Evaluations of Retrieved Cloud Liquid Water from AMSR-E, and Impacts on Numerical Weather Prediction

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- JMA/NWP Models
  - MWR data utilization status
- Evaluations of CLW Retrievals
- Impacts on NWP

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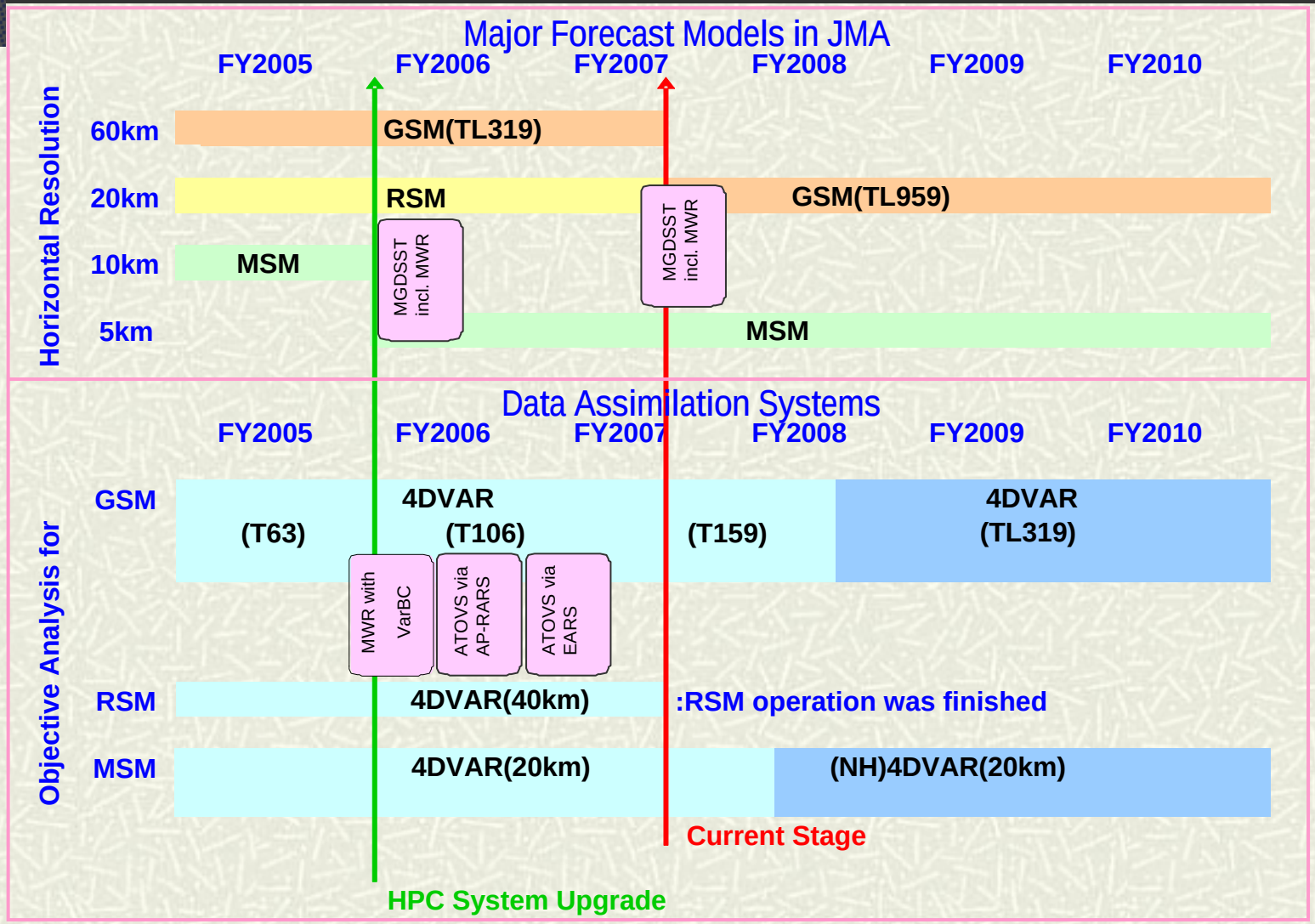
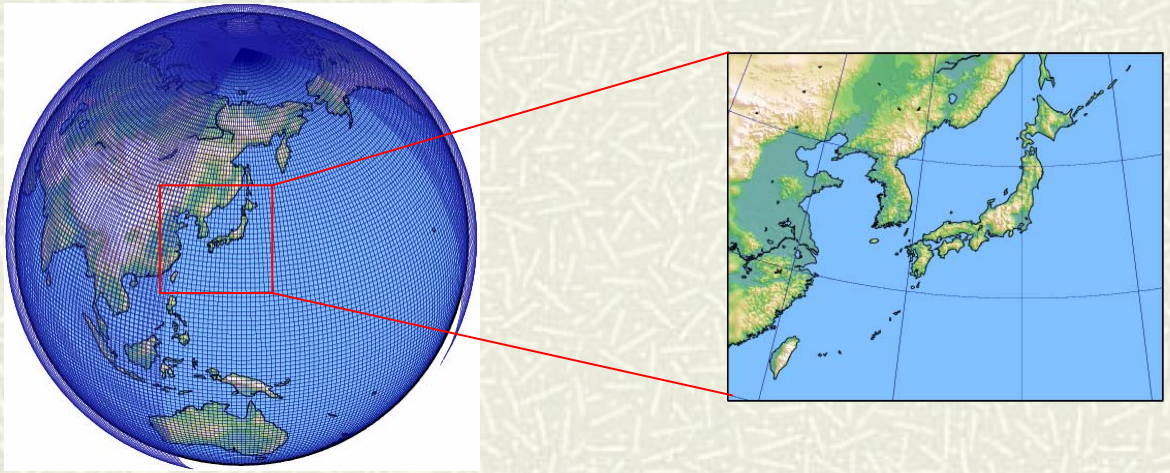
Japan Meteorological Agency

