coupling (consistency between land and atmospheric data assimilations)
Difficulties : lack of resources (EU FP7 EURO4M projet ? PhD students ?)

Conversion algorithms

Recommendations

- Several tools available : GL, c901+c927, PREP_SURFEX,
- Physical conversion to be applied on the native grid (coarse resolution of current ARPEGE climatologies)
- Interpolation should be carried on "flux preserving" variables (e.g. SWI)
- Corrections should be done on soil temperatures based on orography differences, including a redistribution of liquid vs. frozen soil moisture.
- Practical solutions have been given from H-TESSEL to ISBA-2L (recent work from J. Ferreira) and are available in a revised `CPREP1.F90` subroutine. Reflexion will be carried on in SRNWP Expert Teams (Interoperability, Surface)

Soil analysis

Current status

- EKF available in SURFEX and provided to all participants (source code, documentation, input and forcing files to run a test case)
- OI available in SURFEX and provided after the workshop - compilation issues not completely solved (LFI and XRD libraries)
- EnKFs and particule filters coded in SURFEX by NILU - to be evaluated and then merged in SURFEX with other soil analysis schemes (all of them ?).
- Development of an Adaptative Unscented Kalman Filter by Han The (KNMI) in a toy version of the soil analysis (i.e. outside SURFEX).
- Possibility to use ISBA-Ags in the SURFEX EKF (dynamic vegetation + patches) for the assimilation of LAI

Other analyses

Main topics

- Review on snow data assimilation (S. Mostamandy)
- Thoughts about lake data assimilation (N. Gustafsson)
- Results on surface albedo analysis using LandSAF products (J. Cedilnik)

List of suggested actions

- HIRLAM will introduce and test the interface to SURFEX for the various physical parametrization options in HARMONIE
- Météo-France will provide the codes and scripts for soil analysis based on the combined use of CANARI and SURFEX (J.-F. Mahfouf)
- The CANARI software will be improved in various aspects and revived for snow analysis (Maria Diez and Mariken Homleid)
- Météo-France will provide a revised version of the `CPREP1.F90` subroutine for conversions from H-TESSEL to ISBA (F. Bouyssel)
- HIRLAM will implement and test the "c901+c927" conversion in HARMONIE.
- The HARMONIE software package GL will be improved following recommendations from working group (Ulf Andrae)
- Examine the need to modify PREP_SURFEX to satisfy recommendations from working group

Remaining open issues

- Need for a joint effort regarding the development of spatial interpolation techniques. If the EU EURO4M proposal is accepted some resources could be available at Météo-France and SHMI. NILU wants to investigate EnKF techniques and ALADIN/HIRLAM has started to work on variational techniques based on wavelet approach for error covariances.
- Regarding observations, the question was raised on where to put the emphasis : retrievals or radiances ? (pragmatic approach in the short term : lack of resources to work on radiative transfer model and real-time availability of ASCAT retrieved soil moisture from C-band scatterometer)
- Reflexion on soil conversions should be extended to multi-layer soil schemes (HIRLAM, ISBA-DF) - Recommendations to be given to the SRNWP ET on interoperability

Practical exercise with SURFEX EKF

One month assimilation (July 2008) over France (9 pts) using ALADIN short-range forecasts as SURFEX forcing, CANARI screen-level observations and ASCAT superficial soil moisture.

Conclusions

- Successful working week but very busy (combined with a COST E0702 meeting)
- Significant progress has been made on the pratical use of numerical tools (CANARI, SURFEX EKF)
- Many ideas and informations have been exchanged during the week
- A number of actions have been defined on activities on surface assimilation within HARMONIE/ALADIN - even though there still a number of open questions (long term vision)
- Many thanks to Nils and Laura for organizing the working week (all presentations are available on `http://www.netfam.fmi.fi`)
- Many thanks to our Met.No colleagues for hosting us during this week and for solving many technical problems regarding the installation of SURFEX on the various PCs (Viel and Trygve)