Progress and plans on observations at Météo-France

C. Fischer

Content

- Arpège 4D-VAR, Arpège ensemble assimilation (AEARP) & outlook
- Aladin models, Arome-France & outlook

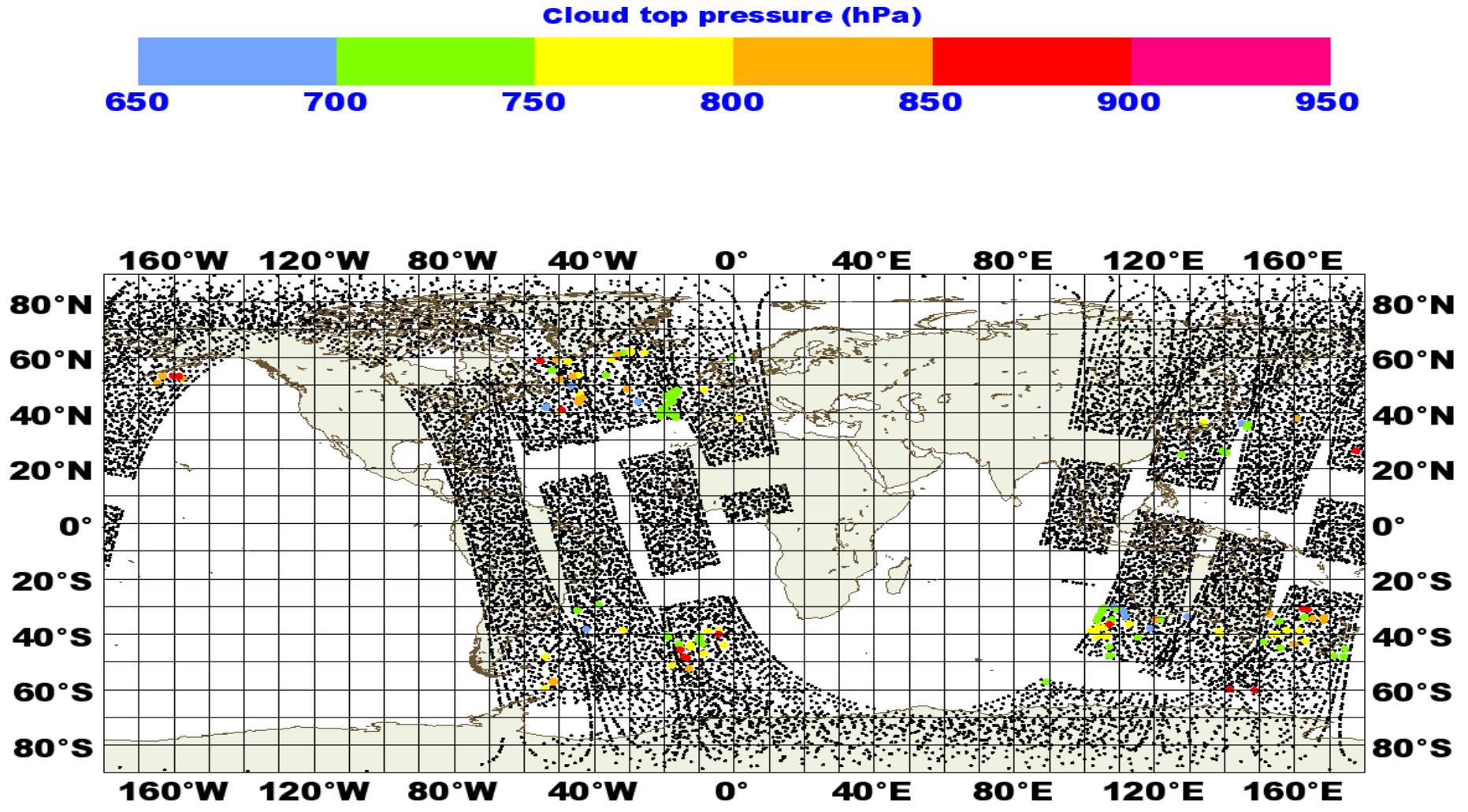
Part 1

AEARP & ARPEGE

Main changes introduced in the E-suite (started in March'12)