Update on JMA models and DA systems



Current Operational Models in JMA

(after Nov. 21, 2007)



GSM
TL959 (20km)
L60 (~0.1hPa)

4 times/day
36, 90 and 216 hrs fcst

DA system
4DVAR (T159 (120km))

MSM
dx=5km
L50 (~22km)

8 times/day
15 and 33 hrs fcst

DA system
4DVAR (20km)

MWR data utilization status

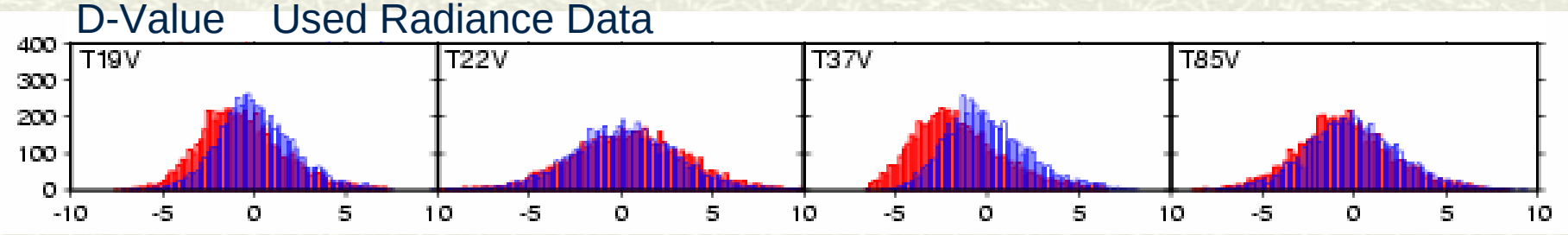
- For MSM
  - SSM/I and TMI TCPW and Rain from Oct 2003
  - AMSR-E TCPW and Rain from Nov 2004
    - rain area – precipitation
    - clear or thin-cloud areas – TCPW
    - thick-cloud area – Not used
- For GSM
  - SSM/I, TMI and AMSR-E Radiance from May 2006
    - less cloud/rain-affected area – vertical TBB

MWR radiance assimilation

- Configurations for GSM
  - Using vertical polarized channels only
    - SSM/I: 19V, 22V, 37V, 85V
    - TMI: 19V, 21V, 37V, 85V
    - AMSR-E: 18V, 23V, 36V, 89V
  - Over clear sky ocean with SST > 5deg.C
  - Thinned by 200km box for every time slots
  - Observation Error Settings: 4σ (σ:STD)
  - Variational Bias Correction
    - Bias correction coefficients are updated in the each analysis
    - Predictors: TCPW, T_{SRF}, T_{SRF}^2, WS_{SRF}, $\cos(Z_{ang})$, Constant

Why CLW?

- Improve the Usage of MWRs
  - cloud-affected data
    → utilization of CLW retrievals
    - remove cloud-effected data
    - bias correction with CLW



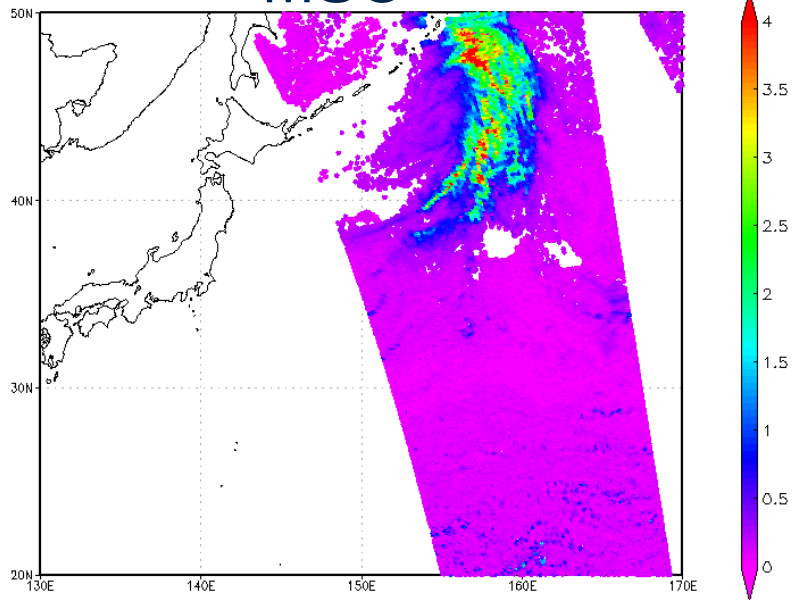
Red: Observation - First Guess(w/oBC)

