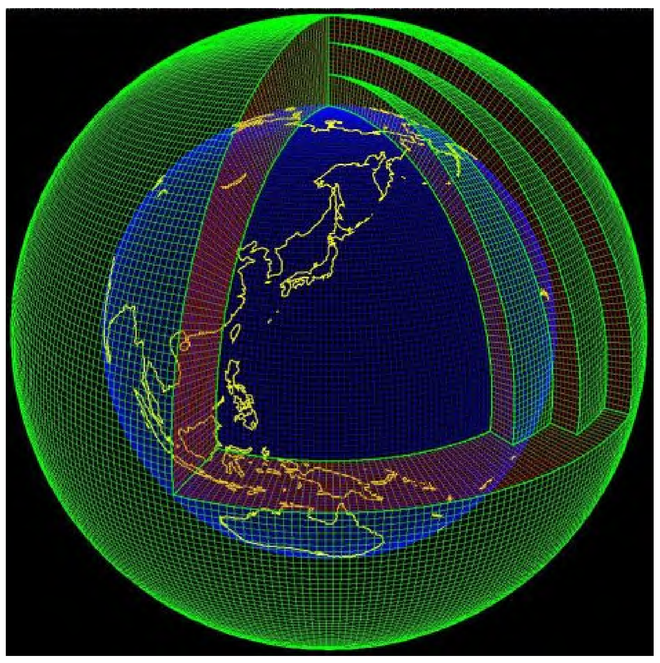
OBSERVATION DATA QUALITY CONTROL IN NUMERICAL WEATHER PREDICTION

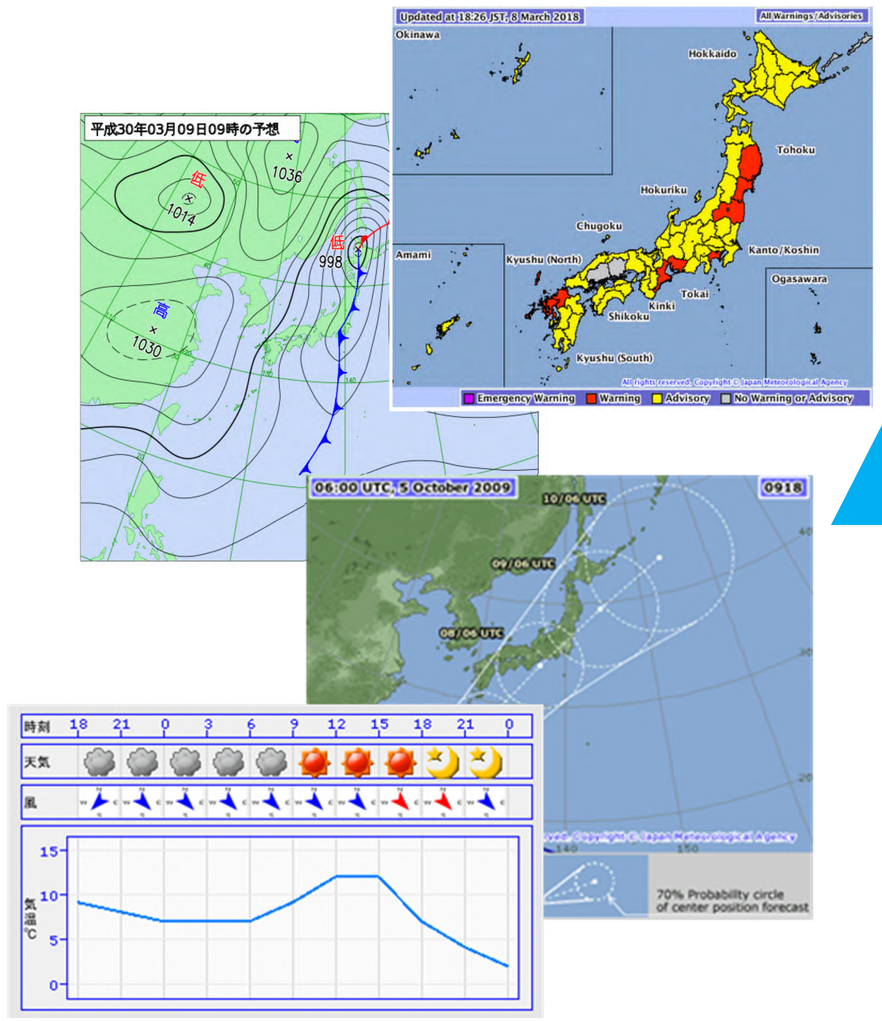
Outline

The Japan Meteorological Agency began numerical weather prediction in June 1959. Since then, NWP model performance has advanced significantly thanks to progress in earth sciences and information technology (e.g., dramatically improved computer resources and efficient telecommunication systems) as well as improved observation systems (especially those involving the use of meteorological and earth-observing satellites).

Models

JMA currently operates several NWP models to cover various types of prediction, including very-short-range forecasts, short-/medium-range forecasts, typhoon track