

# An overview of recent developments/activities in global NWP

Florence Rabier, Alain Joly...  
Météo-France and CNRS

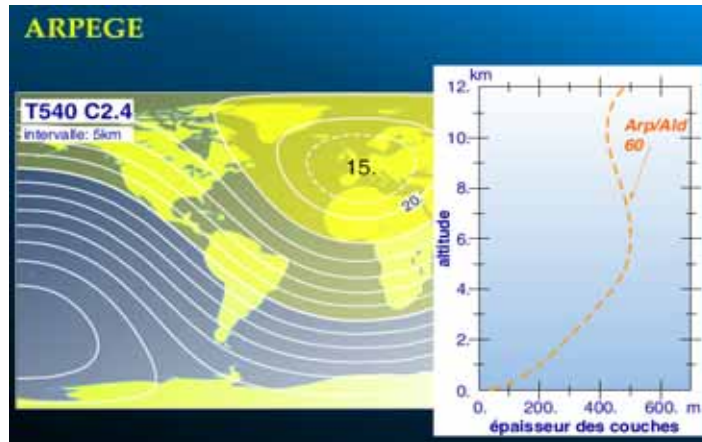


## Changes in 2008

- Change in resolution (horizontal and vertical)
- VarBC: Variational bias correction of radiances
- MSG CSR, ASCAT, MetOp-HIRS, SSM/I F14, more GPS-RO (1-25km)
- IASI data assimilated (+ more AIRS)
- Microwave emissivity over land
- Ensemble data assimilation provides background error variances of the day
- Ensemble Prediction system enhanced



## New resolution; T538C2.4L60



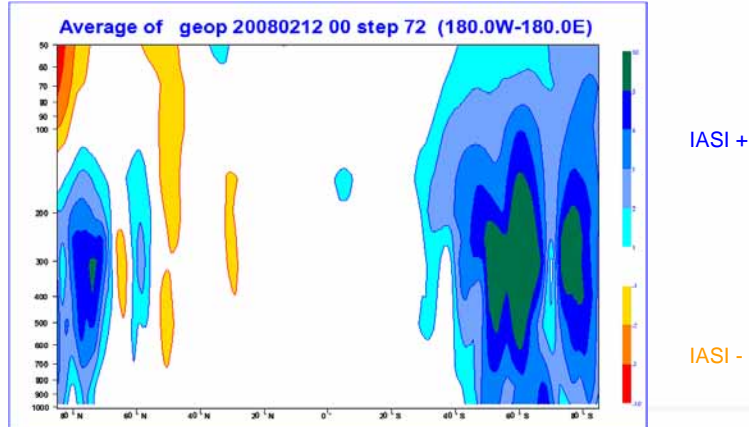
4D-Var: 2 minimisations at T107 and T224

## Change in resolution: T538C2.4



## IASI assimilation: status

IASI is now assimilated, with positive impact (esp. SH). Similar impact was obtained in a summer trial



RMS error difference ,Geopotential, 72h range, 22 days

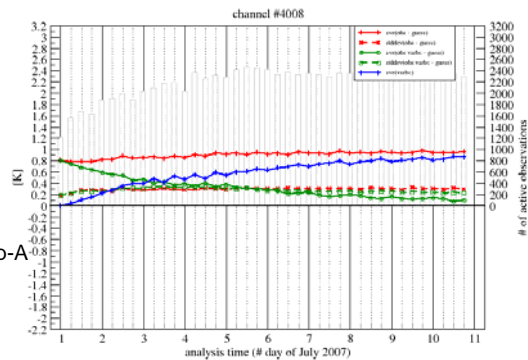
Vincent Guidard



## Variational Bias Correction

- Satellite radiance data have systematic biases that can depend on the scan angle (geometry) and on the flow  
They can be explained by predictors such as powers of the scan angle, thicknesses of some layers of the atmosphere, skin temperature, etc., by a multiple linear regression
- In the VarBC scheme, coefficients of the regression are dynamically adapted at each analysis time.  
They are included in the control variable of the assimilation, and they use other "conventional" data (like radiosondes or aircraft data) as a constraint.