Blue: Observation - First Guess (wBC)

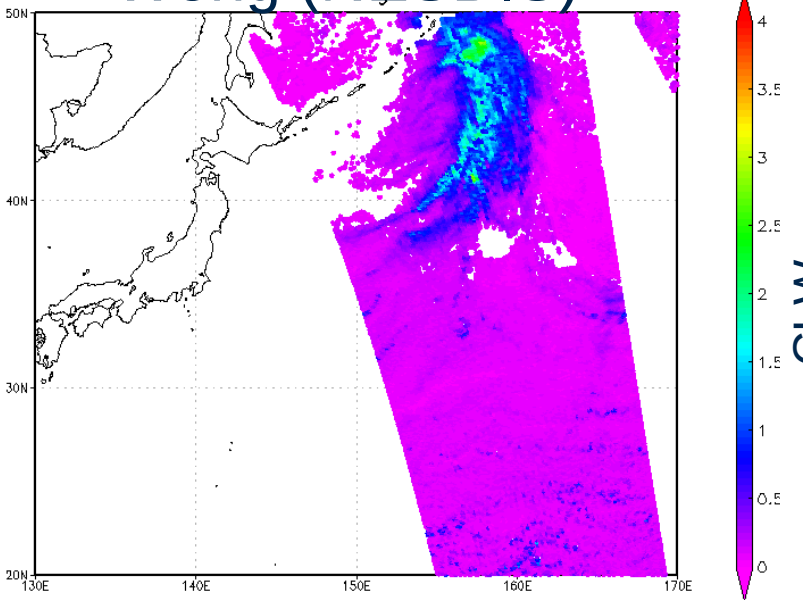
CLW Algorisms

- MSC (Meteorological Satellite Center)
  - used for experiment
- Wentz (JAXA standard products)
- Weng (NESDIS)

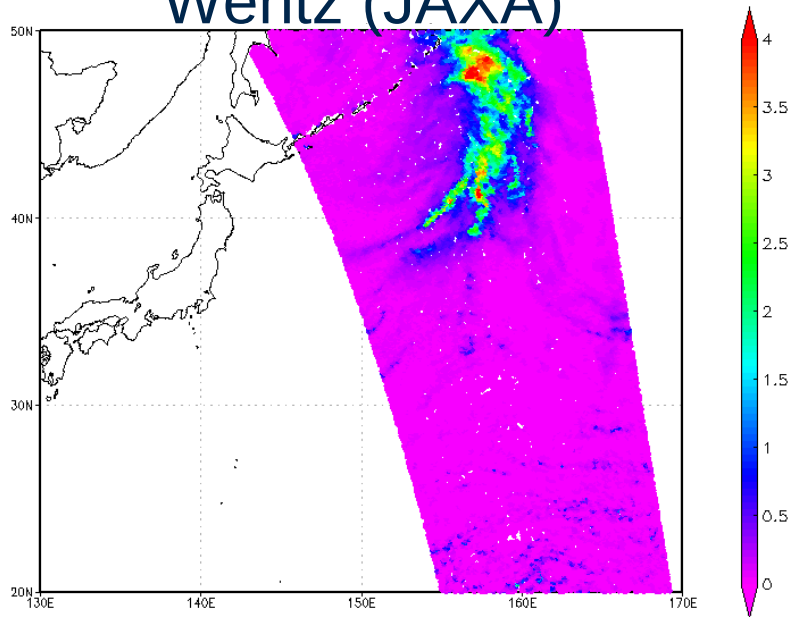
MSC

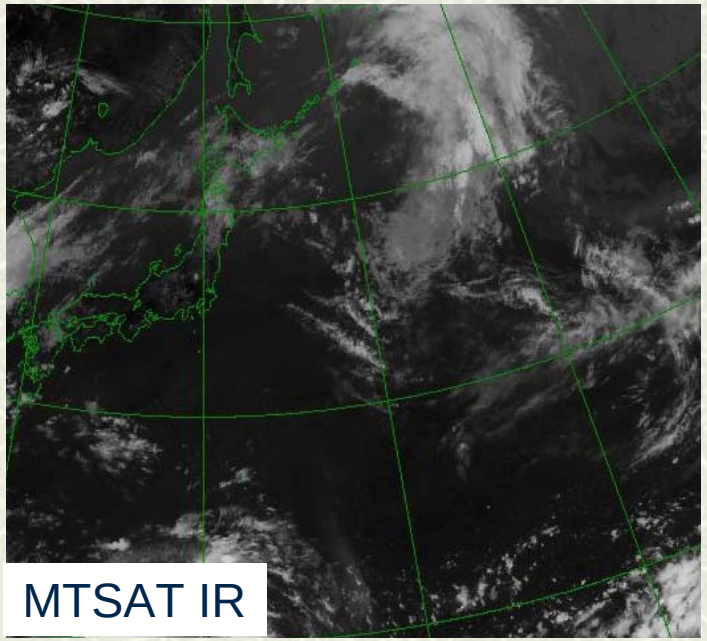


Weng (NESDIS)



