

Extremes Represented in JRA-25 Recent Improvement in Seasonal Forecast Model at JMA

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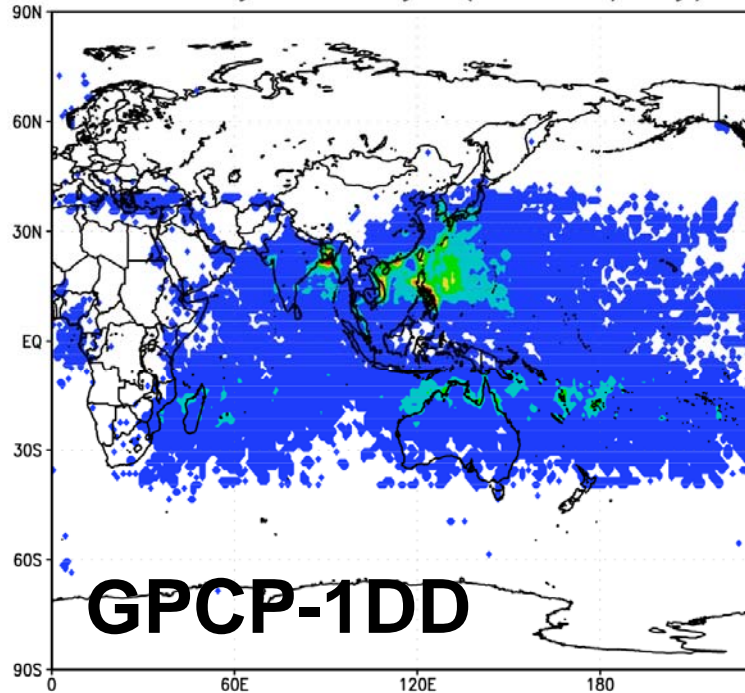
Extremes Represented in JRA-25

- Distribution of Heavy Rain
- Individual Flash Flood
- Heat Wave



Distribution of Heavy Rainfall

Annual heavy rain days (>70mm/day) GPCP-1DD(1997-2006)



GPCP-1DD



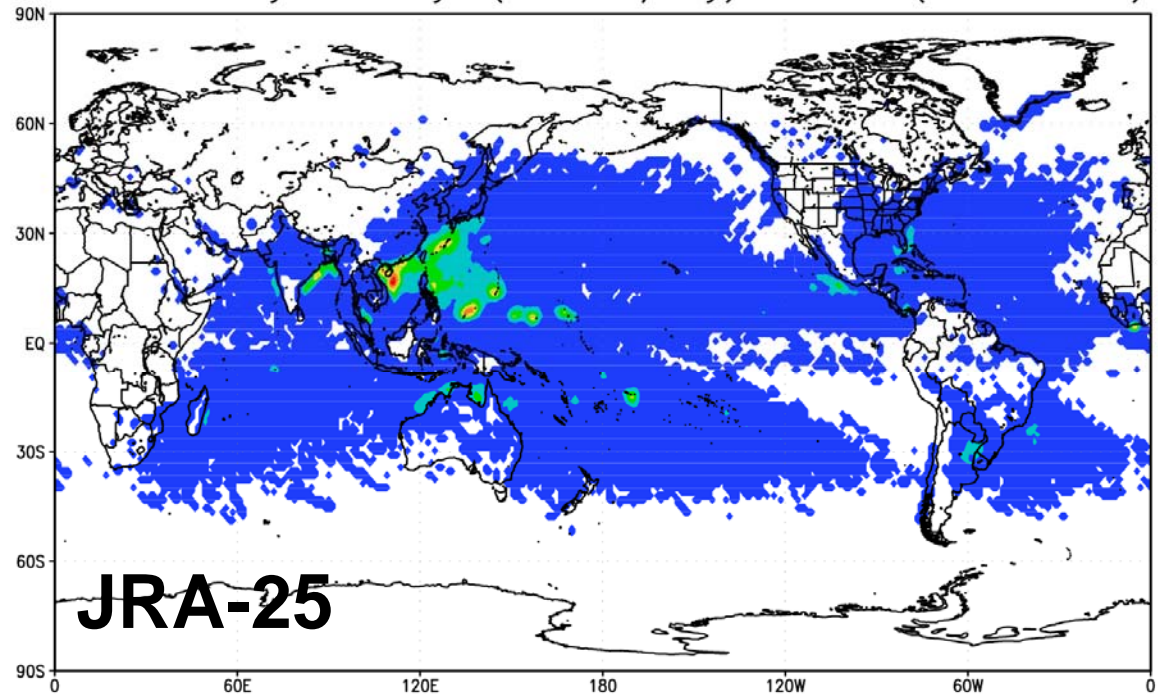
The heavy rain (>70mm/day) is almost only in Asia.