Dee (2004), Auligné et al (2007)

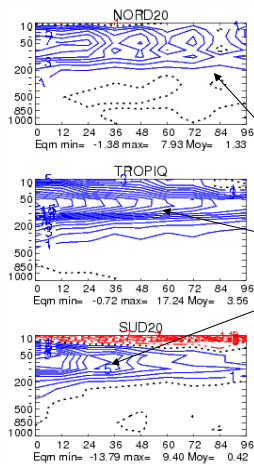


- Channel #8 of AMSU-A onboard MetOp-A
- Learning period: 5 to 15 days

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## Impact of VarBC, operational in Feb 2008

- Impact over a 43-day period of July-August 2007  
VarBC for AMSU-A/B, MHS, SSM/I, HIRS & AIRS, versus static bias correction



Impact on RMSE wrt radiosondes  
for geopotential height

Very positive !

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## Emissivity parametrisation over land

- AMSU microwave observations
  - Great potential for estimating atmospheric temperature and humidity over all surfaces
- Over the ocean
  - Emissivity ~ 0.5
  - Emissivity models good enough to meet the NWP requirements
  - The sea surface contribution to the signal is lower than the land contribution
- Over land
  - High emissivity (~1.0)
  - Only channels that are the least sensitive to the surface are currently assimilated
  - Remaining large uncertainties on land emissivity and skin temperature
    - difficulties to describe the emissivity variation in time and space and with surface types, roughness and moisture content
- Recent advances at Météo-France in the estimation of land emissivity and skin temperature from satellite microwave observations
  - To help surface and sounding channel assimilation
  - Statistic to dynamic approaches
  - Experiments with AMSU and SSM/I

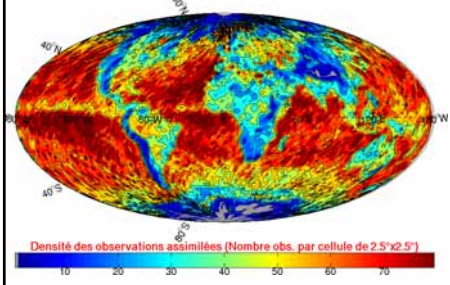
Karbou et al, 2006

Fatima Karbou, Elisabeth Gérard



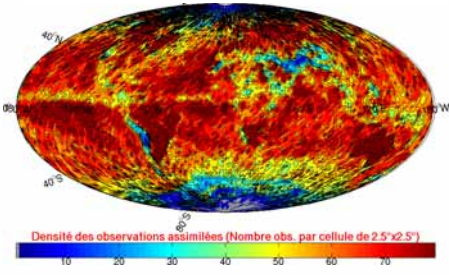
### Number of assimilated data, AMSU-A channel 7, August 2006