- CY37T1_op1
- Retuned σo's: AMSU-A, GPS-RO, TEMP, wind profilers, AIREP & ASCAT winds;
- Cloud (and rain) affected IASI radiances: CO2-slicing;
- Increase of number of observations: IASI (tropospheric channels over sea, stratospheric channels everywhere), EARS/IASI, ground-based GPS from EGVAP;
- Assimilation of RARS/ASCAT winds;
- Ensemble DA system: inflation of B(variances) for model error;
- adaptations in convection scheme; Arpège time-step reduced to 514 s & slight increase of horizontal diffusion;

Added IASI cloudy observations



In color, for conditional test {totally cloudy & cloud top ∈ [650, 900 hPa]

AEARP double (Assimilation d'Ensemble ARPège)

- **ARPEGE changes** are included in the AEARP 4D-VARs
- **inflation of dispersion sizes, in order to take into account model error.** The inflation is of a factor about 1.2 (leading to an increase of spread by a factor 2 to 3, depending on field)

PEARP (Prévision d'Ensemble ARPège)

- **Adapted** to changes in AEARP
- **Adapted to the changes in convection** for those members using a convection closure based on humidity convergence.

(G. Desroziers, L. Berre, C. Labadie, L. Descamps)

Outlook for Arpège 4D-VAR

- Radiances over land (*on hold*)
- Cloud (and rain) affected radiances: assess benefit of model cloud water content for RTTOV-cloud
- Increase of number of observations: NPP/ATMS, NPP/CRIS, Metop-B data, Ocean-SCAT, Megha-Tropiques; geostationary (GOES & MTSAT) radiances;
- Revisited strategy for GPS ZTD blacklisting (allow more data to be assimilated);
- Start testing VarBC for GPS ZTD
- Simplified physics: convection and turbulence (stratiform precipitation and GWD already modified in 2010) – *on hold* -
- Ensemble DA system: feed wavelet structure function parameters
- Increase number of members in AEARP at constant total numerical cost
- Code system overhaul: towards object-oriented coding of the IFS/Arpège assimilation system (« OOPS ») => started with CY38

Part 2

Aladin Overseas & Arome-France

Modifications in ALADIN

- **ARPEGE changes** included in the ALADIN models
- **4 Aladin 3D-VAR configurations**:
  - France: stopped on March 27, 2012
  - La Réunion: cyclone warnings in the Indian Ocean area
  - Polynesia, New Caledonia, French Antilles & Guyana: coupling with IFS

(G. Faure, F. Bouyssel, F. Taillefer)

Modifications in AROME and R&D aspects

- ARPEGE observations changes are included in AROME-France
- assimilation of Doppler radial winds from Plabennec radar site; monitoring of D-winds from Grèzes and X-band from St-Maurel;
- assimilation of SEVIRI over land;
- Assimilation of AMSU-A at higher density (80km instead of 125km)
- assimilation of more buoys in the CANARI OI for SST

