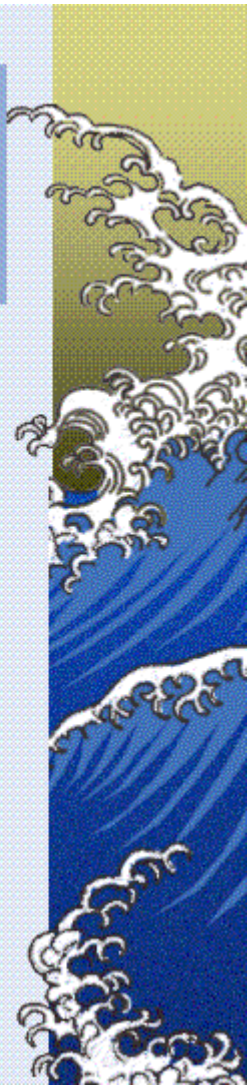
CONTROL AND MONITORING OF THE OBSERVATIONS
Plan of the lecture

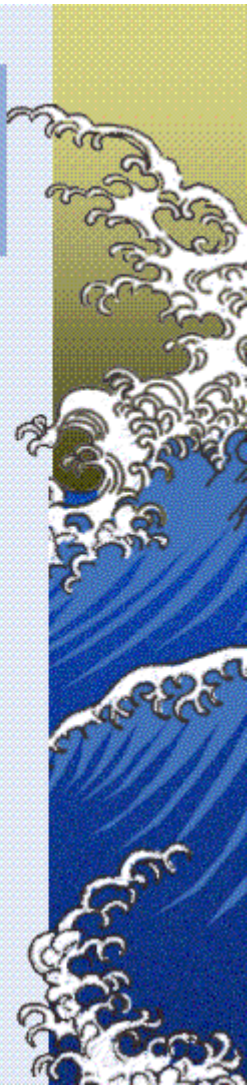
- Problematic
- General principle of the data monitoring
- Sources of observations and model errors
- Generation of a blacklist of suspicious data
- WMO standard thresholds
- Control of the data assimilation system
- Examples of control and monitoring as it is done at Météo-France



CONTROL AND MONITORING OF THE OBSERVATIONS

Problematic

- The quality of the forecasts depend on the quality of the observations used in the data assimilation system
- The observations are not perfect : they contain errors of different kinds and sources
- The control and the monitoring of the data is important to eliminate the wrong ones and determine the list of stations not to be used : blacklist
- Importance of the feedback to the producers (identification of local problems, test of new observations…)
- Exchange of results with other centers : the WMO monitoring of the observations is done by several national centers (for example, ECMWF is the lead center for monitoring the quality of sonde data) ⇒ monthly control reports



CONTROL AND MONITORING OF THE OBSERVATIONS

General Principle of the data monitoring

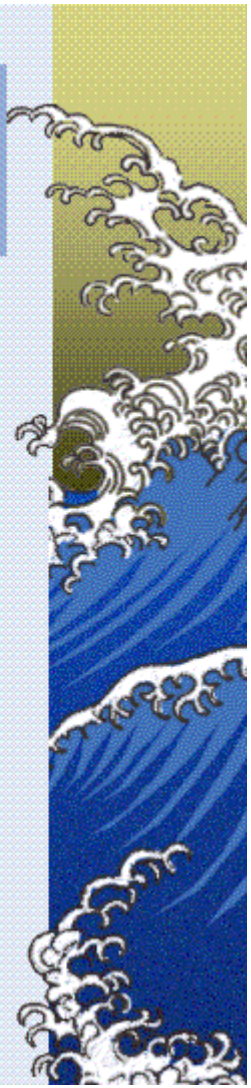
- We use daily and monthly statistics of the observations against a reference : a 6-hour forecast (called guess, or background)
- This reference is interpolated at the obs point. We can define in the space of the obs :

$$O-G = (O - O_{true}) - (G - G_{true}) - (G_{true} - O_{true})$$

obs bias model bias scale bias

the observations errors and the model errors are supposed to be not correlated

- Observations are said suspicious when their statistics (compared to the model) are too far away from the other observations