Bay of Bengal

WNP

South China Sea

Annual heavy rain days (>70mm/day) JRA-25(1979-2006)

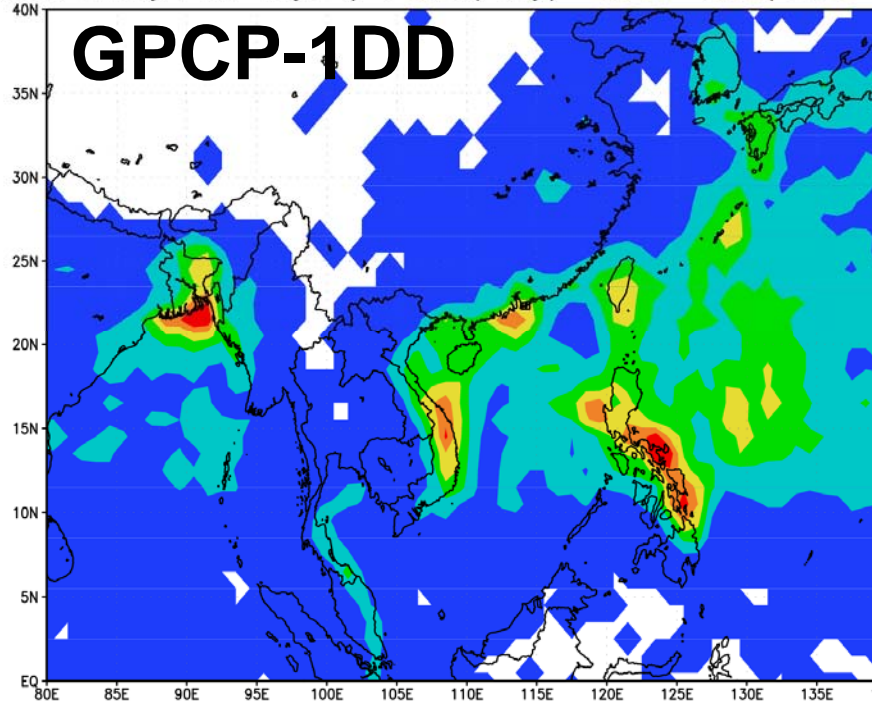


JRA-25



Distribution of Heavy Rainfall

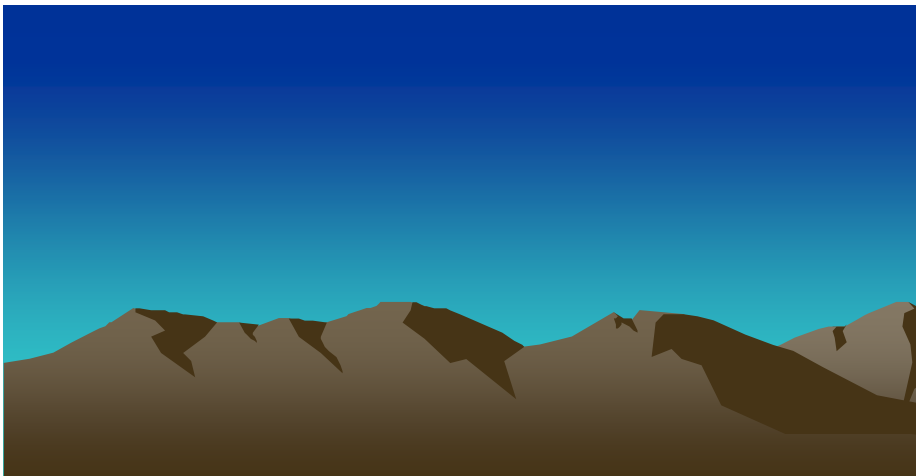
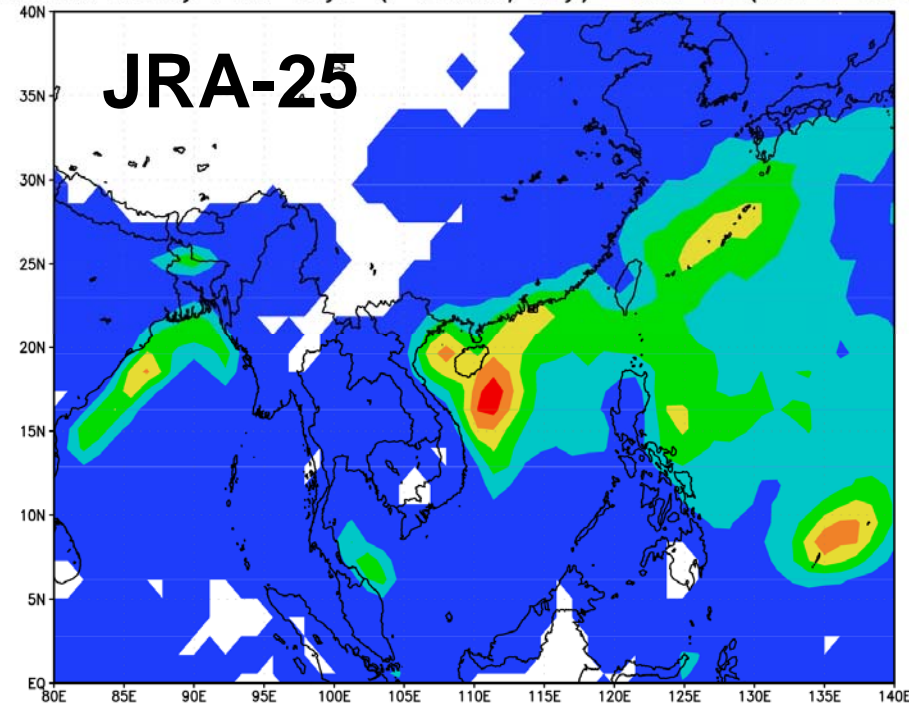
Annual heavy rain days (>70mm/day) GPCP-1DD(1997-2006)



