

Coupled Prediction and data assimilation in JMA and a brief introduction of GODAE OceanView Observing System Evaluation Task Team (OSEval-TT)

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Introduction

Subseasonal Prediction by a coupled model in JMA

- The coupled model improved tropical atmospheric fields over the original atmospheric model, which is consistent with the result of coupled prediction experiments in ECMWF.
- Coupled Reanalysis using the coupled DA system developed in JMA/MRI**
- The coupled DA system well reproduces precipitation and lagged correlation between SST and precipitation in The Tropics.
- Introduction of GODAE OceanView OSEval TT**
- The TT is willing to support the international efforts on OSEs for S2S forecasts.
- Possible future OSE plans for S2S forecasts in JMA**

Coupled Reanalysis

CDA System (MRI-CDA1)

- Based on JMA's operational systems
- Outer-Loop Coupling
- Assim. cycle: Atmos.: 6 hours, **Ocean: 10 days**

Components

- Atmos. 4DVAR System (Res: TL159L100)
 - Used as the inner model
- Coupled A-O Model
 - (Res: TL159L60 (Atoms.), $1^\circ \times 0.5^\circ$ (Ocean))
 - Used as the outer model
- Oceanic 3DVAR System

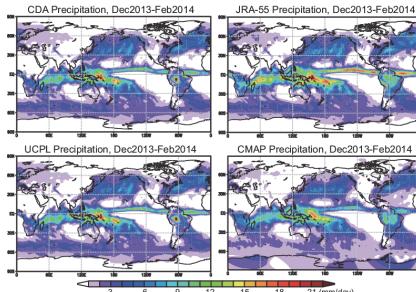


Fig. 3: Precipitation fields averaged in the period from Dec. 2013 to Feb. 2014 in CDA (upper left), UCPL (lower left), JRA-55 (upper right), and observation data (CMAP, lower right).

There is extremely large precip. in ITCZ, SPCZ and the tropical Indian Ocean in JRA-55 compared with CMAP. Large precipitation is disappeared in CDA and UCPL. This improvement is caused by the difference of the models between CDA (UCPL) and JRA-55.

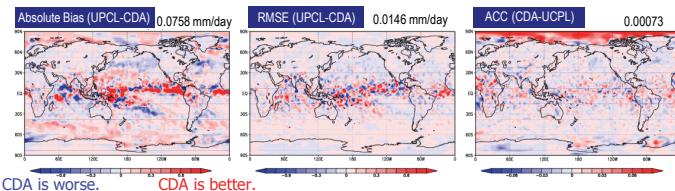


Fig. 4: Reduction of absolute bias (left) and RMSE (middle), and increase of Anomaly Correlation Coefficient (ACC, right) of pentad-averaged precipitation in CDA from those in UCPL. The biases, RMSEs, and ACCs are calculated for Dec2013-Nov2015 using CMAP pentad data as the reference. The biases are removed before the calculation of RMSEs and ACCs. Average over the area between 30°S and 30°N is denoted on the top of each panel.

Lagged correlation b/w SST and Precipitation

- Time series of SST and precipitation averaged in 10°S-10°N, 130-150°E.
- Bandpass filter for 20 to 100 days

LCC, SST-Precip.

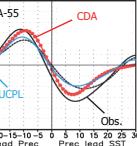


Fig. 5: Plots of Lagged Correlation coefficients of precip. against SST for Nov2014-Apr2015. CDA represents lagged correlation of precip. behind SST better than JRA-55 and UCPL. A similar improvement of CFSR over NCEP-R1 and -R2 was reported in Saha et al. 2010. This improvement is achieved by adjusting SST fields to precip. in CDA.

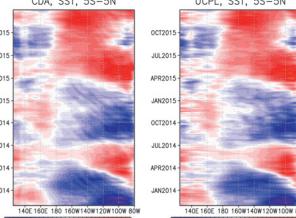


Fig. 6: SST variation in the equatorial Pacific averaged 5°S-5°N. The westward propagation of anomaly in the eastern equatorial Pacific is better seen in CDA.