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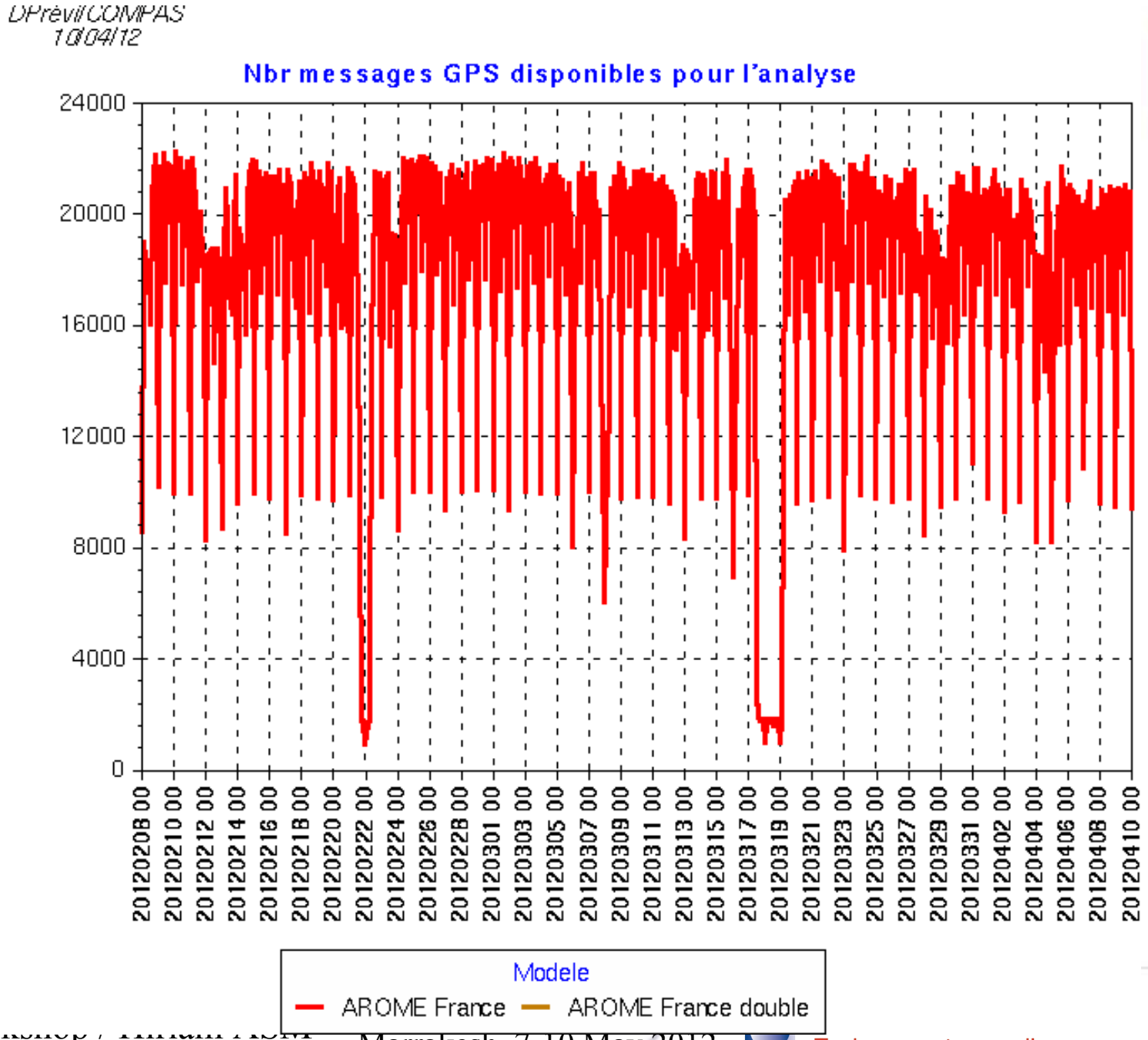
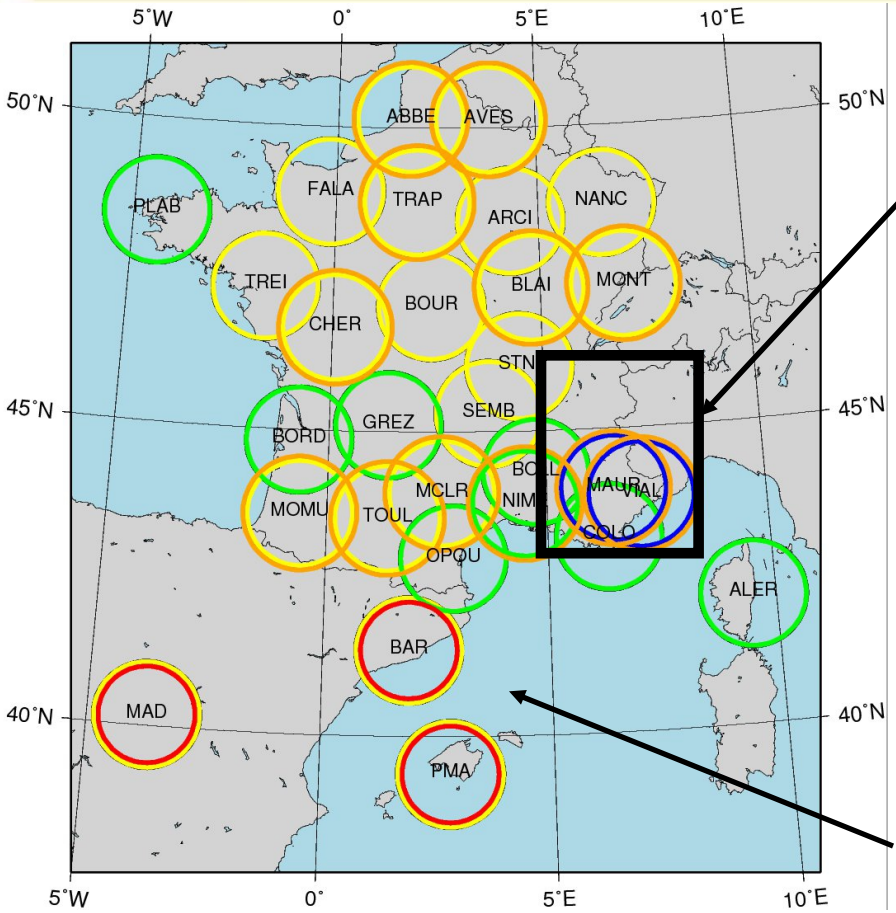
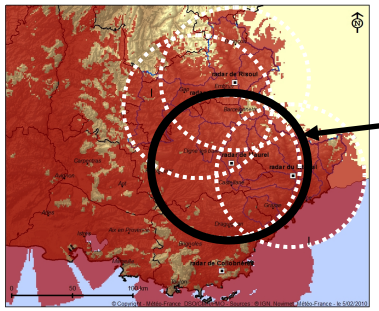