Similar distribution of heavy rain days (>70mm/day) between GPCP-1DD and JRA-25.

Bay of Bengal
South China Sea
Philippine Sea

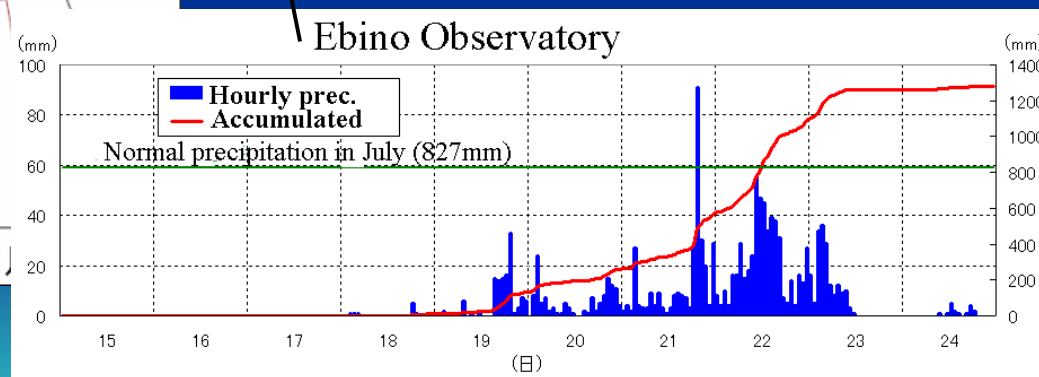
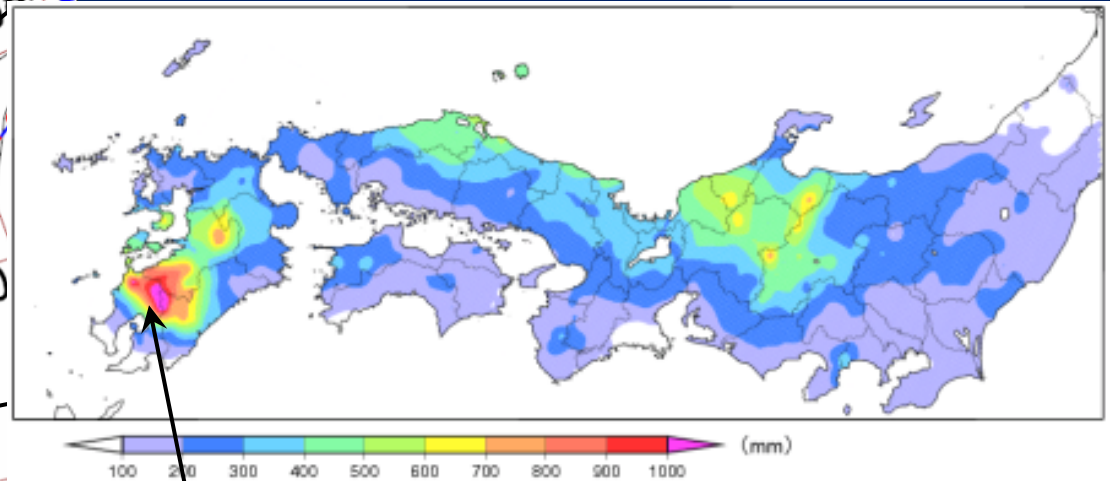
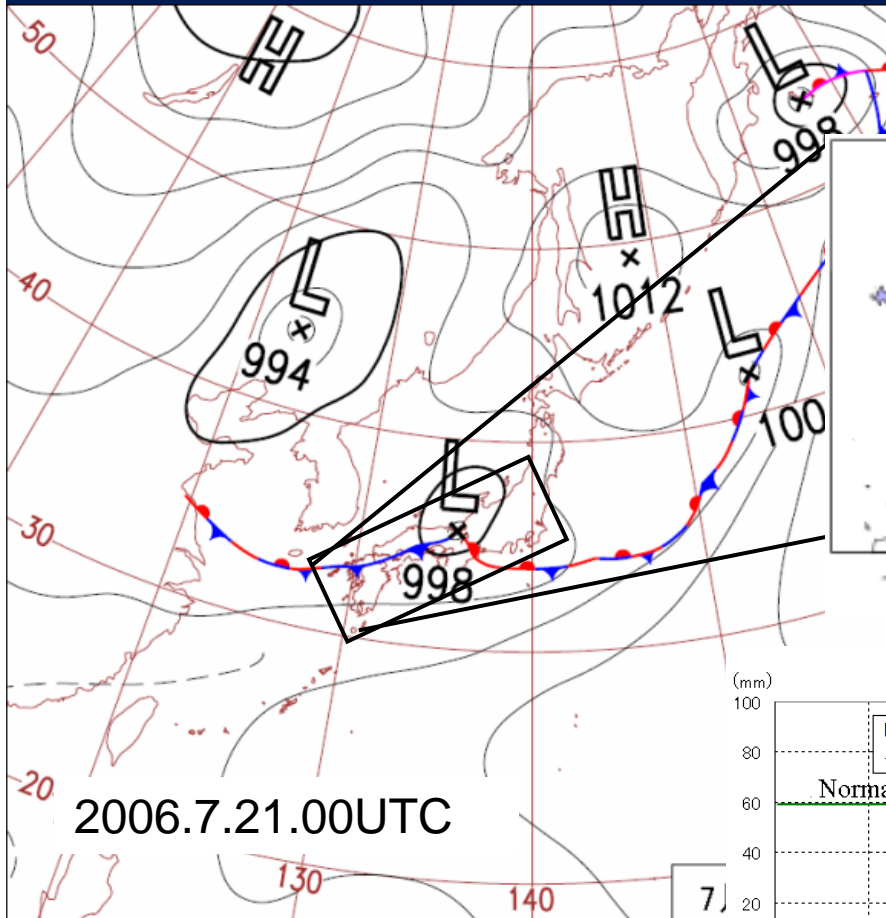
Annual heavy rain days (>70mm/day) JRA-25(1979-2006)