CONTROL AND MONITORING OF THE OBSERVATIONS

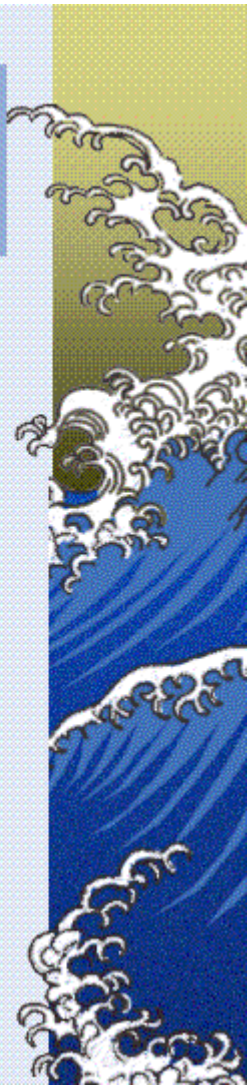
Sources of model and observations errors

In the model (guess or background) :

- Systematic errors of prediction
- Lack of resolution
- Weakness in the description of the physical processes
- Errors in the starting point (analysis with not enough obs)
- Amplification of errors (hydrodynamical instabilities)

In the observations :

- Instrumental errors (little in most cases)
- Errors in the coding/decoding pocedures
- Representativity / resolution of the model
- Observation operators errors (when calculating the values of the model at obs points)



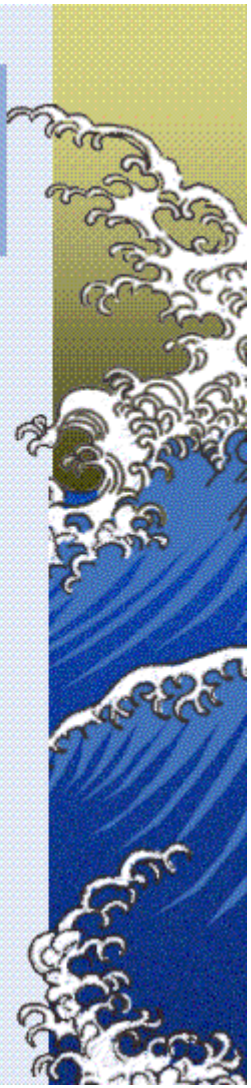
CONTROL AND MONITORING OF THE OBSERVATIONS

Instrumental errors

We know the error statistics for the following instruments :

- Synoptic stations (5000) or automatic (600)
- Radiosondes (700) and Pilots (400)
- Selected Ships (5000)
- Drifting (1000) or moored (300) Buoys
- Airlines compagnies (300) and Asdar systems (20)
- Acars (800) and Amdar (150)
- Geostationnary (6) and polar (2) satellites

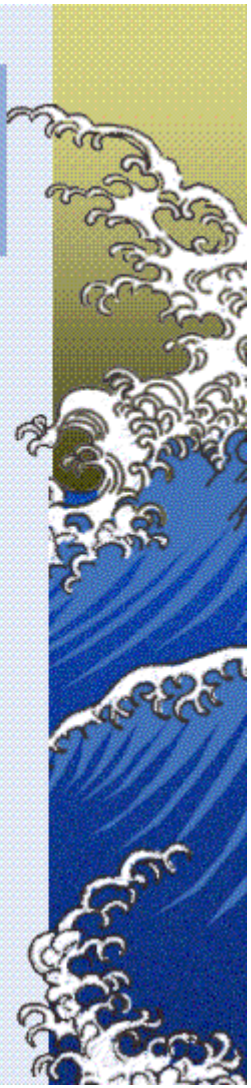
These informations are exchanged between the centers involved in the monitoring of the observations.