Reference



Number of data used

Emissivity dynamically estimated from Ch3

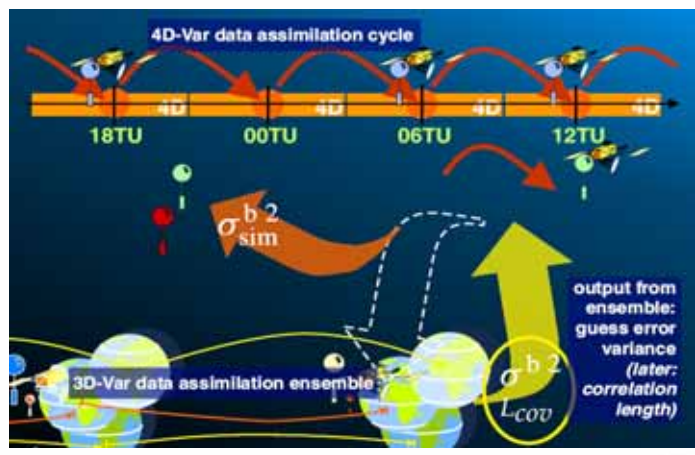


Number of data used

Fatima Karbou



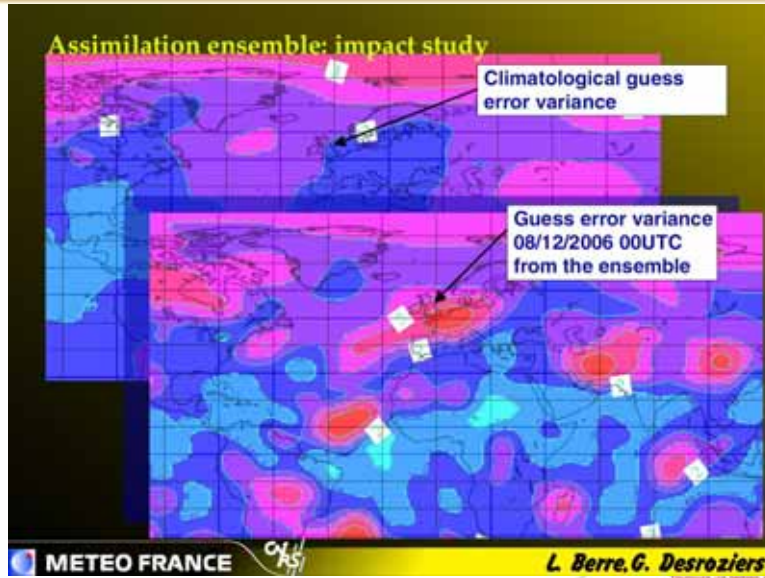
## Ensemble data assimilation



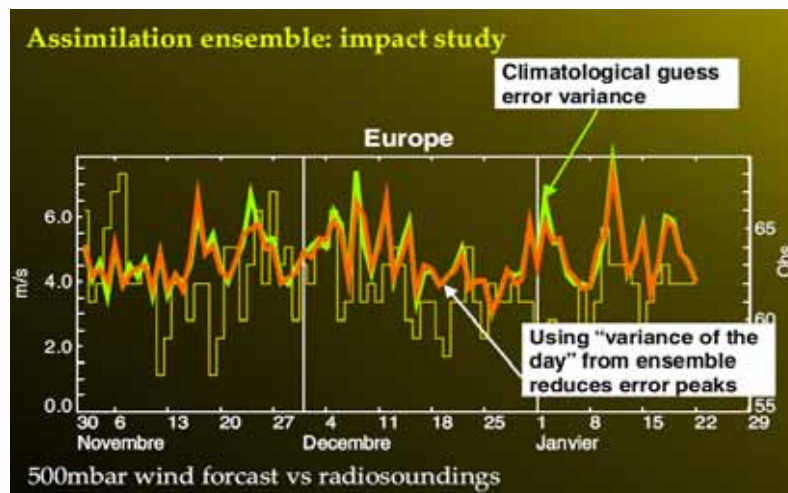
Ensemble assimilation: 6 assimilation cycles of 6h-window 3D-VAR FGAT in TL358C1.0L60



## Ensemble data assimilation



## Ensemble data assimilation



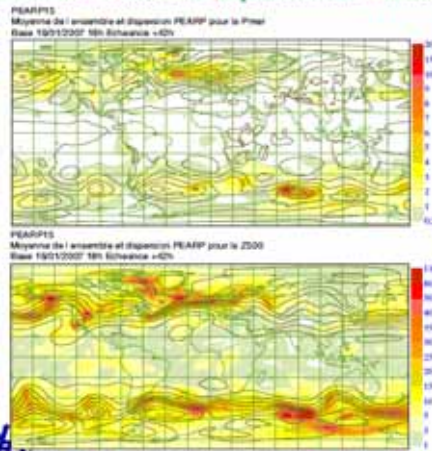
# Ensemble prediction system

## PEARP 2008: contents

- **revized initialization** ; *(uses modulated error variance, uses evolved perturbations from previous run, introduces 3 new singular vector computation areas with new recombination)*
- **revized individual model** ; *(same vertical levels as ARPEGE except for the mesosphere which is removed, leading to a 55 levels model)*
- **revized output** ; *(full global TIGGE contribution ; provides boundary conditions for ALADIN limited area ensemble forecast by Hungarian Met Service)*

# Ensemble prediction system

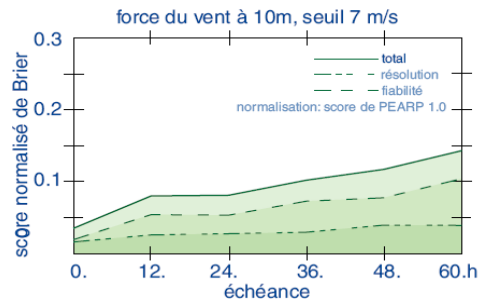
## PEARP 2008: some aspects of the validation