Changes in the radar network



There is a need for a radar coverage in this area: Rhytmme project (Hydrometeorological risks in Mediterranean mountainous: new X-band radars)



- **4 radars in 2013**
- **Mt-Vial currently cannot be used (poor quality for assimilation)**
- **Tests with Mt-Maurel**

Introduction of the Spanish radars (Madrid, Barcelona, Palma de Mallorca)

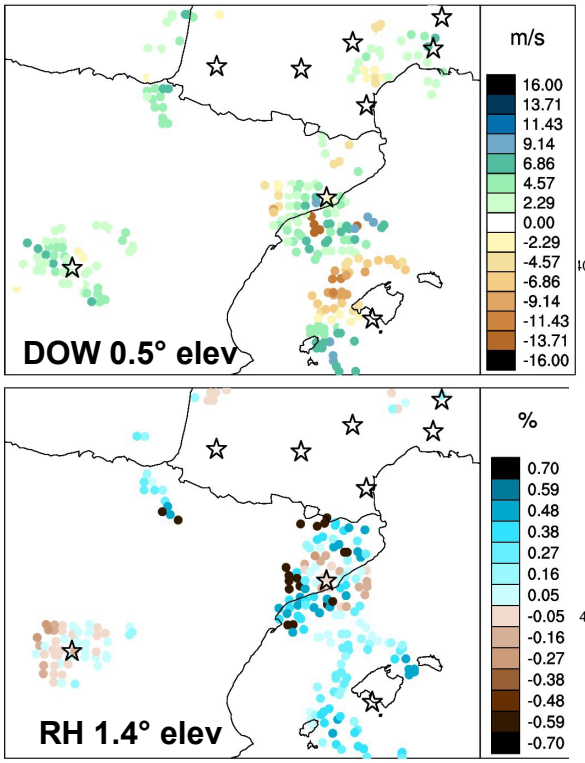
16 French radars in C band (yellow circles) and 3 Spanish radars in C band (red circles). 8 in S band (green circles). 12 polarimetric radars (orange circles) from which 2 radars in X band (blue circles)

