Center Report From JMA

Recent updates of JMA's NWP system development

- Upgrades of the JMA's global NWP system and EPS
  - Kawaguchi et al., Ota et al., and Ota 2025 in WGNE Bluebook
- Upgrades of the JMA sub-seasonal and seasonal EPS
  - Kubo et al. and Adachi et al. 2025 in WGNE Bluebook
- Improvements to observation processing for the global analysis
  - One of the most major upgrades in the recent years
  - Significant impacts on 500hPa height
- Updates on regional NWP systems will be reported at the km-scale modelling session of WGNE-40

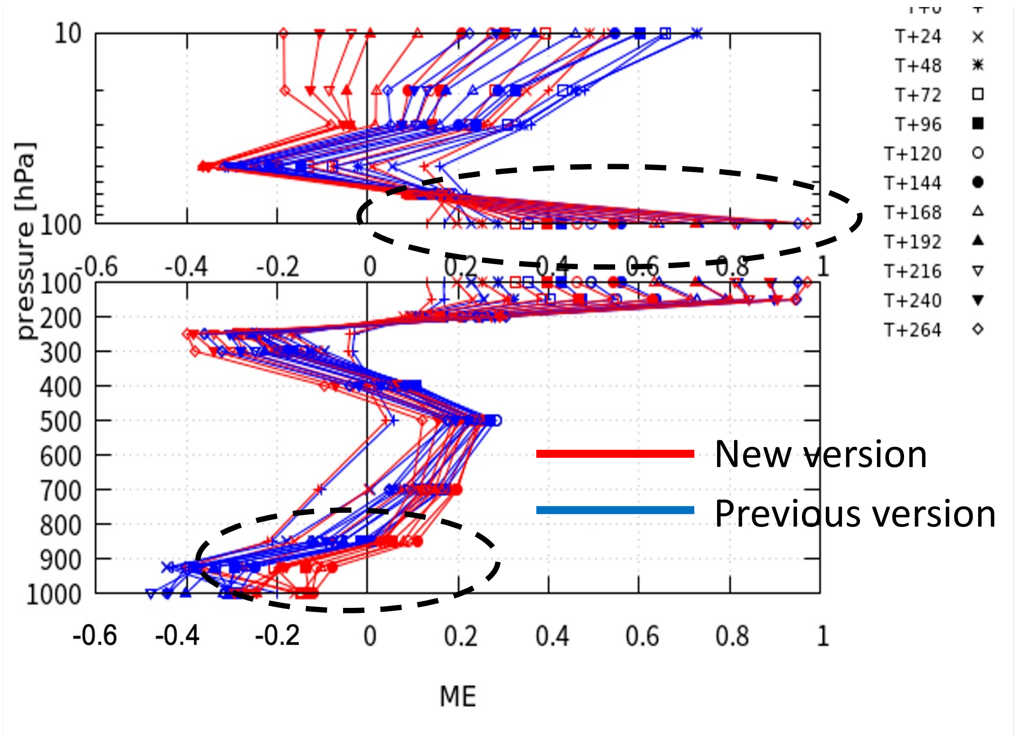
Recent updates of JMA's NWP system development

- Upgrades of the JMA's global NWP system and EPS
  - Kawaguchi et al., Ota et al., and Ota 2025 in WGNE Bluebook
- Upgrades of the JMA sub-seasonal and seasonal EPS
  - Kubo et al. and Adachi et al. 2025 in WGNE Bluebook
- Improvements to observation processing for the global analysis
  - One of the most major upgrades in the recent years
  - Significant impacts on 500hPa height
- Updates on regional NWP systems will be reported at the km-scale modelling session of WGNE-40