Possible future OSE plans for S2S forecasts in JMA

- OSEs for S2S forecasts using the current operational seasonal forecasting system (including a coupled model and an ocean data assimilation system) in or the next-generation system in JMA.
- OSEs using the coupled data assimilation system introduced above.
- JMA is willing to collaborate with the international community in this field.**

Subseasonal Prediction by a coupled model

Experimental Design

- Tested for 91 cases (every 5 days from Jun 2016 to Aug 2017)
- Deterministic Forecast, 1-day averaged data, verified against JRA-55

Uncoupled Atmospheric model

- Based on JMA's operational model for NWP (as of Jun 2017)
- Resolution: TL159L100, Prescribed SST and Sea-Ice

Coupled Model

- The atmospheric model is coupled with the JMA's operational ocean and sea-ice model for seasonal forecasts.
- Resolution: TL159L100 (atmosphere) + $1^\circ \times 0.3-0.5^\circ$ L52 (Ocean)

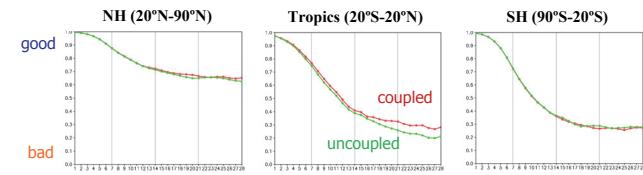


Fig. 1: ACC score of forecasted geopotential height at 500 hPa (Z500). In the tropics, the coupled prediction improved the ACC score over the uncoupled one particularly for longer lead-time forecasts. The difference of the score is significant in NH and SH.

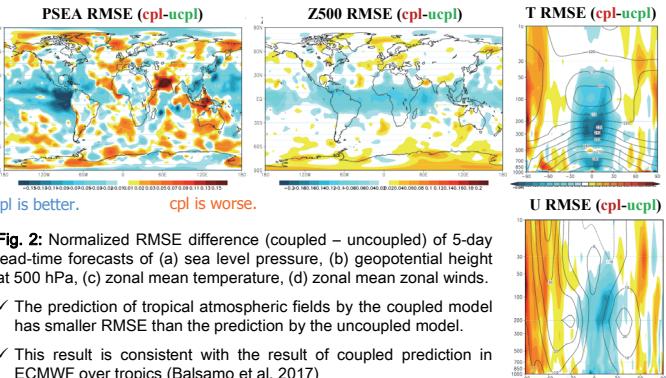


Fig. 2: Normalized RMSE difference (coupled – uncoupled) of 5-day lead-time forecasts of (a) sea level pressure, (b) geopotential height at 500 hPa, (c) zonal mean temperature, (d) zonal mean zonal winds.

- The prediction of tropical atmospheric fields by the coupled model has smaller RMSE than the prediction by the uncoupled model.
- This result is consistent with the result of coupled prediction in ECMWF over tropics (Balsamo et al. 2017)

GODAE OceanView Observing System Evaluation TT



GODAE OceanView

- Provides a forum for national forecasting centres to communicate and exchange knowledge and expertise on ocean data assimilation and ocean predictions

Observing System Evaluation Task Team (OSEval TT)

- Co-chairs: Yosuke Fujii (JMA/MRI), and Elisabeth Rémy (Mercator Ocean)
- Members from NOAA, JPL, ECMWF, MetOffice, CSIRO, JAMSTEC, KORDI, etc.
- Mission: To provide consistent and scientifically justified requirements and feedbacks to agencies in charge of Global and Regional Ocean Observing Systems

Future Vision

- Aim to construct a positive feedback cycle b/w observational agency and operational centers



Activities

- Task team meetings (approximately every 2 years)
- Delayed-mode OSE for ENSO forecasts (ECMWF, JMA)
- White paper on ocean data assimilation requirements for TPOS2020 kick-off meeting in Jan. 2014 at La Jolla (Fujii et al. 2015, QRMS)
- Examination of satellite salinity impacts (SMOS-Nino2015, ESA project)
- Evaluation of the Atlantic observing system (AtlantOS, EU Horizon 2020 project)
- Preparing a community white paper on ocean observing system evaluation activities for OceanObs19. Also supporting the community white paper on S2S forecasts.
- The TT is willing to support the international efforts on OSEs for S2S forecasts**