forecasts and aviation forecasts. The Agency also operates ensemble prediction systems (EPSs) and a coupled ocean-atmosphere model for other forecasts, including one-week/one-month/seasonal predictions and El-Niño forecasts.



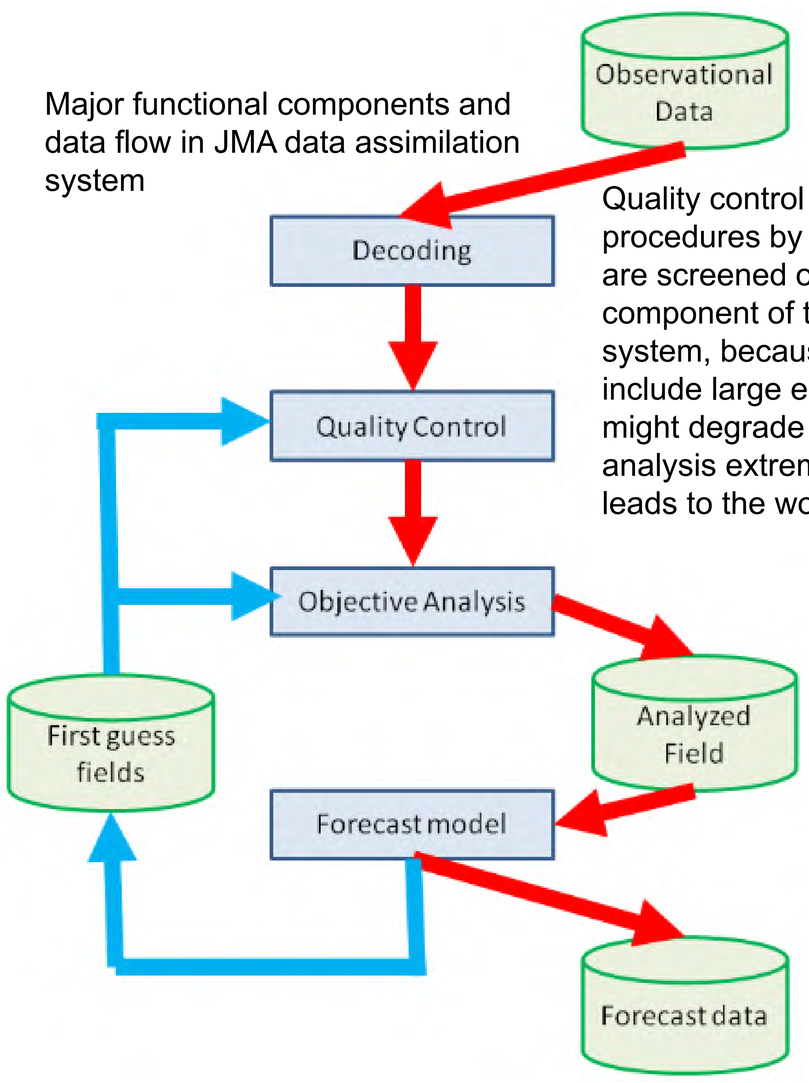


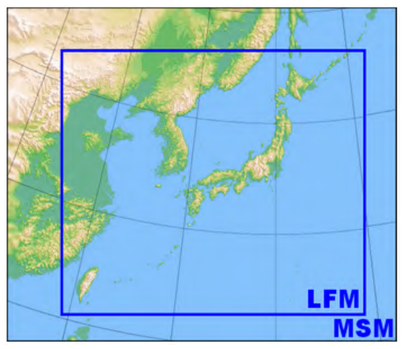
Data assimilation

Data assimilation systems for NWP are based on the variational method. The four-dimensional variational (4D-Var) systems was introduced for Meso-Scale Analysis and Global Analysis in March 2002 and February 2005, respectively. The Local Forecast Model is initialized with an hourly assimilation-forecast cycle running three-dimensional variational (3D-Var) analysis and one-hour forecasts in turn for three hours.