Upgrades of the JMA's global NWP system and EPS

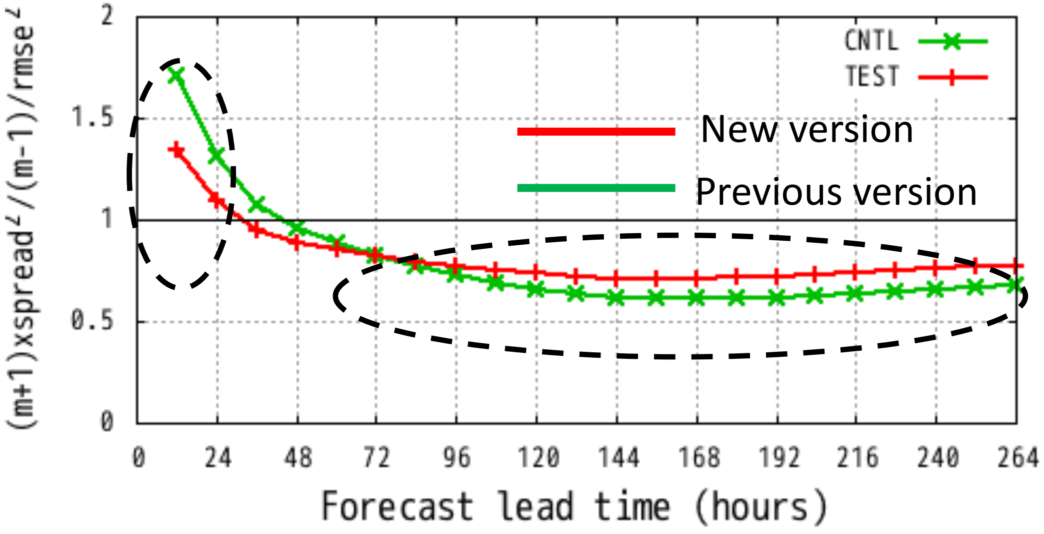
- Updates of climatological annual mean CO_2 concentration from 396.0 ppmv (as of 2013) to 417.9 ppmv (as of 2022) based on WMO (2023)
- Upgrades of LAI climatology ancillary data to a gridded version
- Incorporation of Stochastic Humidity Profile for Convective parametrization (SHPC, Tompkins and Berner 2008) method into the global EPS
  - Aims to mitigate underdispersiveness in the tropics and reduce the amplitude of the initial perturbations made from the Singular Vector (SV) method in the tropics, which is too large.
- A new decomposition method for MPI parallelization and data structure (reported at the HPC review session of WGNE-38)
  - Suitable for both semi-Lagrangian advection and spectral transform, also for derivative stencils
  - Flexible data array structure adapted to both CPU and GPU

Vertical profiles of mean errors for temperature [K] against radiosonde observations in the 20 -90°N

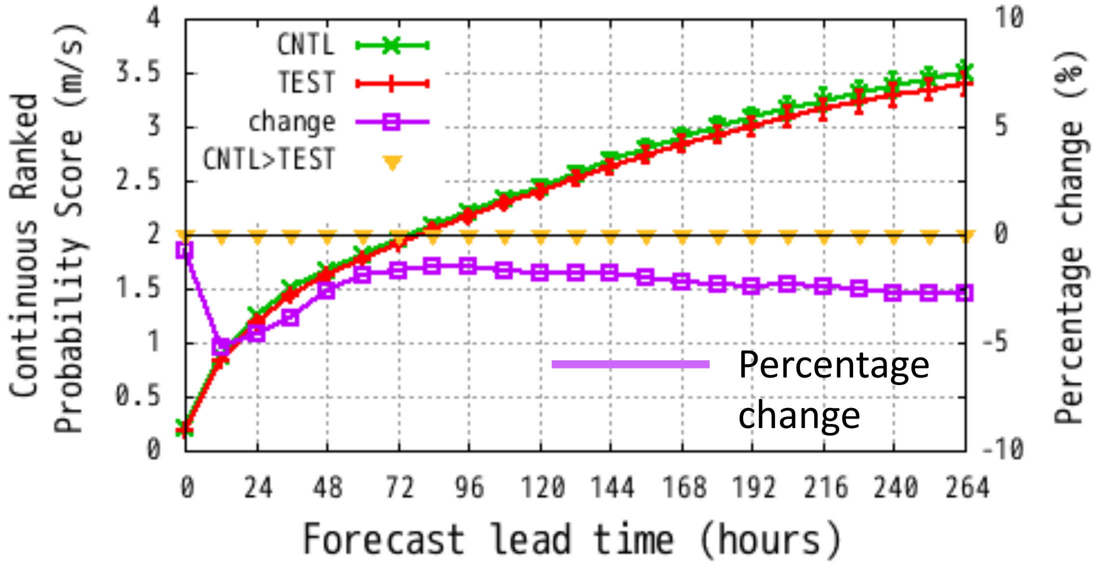


- Reduction of lower-tropospheric cold bias due to LAI climatology update
- Reduction of lower-stratospheric warm bias due to CO_2 climatology update
- Mitigate over-dispersiveness of spread in the beginning of forecasts due to reduction of initial perturbation
- Mitigate under-dispersiveness of spread after T+72hr due to incorporation of SHPC

Spread/RMSE relationship of u-wind at 250 ha over the tropics in Summer 2023



CRPS of u-wind at 250 ha over the tropics in Summer 2023



気象庁 Japan Meteorological Agency
KAWAGUCHI Masashi, OTA Yoichiro and Global Modelling, DA&EPS teams