Assimilation of radars from AEMET

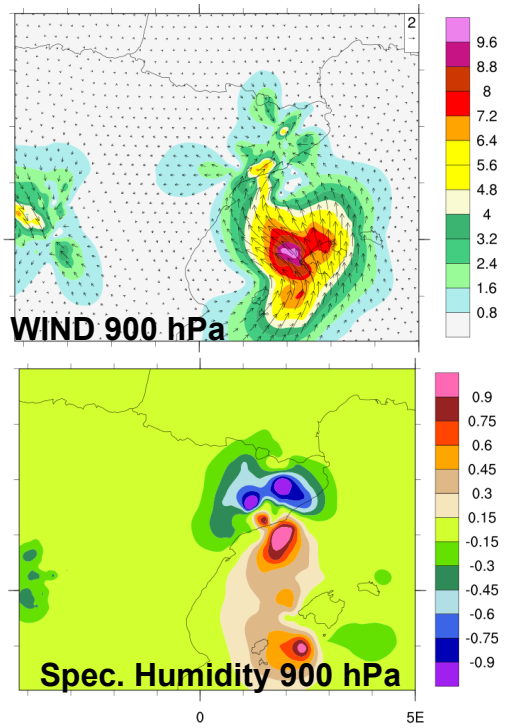
Preliminary experiments considering radars from Madrid, Barcelona and Palma de Mallorca:

- **2 elevations for the moment (0.5° and 1.4°), 120 km ranges, double PRF, Z, DOW and QF**
- **PPIs in polar coordinates (δr = 500m, δazimuth = 0.8°)**
- **non-meteorological clutters deduced from good signal using the Doppler spectrum (but not removed ! => possible ambiguity and bad quality of reflectivity!)**

Increments in observation space (DOW positive towards the radar)



Analysis differences with/without AEMET radars at 9 UTC



⟹ The whole processing chain has been validated and encouraging results have been obtained.

⇒ Tests in quasi-real time are planned in june/july in AROME WMED

Impact of obs on analysis: DFS

- Regularly computed by our monitoring team (COMPAS), as a mean over all analyses of a day (8 for Arome-FR)
- DFS = Degrees of Freedom for Signal = statistical objective measure of the ability of an obs (group of obs) to modify the analysis:

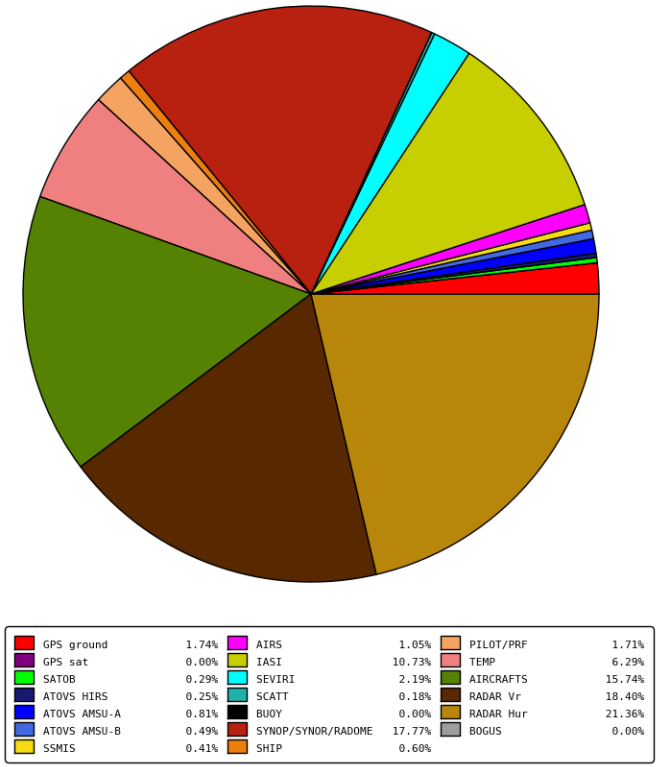
$$DFS = Tr\left(\frac{\partial(H\mathbf{x}^a)}{\partial(\mathbf{y}^o)}\right) = Tr\left(\mathbf{HK}\right)$$