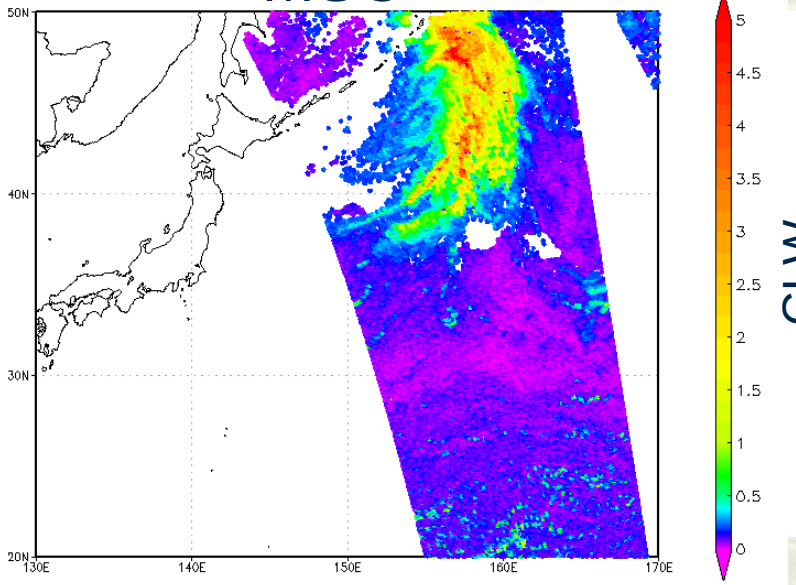
Wentz (JAXA)



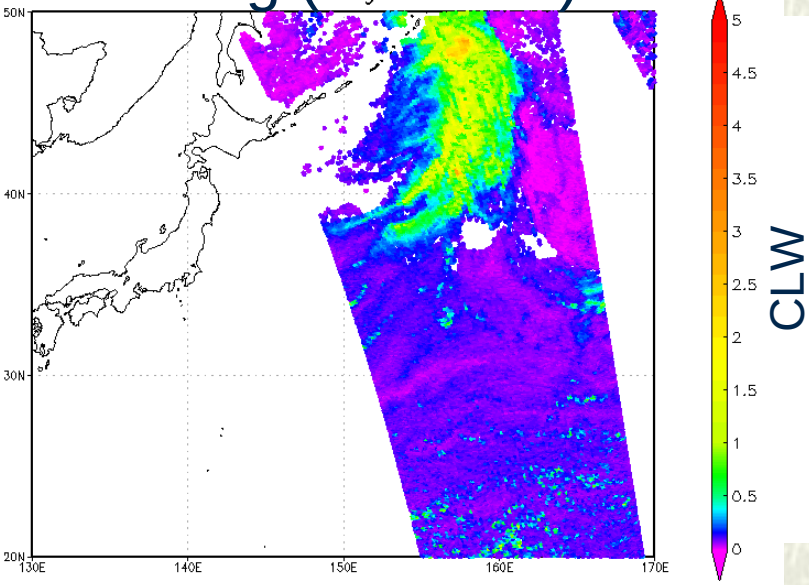


5 Aug, 2007

MSC

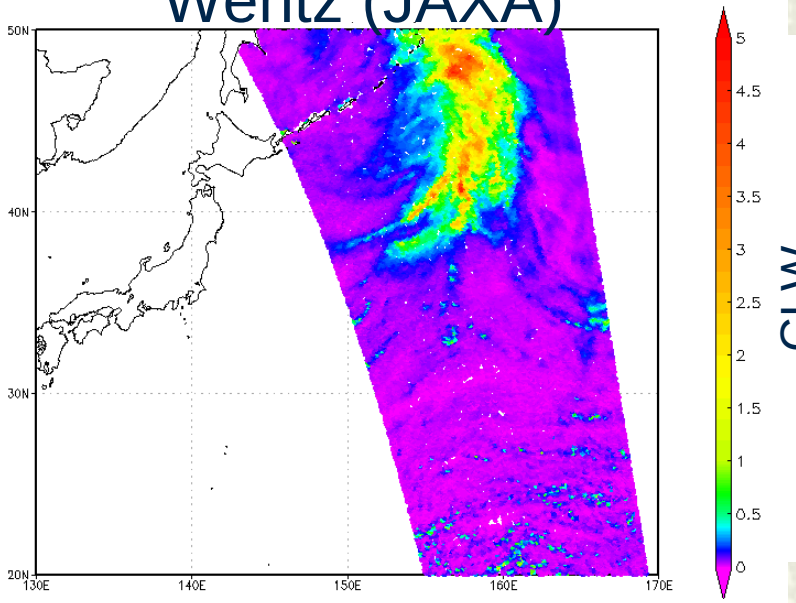


Weng (NESDIS)