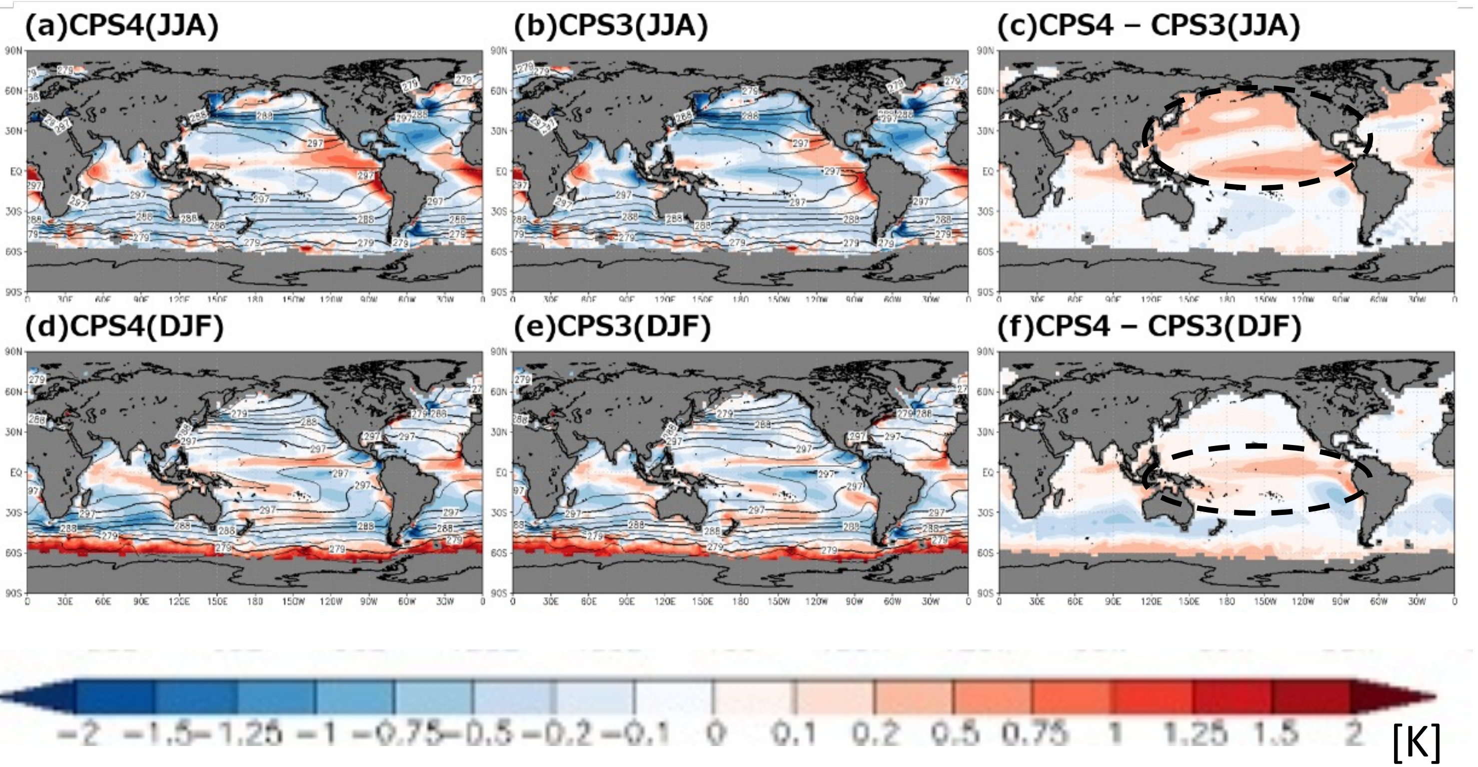
Recent updates of JMA's NWP system development

- Upgrades of the JMA's global NWP system and EPS
  - Kawaguchi et al., Ota et al., and Ota 2025 in WGNE Bluebook
- Upgrades of the JMA sub-seasonal and seasonal EPS
  - Kubo et al. and Adachi et al. 2025 in WGNE Bluebook
- Improvements to observation processing for the global analysis
  - One of the most major upgrades in the recent years
  - Significant impacts on 500hPa height
- Updates on regional NWP systems will be reported at the km-scale modelling session of WGNE-40

