

Changes in the operational version of ARPEGE

January - June 2004

1. 2004, January 29th : **Improvement of 4d-var (et al.)**

- new background error statistics (from an "ensemble" method, work of M. Belo Pereira)
- improved simplified physics : improved vertical diffusion in the two inner loops, suppression of the (expensive) radiation and convection schemes
- new minimizer , using a preconditioned conjugate-gradient algorithm (CONGRAD) : more efficient for quadratic problems, preconditioning allowed
- lower cost : from (45+20) to (40+15) iterations
- improved SST analysis (finer description of sea-ice extension)
- use of monotonic semi-Lagrangian interpolators in dynamics
- a "few" changes in physics :
 - reduction of snow-melting / rain-evaporation speeds (to limit fibrillations around 0 °C, according to the results of M. Tudor),
 - tuning of the convective cloudiness diagnostic,
 - cleaning and speed-up of the radiation code,
 - new computation of mixing lengths (a step towards interactive ones),
 - improved robustness to changes in vertical resolution,
 - new tuning parameters for cloud condensates et cloudiness
- longer forecast ranges (24 h longer at 06 and 18 UTC)

⇒ *clear improvements of wind field and SST, less spurious cyclogenesis*

2. 2004, February 10th : **New "production" run**

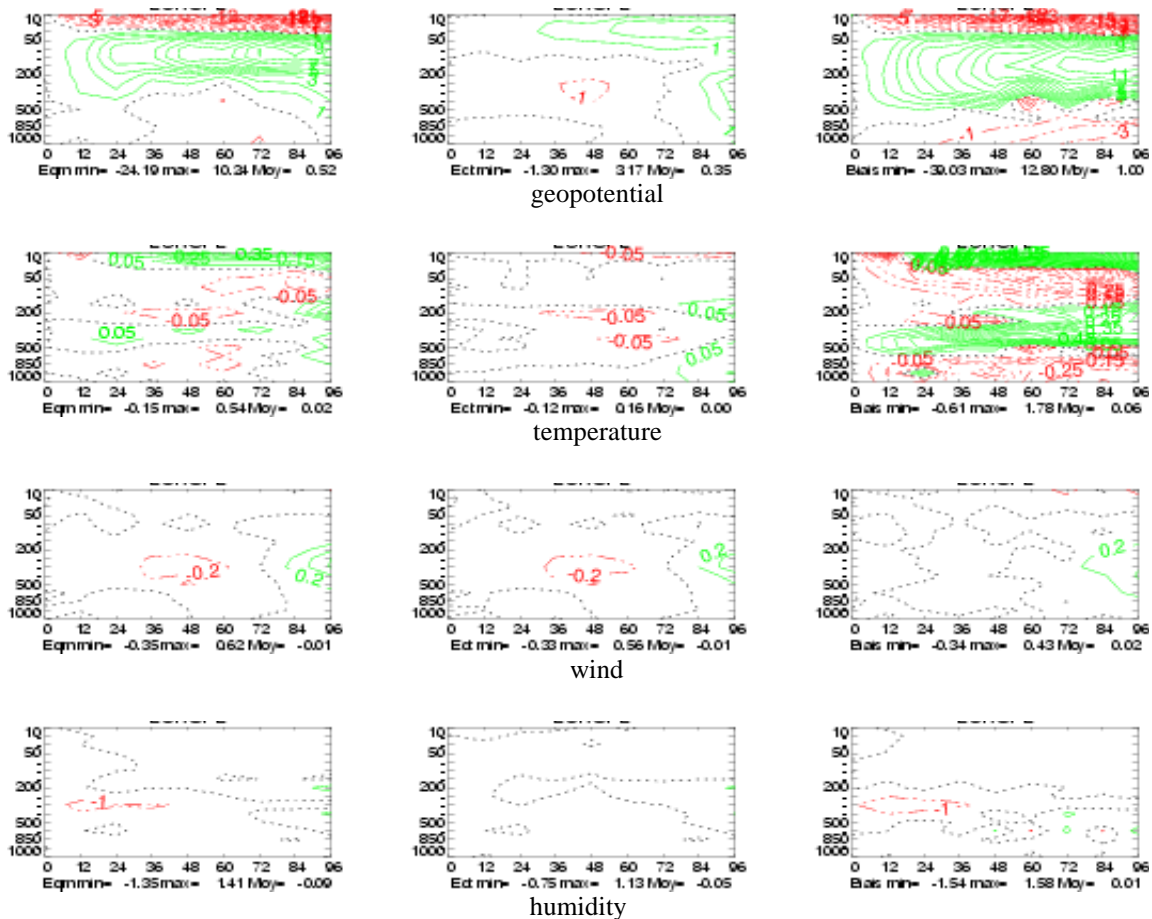
- 30 h forecast from 00 UTC
- very short cut-off : 1h instead of 1h50 (and 8h10 in the assimilation cycle)

⇒ *to have forecasts available early in the morning*

3. 2004, May 24th : **New physics**

- new, intermittent (called every 3h), radiation scheme : FMR15 ("old Morcrette scheme")
- improved cloudiness (less 0/1, more ice ⇔ more cirrus)
- preconditioning of the second minimization in 4d-var (using output from the first one, allowed by CONGRAD)
- new statistical model (forecast errors) for the analysis of surface fields (T2m, H2m) (more details in Newsletter 21)
- improved soil moisture initialization :
 - from better analysis increments of T2m and Hu2m first ! (impact on surface temperature too)
 - reduced increments (halved), direct use of the sun direction
 - spatial smoothing of initial soil moisture after corrections
 - bias correction for T2m and temporal smoothing of soil moisture increments suppressed (more details in Newsletters 24 and 22)
- some slight code changes

⇒ *a positive impact*



Comparison against TEMP observations over Europe : new against old model, average over 2 months : 15/03 – 23/05; green corresponds to an improvement, red to a deterioration; isolines every 1m for geopotential, 0.05 K for temperature, 0.20 m/s for wind, 1% for relative humidity

4. Summer parallel suite : Observations & Physics & ...

- New library : CY28T2 (CY28T1 + the following changes)
- New satellite observations :
 - QuikSCAT winds
 - AMSU-B observations (*thanks to the contribution of Z. Sahlaoui*)
 - AIRS observations
 - EARS ATOVS data (from EUMETSAT and Lannion)
- Variational quality control (*thanks to the work of M. Jurasek*)
- New balance equations in Jb, to better take into account ageostrophic contributions
- 2d climatological fields for ozone, instead of constants, to be used by the radiation scheme & 2d climatological fields for aerosols (id.)
- Reduced thermal inertia for vegetation (by about 25 %), following the improvement of the radiative budget, and improving surface temperature at night.
- Retuned mesospheric drag to reduce temperature bias at the top of the model (around 1 hPa)

5. About cut-off changes :

The sensitivity experiments performed to evaluate the impact of shifted and longer assimilation windows were not so conclusive. Consequently the operational schedule at Météo-France, with now 2 production runs at 00 UTC, is remain unchanged.

CONTENTS

1. 2004, January 29th : Improvement of 4d-var (et al.)	2
2. 2004, February 10th : New "production" run	2
3. 2004, May 24th : New physics	2
4. Summer parallel suite : Observations & Physics &	3
5. About cut-off changes :	3