## Ensemble prediction system

### PEARP 2008: some aspects of the validation

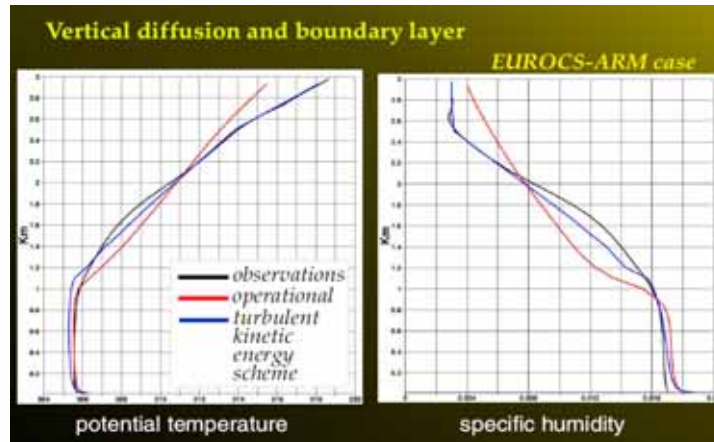
**Brier skill score**, using the previous version as the reference ("relative" Brier skill score); event: 10m wind speed > 7m/s



## Planned changes

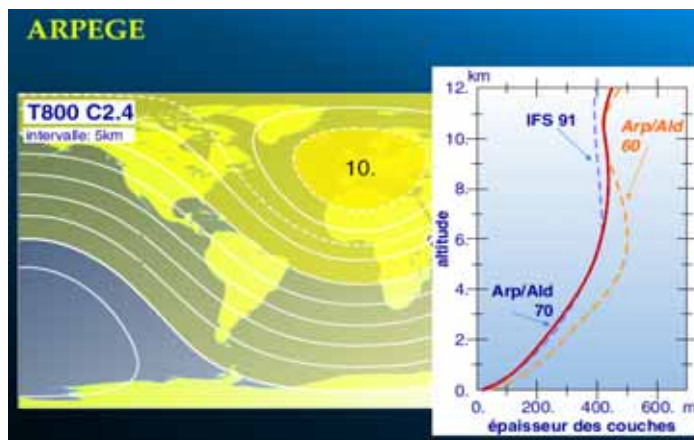
- New vertical diffusion / boundary layer scheme in ARPEGE/ALADIN: CBR prognostic 1D turbulent kinetic energy with top PBL entrainment, BL89 mixing length
- Kain-Fritsch Bechtold shallow convection scheme with retroaction on the « dry » turbulent scheme
- New 'ECUME' sea surface flux parametrisation in ARPEGE/ALADIN
- ...
- Increase density of satellite radiances

## Global model : physics



E. Bazile

## Future resolution: T799C2.4L70

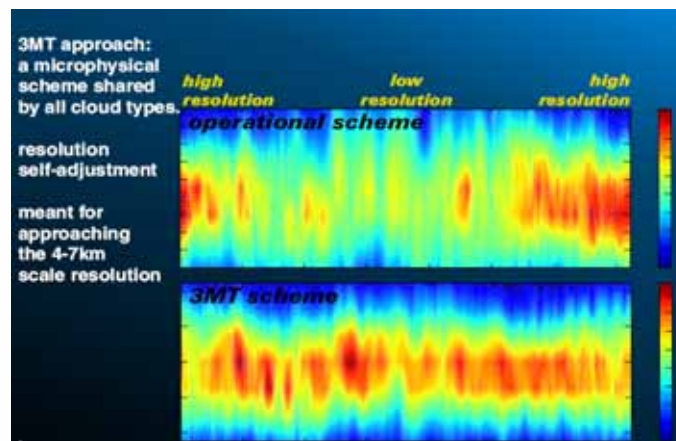


## Ensemble prediction system

### ARPEGE variable resolution ensemble forecasting system

- 2007 : system handed to Research Dept; "globalization";
- 2007 : PEARP probabilistic evaluation;
- 2008-9 : towards PEARP version 2 :
  - ensemble size up to ~ 30-40 members
  - coupled downstream with assimilation ensemble
  - implement some form of model error (multiple physics)
  - determine model climate in a not-so-expensive way
  - select and develop some pilot applications
- beyond : towards probabilistic short-range rainfall forecast

## Longer term: new convection scheme



3MT= Modular Multiscale Microphysics and Transport

O. Rivière, J-M Piriou, ALADIN group