Upgrades of the JMA seasonal EPS

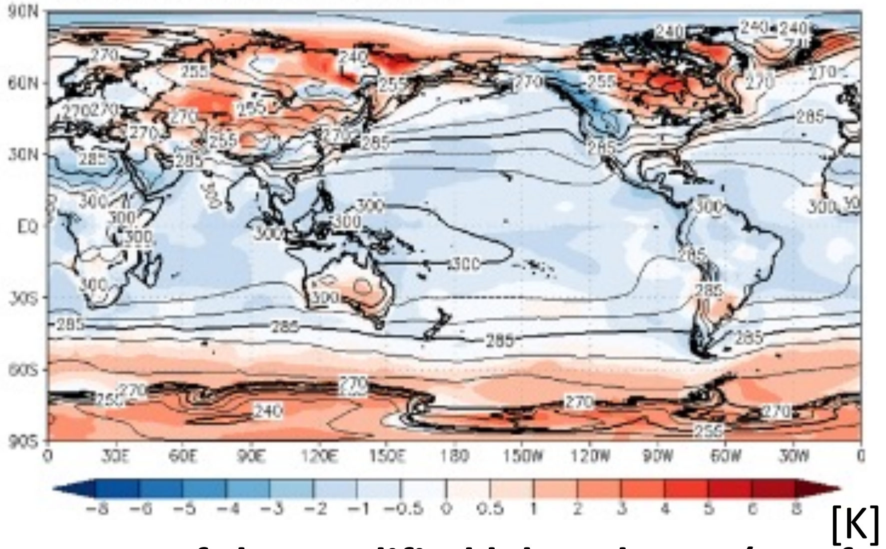
- An upgrade of the JMA sub-seasonal and seasonal ensemble prediction system (JMA/MRI-CPS, hereafter CPS) from CPS3 (Hirahara et al. 2023) to CPS4 is scheduled in the beginning of 2026
- Outline of CPS4 improvements to CPS3 are :
  - Physics: Cloud, convection, radiation with prognostic ozone, lake model and land-snow model
  - Initial perturbation : Replace BGM with SV + LETKF
  - Model perturbation : Incorporation of SHPC
  - Increase of vertical levels from 100 to 128 (same levels as global NWP and EPS)
  - Upgrade of ocean model to MRI.COM v5.0 (Sakamoto et al. 2023)

SST biases from Re-forecast Experiments (1991-2020)

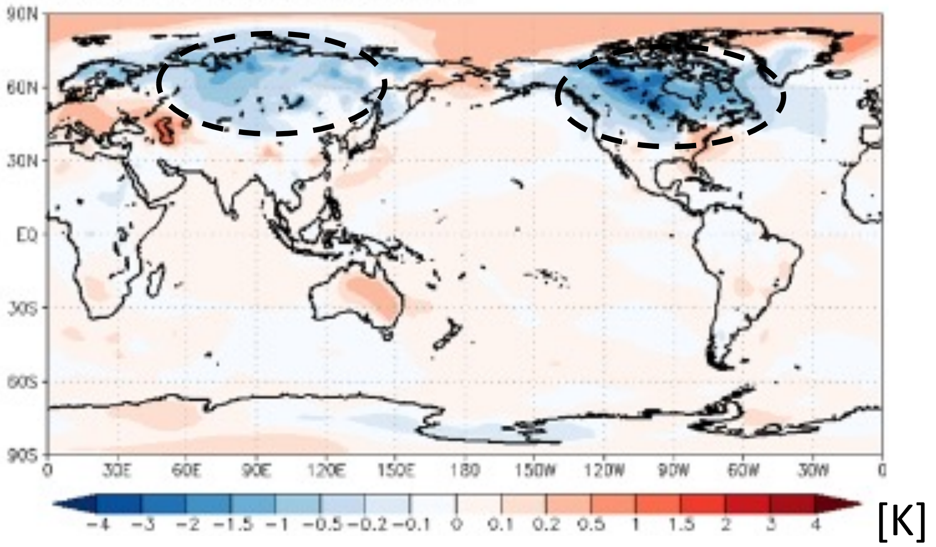


- Reduction of SST cold bias mainly due to cloud and convection schemes improvement
- Reduction of warm bias over the Eurasia and North America due to lake model improvement

Surface air temperature (contours) and biases relative to JRA-3Q (shading) in boreal winter



Impact of the modified lake scheme (Tsurf after minus before modification)



KUBO Yutaro, ADACHI Yukimasa and Coupled Modelling team

Recent updates of JMA's NWP system development

- Upgrades of the JMA's global NWP system and EPS
  - Kawaguchi et al., Ota et al., and Ota 2025 in WGNE Bluebook
- Upgrades of the JMA sub-seasonal and seasonal EPS
  - Kubo et al. and Adachi et al. 2025 in WGNE Bluebook
- Improvements to observation processing for the global analysis
  - One of the most major upgrades in the recent years
  - Significant impacts on 500hPa height
- Updates on regional NWP systems will be reported at the km-scale modelling session of WGNE-40