Flash Flood in Southern Japan

2006.7.21-27

Precipitation (mm) 2006.7.15-7.24

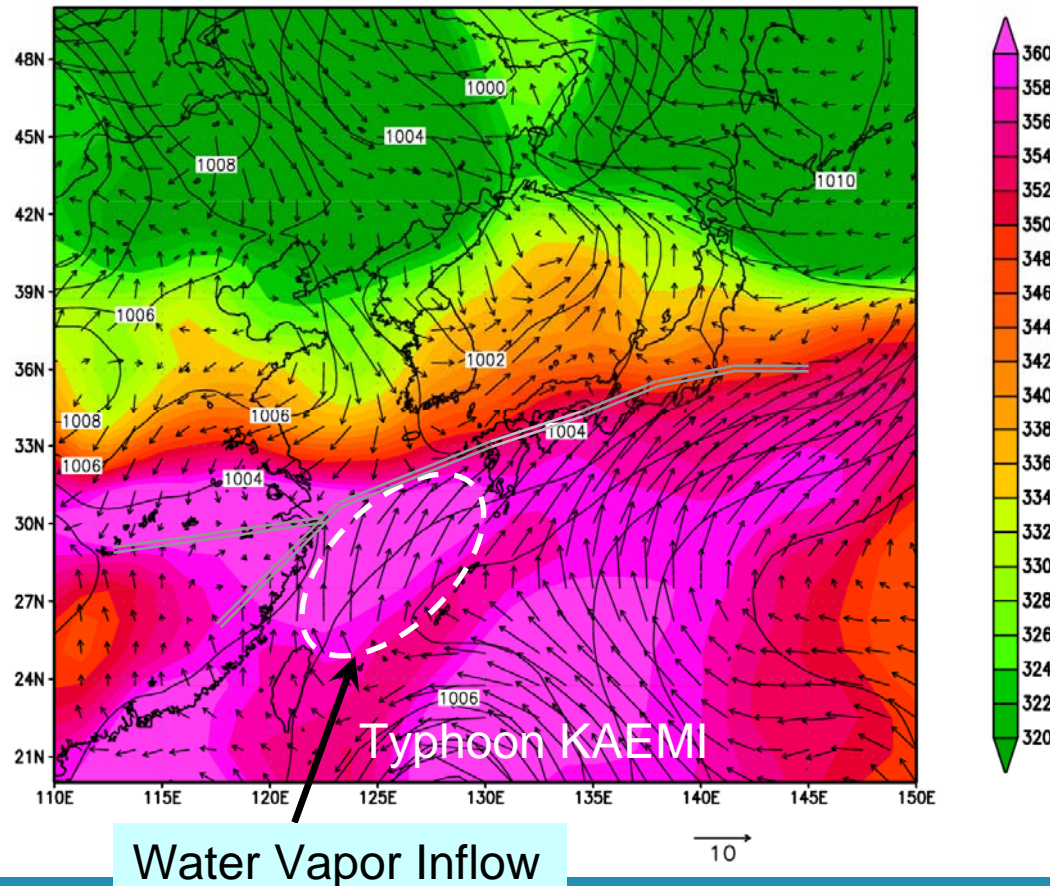


Over 1000mm/3days observed in Southern Kyushu.

Flash Flood in Southern Japan

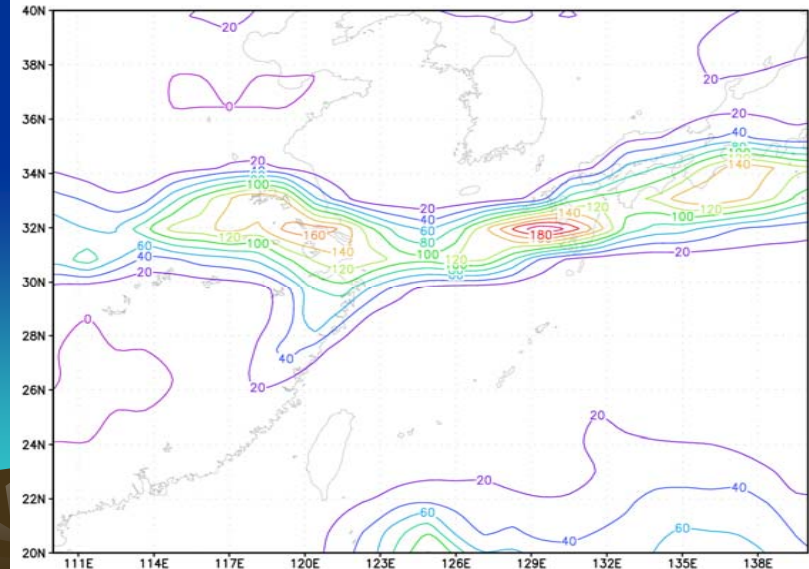
2006.7.21-27

Theta-e850, V850, and SLP 2006.07.22.12UTC



Intense vapor inflow converge in South China Sea ~ Kyushu Island, and cause heavy rainfall along 32N from China to Japan.