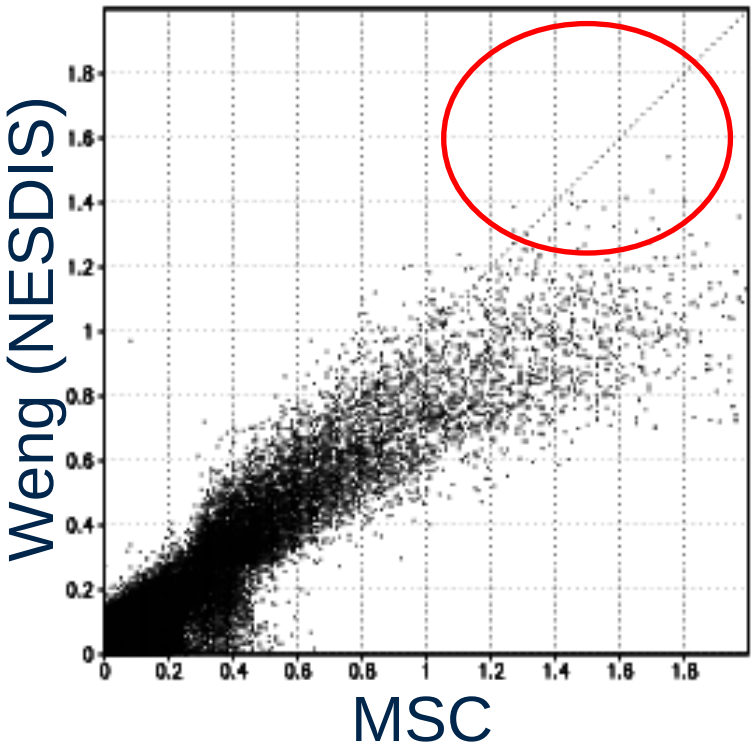
5 Aug, 2007

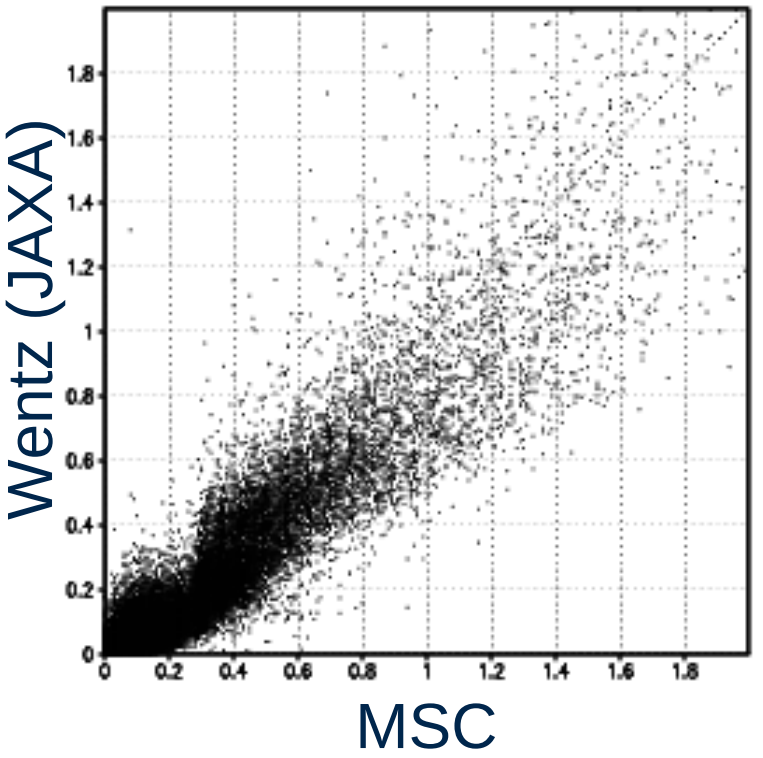
Wentz (JAXA)