Quality control

Major functional components and data flow in JMA data assimilation system





Quality control (QC) is a series of procedures by which “bad” observations are screened out. The QC is a vital component of the objective analysis system, because observations sometimes include large error and the erroneous data might degrade the quality of atmospheric analysis extremely. Such degradation leads to the worse forecast skill.

Real-time QC

First Step

- climatologically check
- ship/flight path check
- bias correction
- wind correction
- T lapse rate
- interpolation (T,RH,wind)
- hydrostatic check
- ice (freezing)
- wind shear
- sea-level correction

Etc.

Second Step

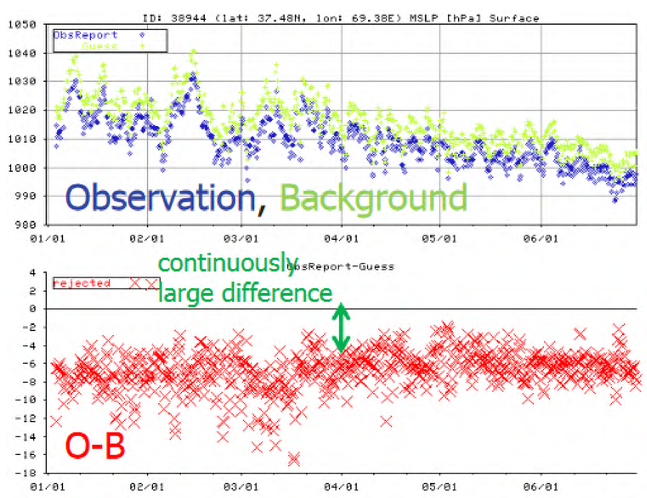
- Gross error check

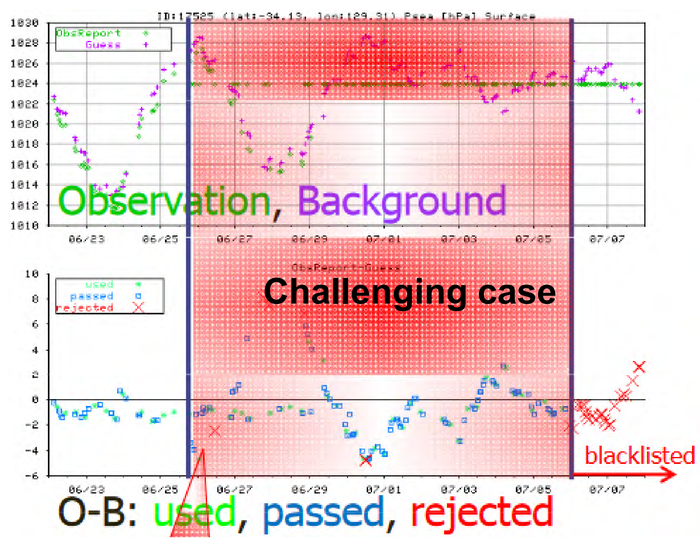
Reject rough error
human error
instrumental malfunction
communication error
etc.

- Spatial consistency check

Compare with surrounding observations

Etc.





Non-real-time QC

Sometimes, data of low quality pass real–time QC.
→ real-time QC is not perfect.

Blacklist is managed for these case.

- Blacklist needs careful monitoring, and is updated when
  [add]
  Platforms (stations, airplanes, ships, etc.) found to report biased or erratic observations
  [remove]
  The quality has returned to an accepted standard
- Blacklisted observations are rejected before real-time QC procedures.

Gross error check, Spatial consistency check
O-B are checked.