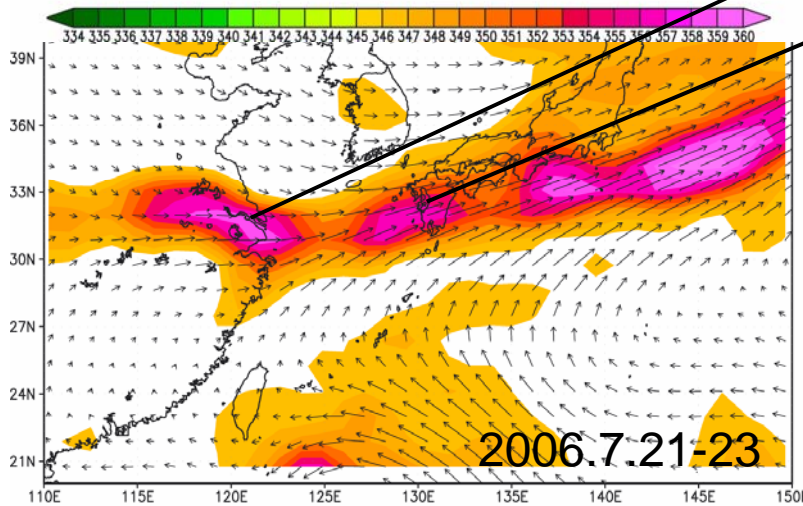
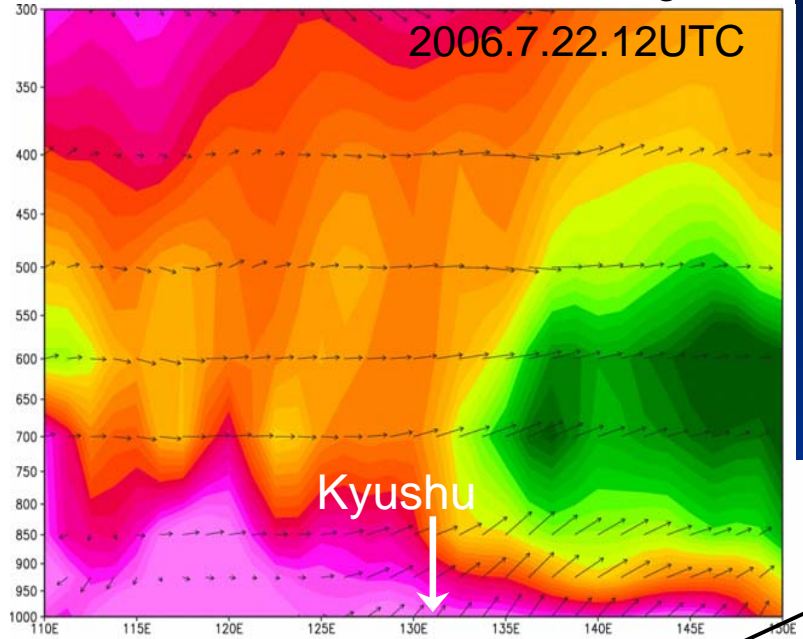
Total Rainfall (mm) 2006.7.21-23