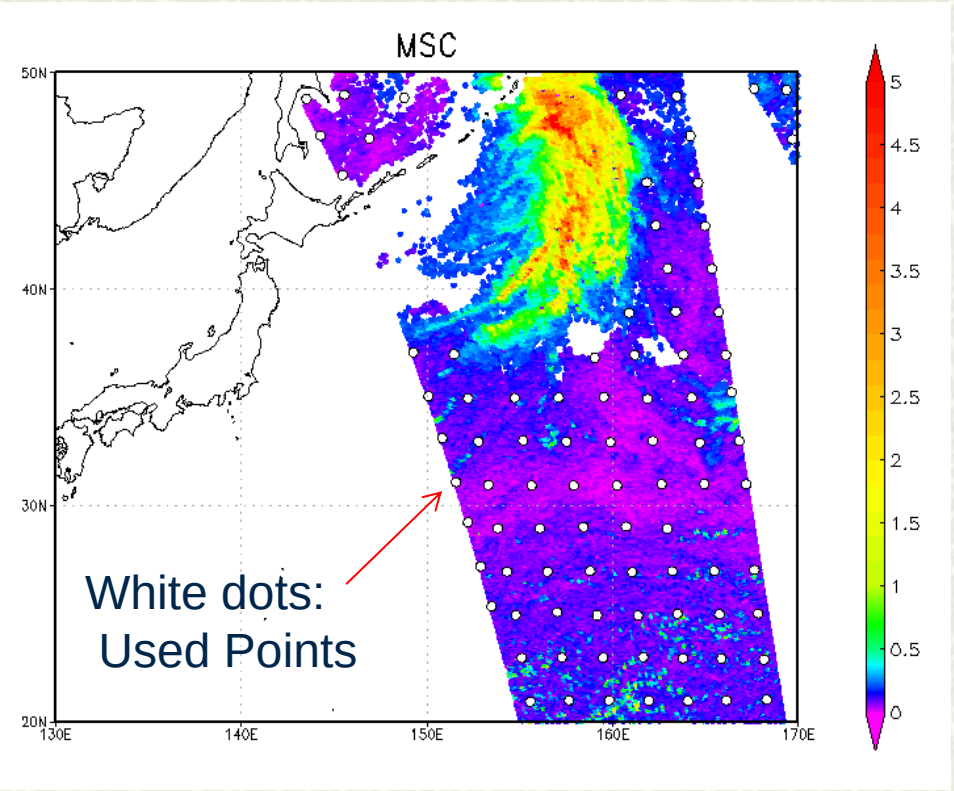
- Weng:
  saturated in thick cloud area
- Wentz:
  larger number of nearly 0