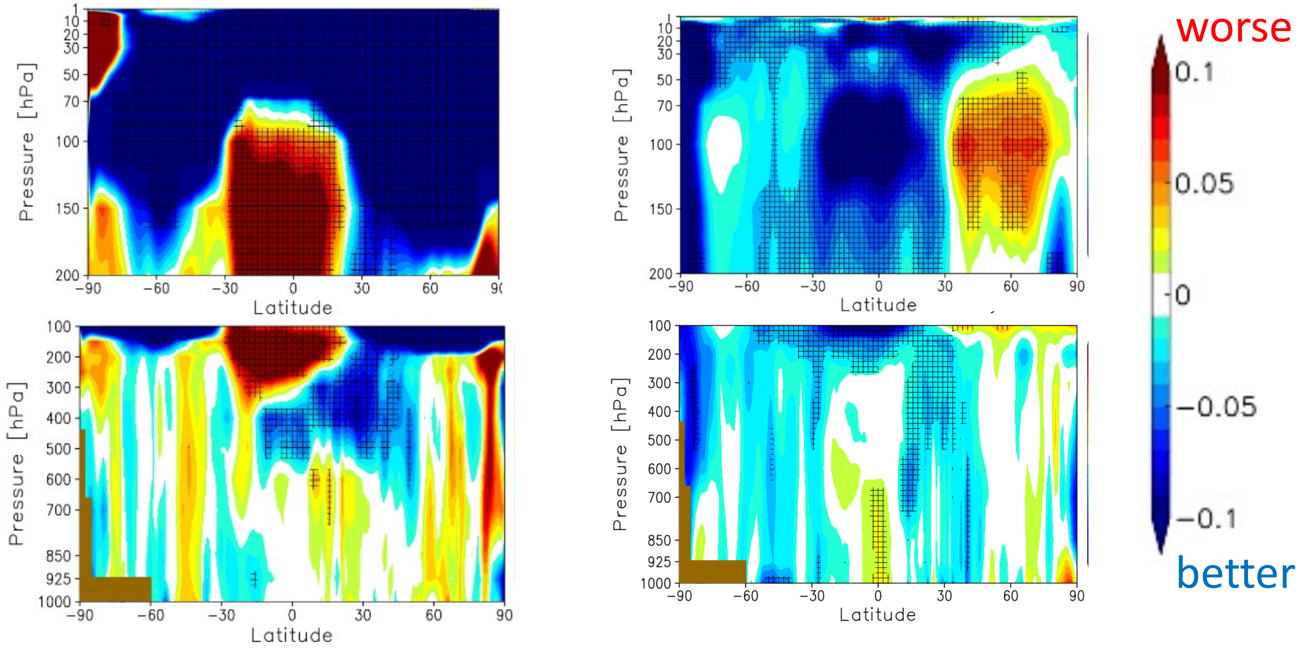
Improvements to observation processing for the global analysis: GOBS2510

- **One of the major upgrades for the observation processing in the recent 5 years**
  - Refinement of observation errors for GNSS-RO and start assimilation of COSMIC-2 and Metop-C
  - Assimilation of Metop-B, -C polar AMV
  - Update the coefficients for RTTOV-13 and updates of emissivity models in RTTOV (Shimizu et al., WGNEBluebook 2025)
  - Improvements to assimilation schemes for all-sky assimilation of microwave humidity sounders
    - Incorporation of a dynamic emissivity method for 183GHz channels, averaging of observations to the inner model (TL319) grid and etc..
  - Assimilation of window-channels of microwave temperature sounders (AMSU-A ch 1,2 and ATMS ch 1,2) for better representation of humidity analysis. (Urata and Shimizu, WGNE Bluebook 2025)
  - Assimilation of CSR of CO2 bands from Himawari, GOES and Meteosat (Okabe and

- Refinement of an observation error profile to mitigate side-effects of too strong constraint in the stratospheric analysis by GNSS-RO to the tropospheric atmosphere through 4DVAR
  - Increase observation error from 1% to 1.25% of observation values between 10km and 30km height levels
  - Inflation of observation error with a factor of 1.41
- Based on the obs. error refinement, assimilation of COSMIC-2 and Metop-C improved tropospheric forecasts.

Impact of GNSS-RO before GOBS2510: Relative improvement of zonal mean height to w/o GNSS-RO (T+48hr)

impact of GOBS2510 incl. GNSS-RO upgrade (COSMIC-2,Metop-C, Obs error refinement). : Relative improvement of zonal mean height



Root-mean-square error diff. (after minus before GOBS2510) of 500-hPa geopotential height [m] red: summer, blue: winter