Flash Flood in Southern Japan

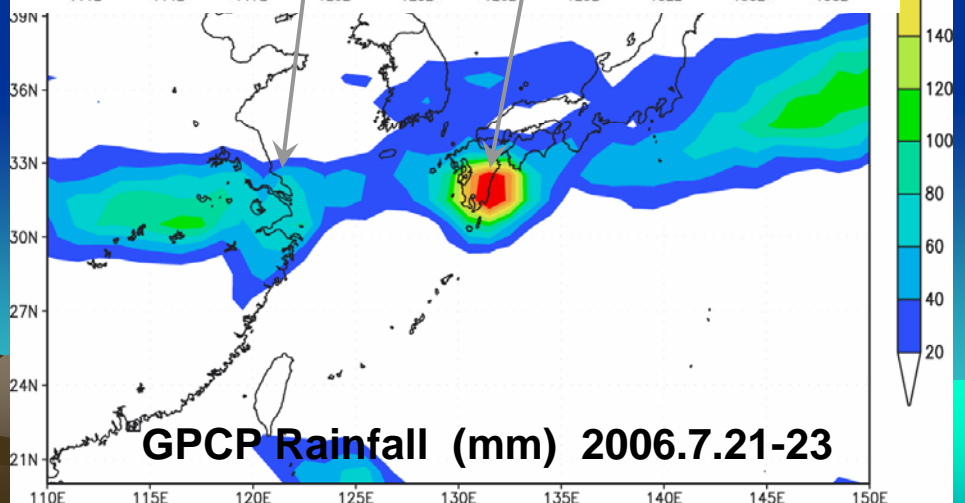
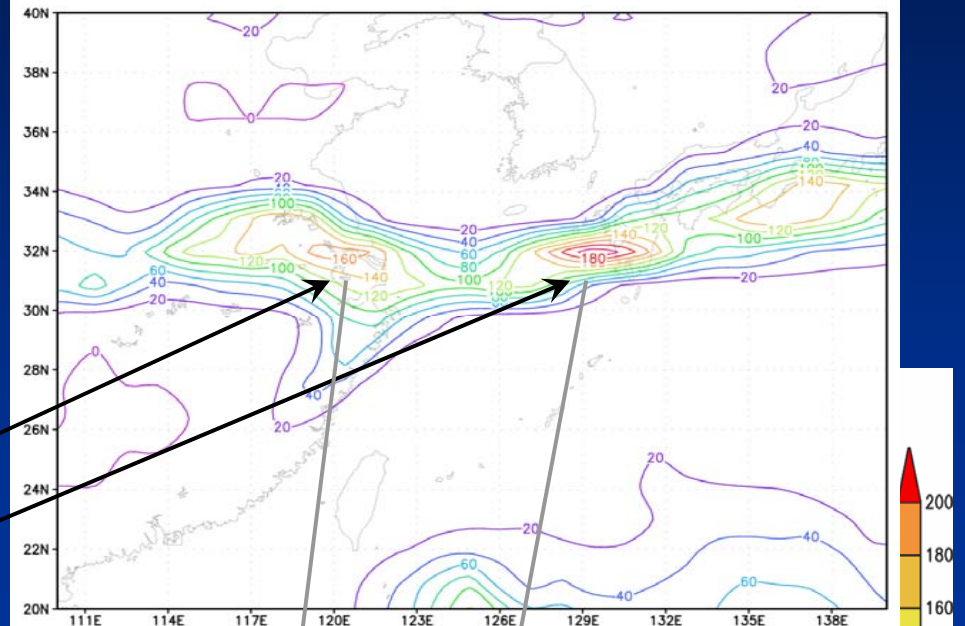
2006.7.21-27