CLW Scatter Plots

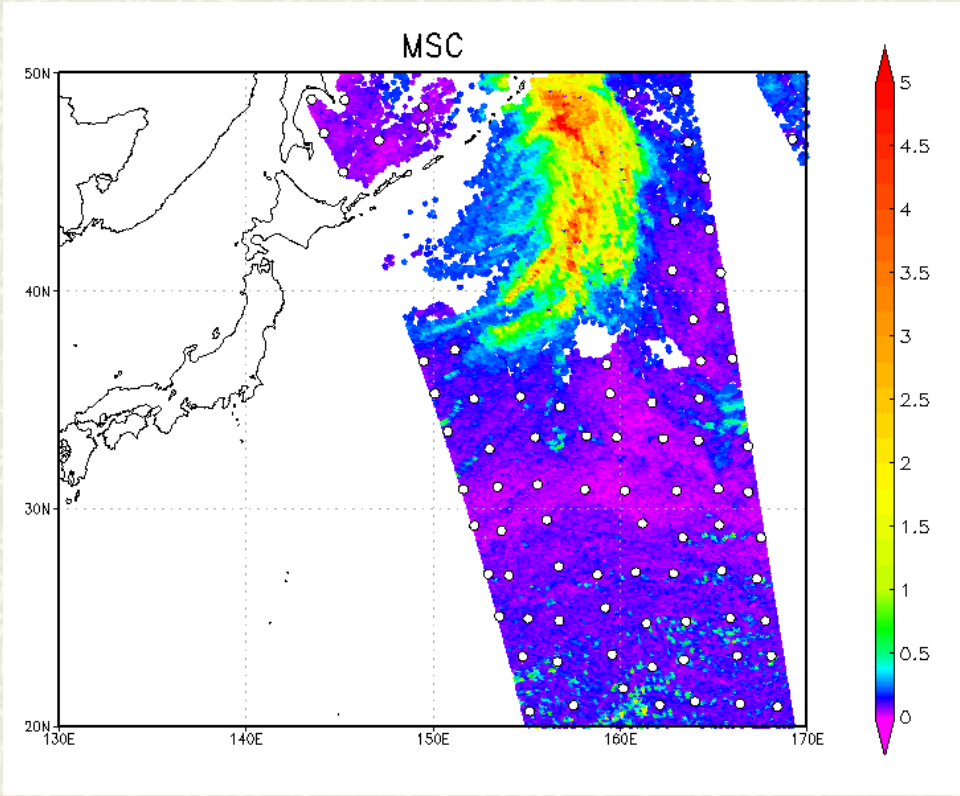




Used Data



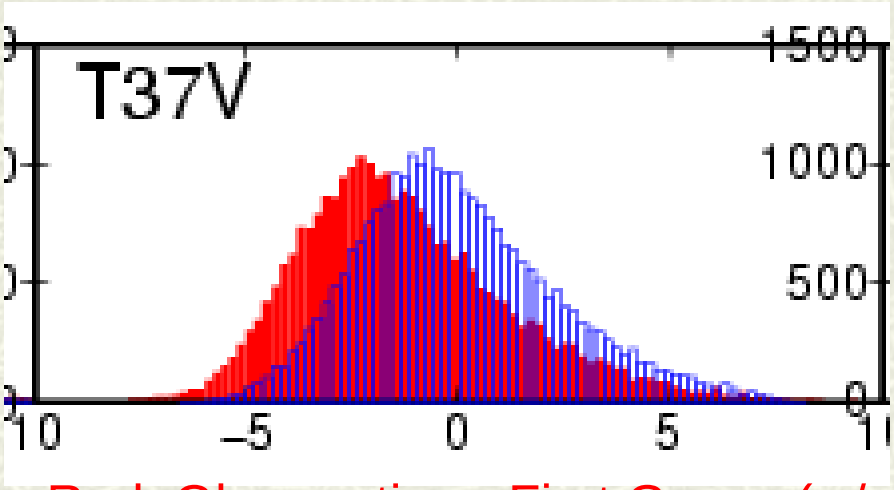
Control: nearly Routine w/o using CLW



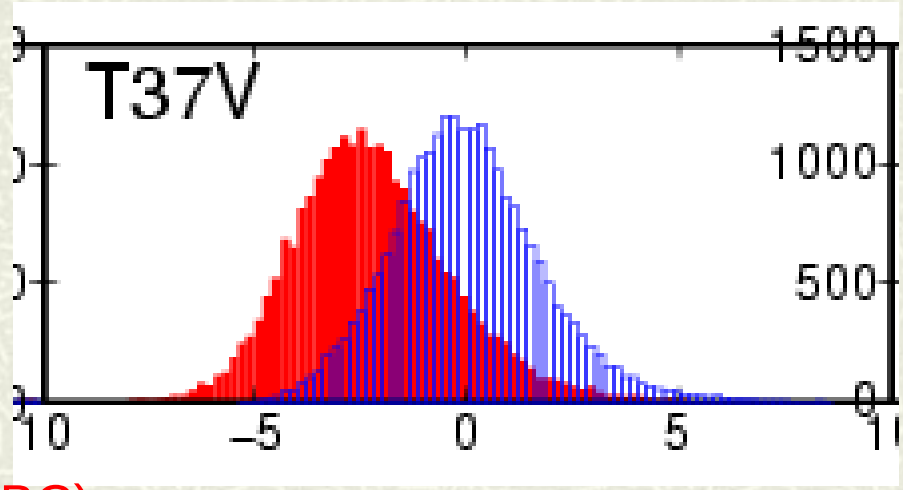
Test: using CLW for thinning

Departure Value

Cntl: w/o CLW QC



Test: w CLW QC

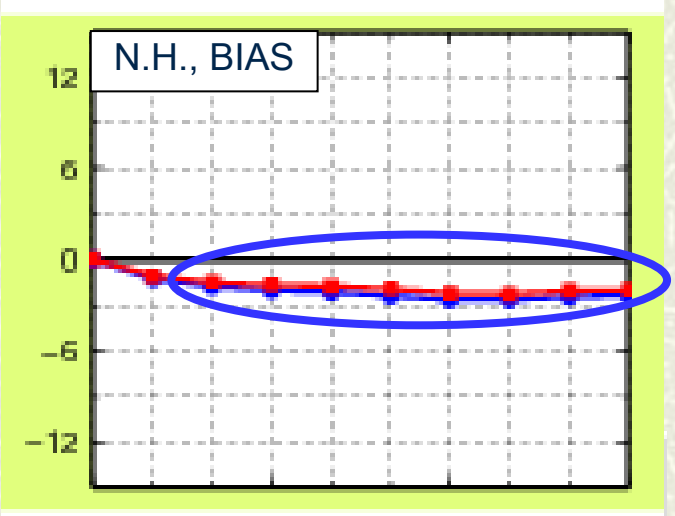


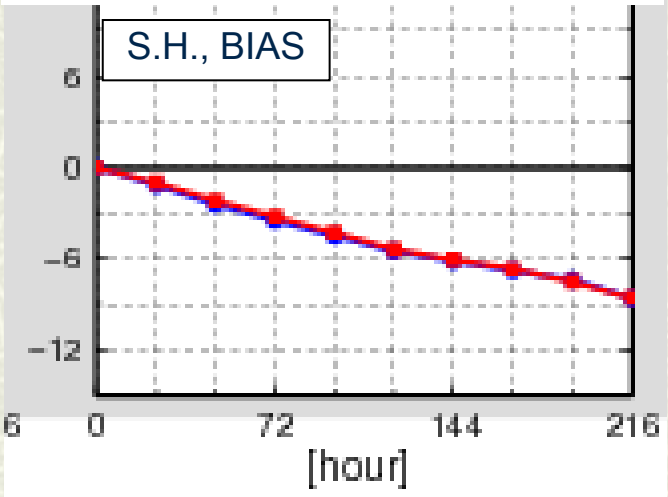
Red: Observation - First Guess (w/oBC)
Blue: Observation - First Guess (wBC)