CONTROL AND MONITORING OF THE OBSERVATIONS

Blacklisting observations

- Knowledge of the mean behaviour (in term of statistics of obs-guess) of the observations
- Define thresholds of large errors (WMO for example)
- Assessing each platform taking into account model and representativity problems
- Looking at the stability in time of the errors in the past months
- Looking to the other observations available in the same region
- Looking to ECMWF blacklist
- Suppress observations of the blacklist when they are better



CONTROL AND MONITORING OF THE OBSERVATIONS

WMO Standard thresholds

Surface observations (Synop, Ship, Buoy)

Surf pres : nb min = 20 obs, gross error |O-G| ≥ 15 hPa,
25% of gross errors or (|bias| ≥4hPa or std dev ≥ 6hPa)

T2m : nb min = 20 obs, gross error |O-G| ≥ 20°K
25% of gross errors or rms ≥ 10°K

Hu2m : nb min = 20 obs, gross error |O-G| ≥ 0.5
25% of gross errors or |bias| ≥ 0.5

ff10m : nb min = 20 obs, gross error |O-G| ≥ 25m/s
25% of gross errors or bias ≥ 5m/s

dd10m : (ff ≥ 3m/s), nb min = 20 obs
Synop/Ship : |bias| ≥30° or std dev ≥ 80°
Buoy : |bias| ≥20° or std dev ≥ 60°

CONTROL AND MONITORING OF THE OBSERVATIONS

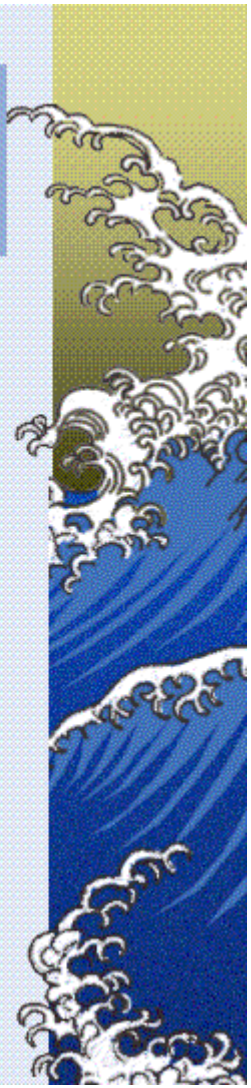
WMO Standard thresholds

Upperair observations (Temp, Pilot, Airep)

Geopotential (Temp and Pilot) : nb min = 10 obs,

gross error :
- 100m at 1000-700 hpa
- 150m at 500 hpa
- 175m at 400 hpa
- 200m at 300 hpa
- 225m at 250 hpa
- 250m at 200 hpa
- 275m at 150 hpa
- 300m at 100 hpa

25% of gross errors or 3 levels with weighted rms $\geq$ 100m



CONTROL AND MONITORING OF THE OBSERVATIONS

WMO Standard thresholds

Upperair observations (Temp, Pilot, Airep)

FF (Temp, Airep and Pilot) : nb min = 10 obs,

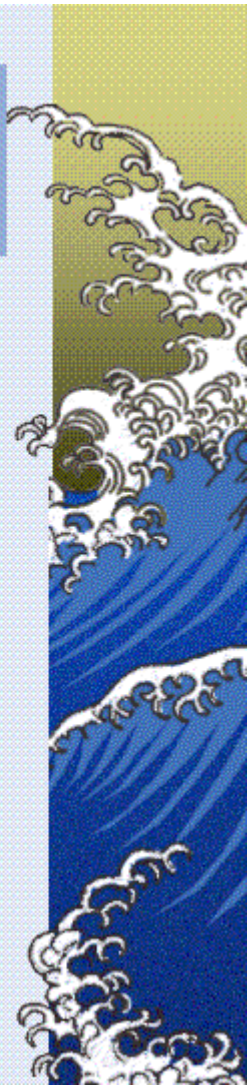
gross error Airep : FF ≥ 40m/s

gross error Temp/Pilot : 35m/s at 1000-850 hpa
40m/s at 700 hpa
45m/s at 500 hpa
50m/s at 400 hpa
60m/s at 300-250 hpa
50m/s at 200-150 hpa
45m/s at 100 hpa

25% of gross errors or rms ≥ 15m/s

CONTROL AND MONITORING OF THE OBSERVATIONS

Control of the assimilations

Knowledge of the daily statistics for each class of :

- number of obs (after removing of gross errors)
- number of rejections
- number of gross errors (WMO standard tresholds)
- bias (obs-guess)
- standard deviation (obs-guess)
- bias (obs-analysis)
- standard deviation (obs-analysis)