Theta-e and horizontal wind along 31N



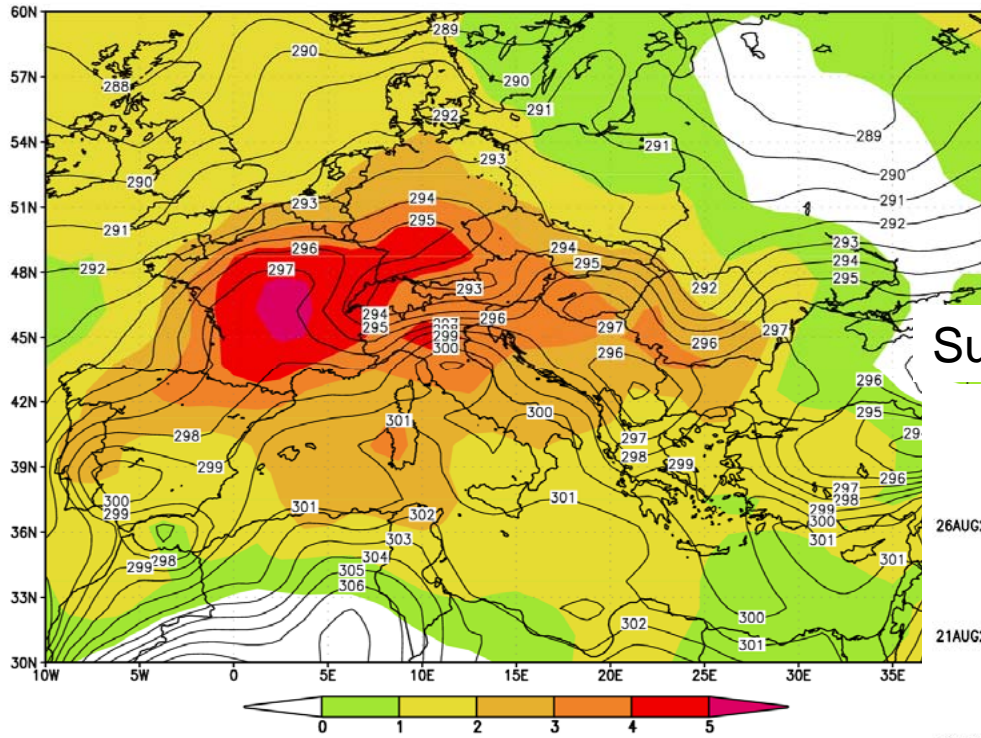
Water Vapor flux and its convergence

JRA-25 Rainfall (mm) 2006.7.21-23



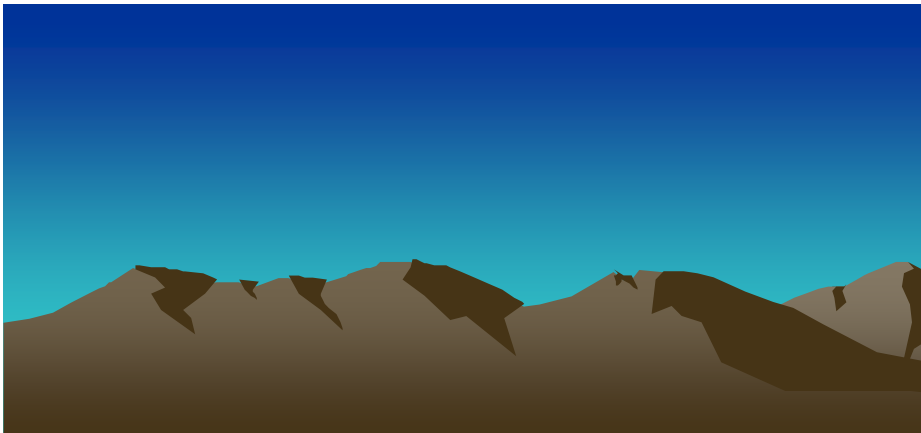