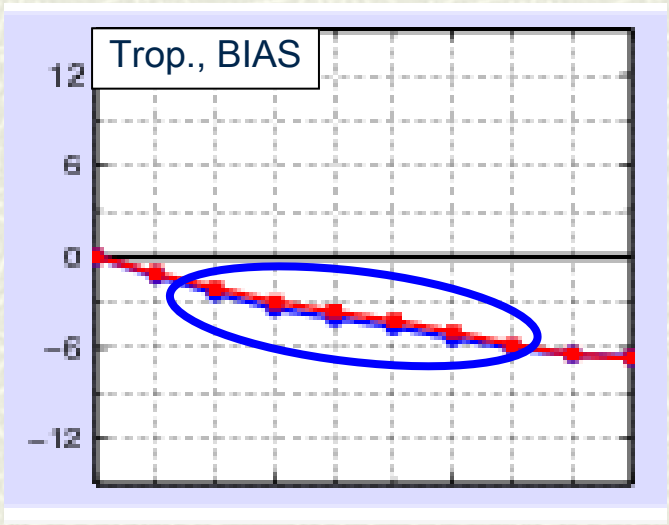
Skewness: 0.82 → 0.13

OSE results

500hPa GPH forecast BIAS







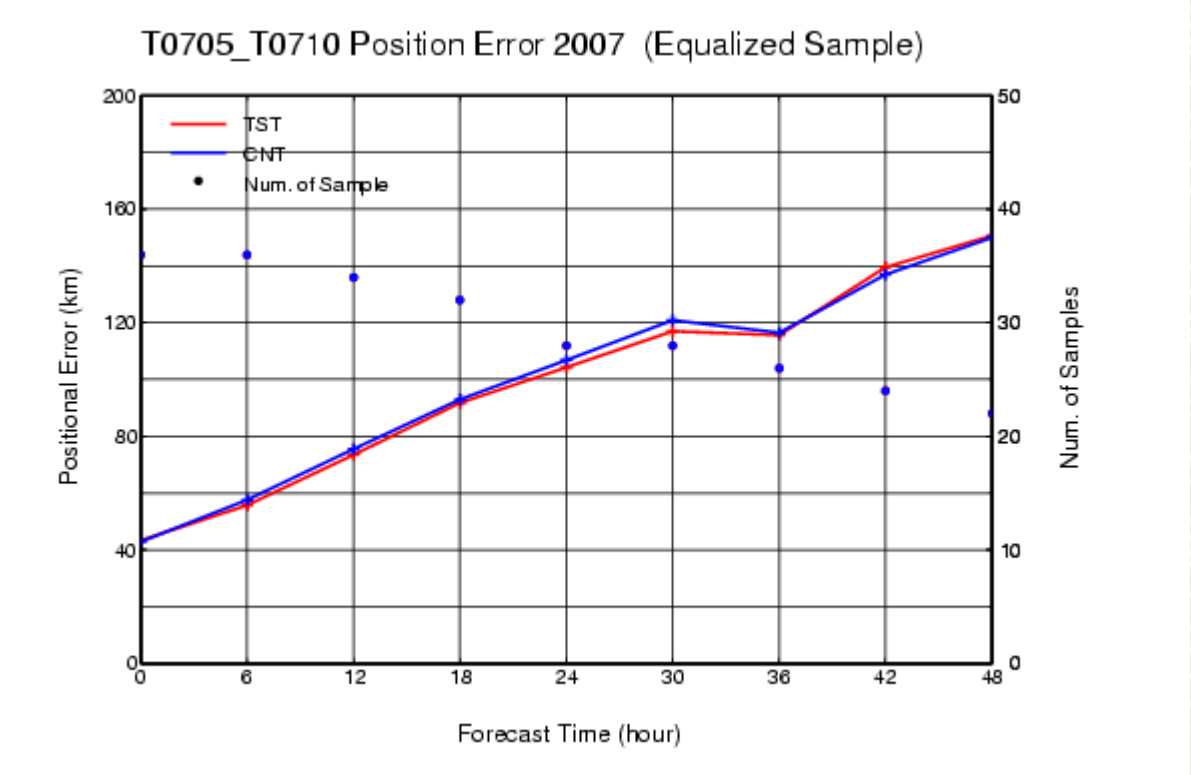
N.H. & Trop. : Improved

Cntl: w/o CLW QC

Test: w CLW QC

OSE results

Typhoon position error → Neutral



Cntl: w/o CLW QC / Test: w CLW QC

Summary

- About MWR
  - MSM : using retrieved Rain and Precipitable Water
  - GSM : using radiance data over the clear sky ocean
- Utilization of CLW
  - removing cloud-affected data
- Impacts on NWP
  - N.H. & Trop. Z500 : improved
  - Typhoon : neutral

Future Plan

- Utilization of Cloud/rain-affected Data
  - Assimilation of CLW?
- Adding DMSP-F16/SSMIS
  - Ongoing experiment: slightly improved
- Utilization in land area

END

Thank you!