- DFS are computed using perturbed analyses (e.g. from ensembles)
- If R is block-diagonal:

$$DFS_i = Tr\left(\Pi_i \mathbf{HK} \Pi_i^{\mathrm{T}}\right)$$

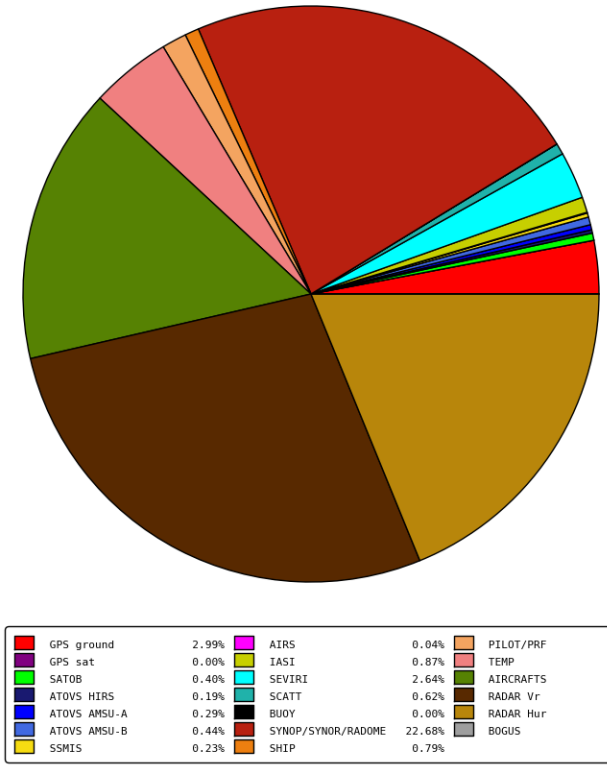
Impact of obs on Arome-FR analysis

Proportions des nombres d'observations utilisées par type d'obs
analyses cut-off AROME - AROME France oper
observations conventionnelles et satellites
cumul du nombre d'observations utilisées sur la période 2011090700 - 2011090721 : 209513



Proportions des nombres d'observations utilisées par type d'obs
analyses cut-off AROME - AROME France oper
observations conventionnelles et satellites
cumul du nombre d'observations utilisées sur la période 2011110300 - 2011110321 : 280292

Part des DFS par type d'obs
analyses cut-off AROME - AROME France oper
observations conventionnelles et satellites
cumul du DFS sur la période 2011090700 - 2011090721 : 79471



Part des DFS par type d'obs
analyses cut-off AROME - AROME France oper
observations conventionnelles et satellites
cumul du DFS sur la période 2011110300 - 2011110321 : 121916

Outlook for LAMs

- Experiments with 1-hourly cycles (RUC) : see talk by Pierre Brousseau
- Use of ensemble assimilation information, situation-dependent aspects
- New tests with « Jk » term (weak constraint towards coupling data)
- Heterogeneous B matrix: extended control vector to accommodate for different structure functions (in masked areas), Montmerle & Berre (QJRMS, 2010).
- Radar:
  - assess impact of windmill signals,
  - evaluate assimilation of X-band radars from the RYTHMME network,
  - radar data exchange within HYMEX,
  - sensitivity studies towards the inclusion of a total precipitating hydrometeor content in c.v.
- Assimilate more ground-based GPS (re-visit blacklisting & VarBC)
- Increase number of vertical levels in Arome-FR: this increase probably requires to also increase the vertical layout in RTTOV-levels;
- Aladin applications at MF: assess benefit of denser observations
- Code system overhaul: towards object-oriented coding of the IFS/Arpège assimilation system (« OOPS ») => started with CY38

شكرا على اهتمامكم