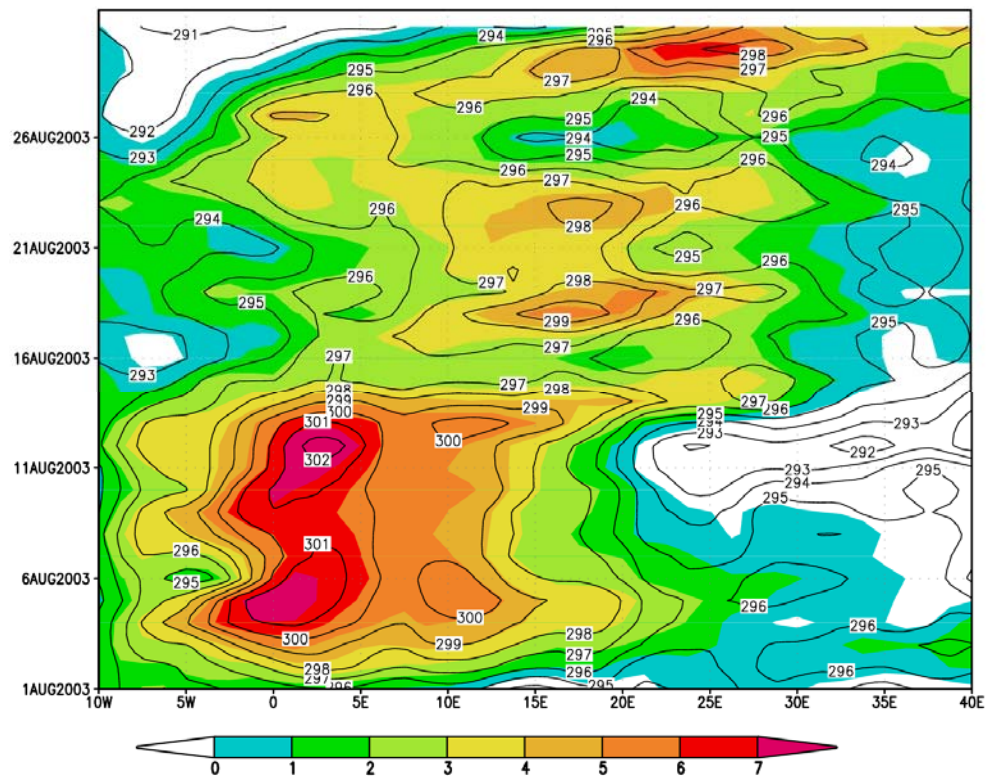
Heat Waves

Surface temperature and its anomaly (K) Aug2003



Europe Aug2003

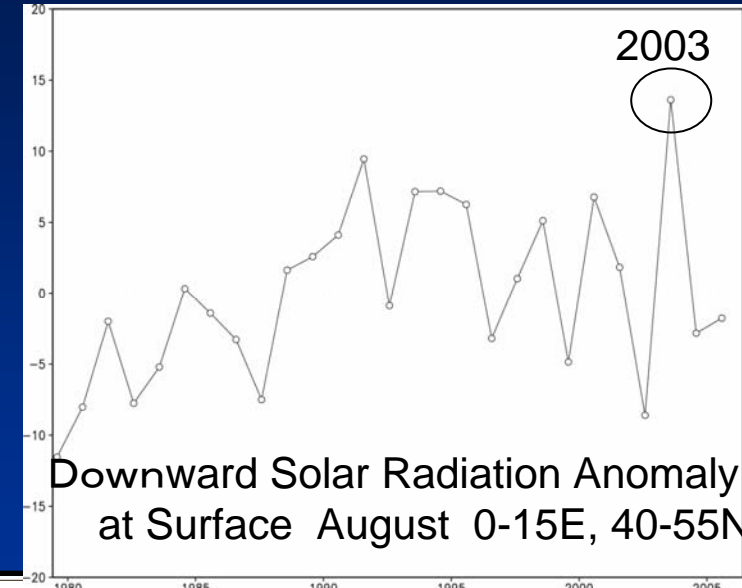
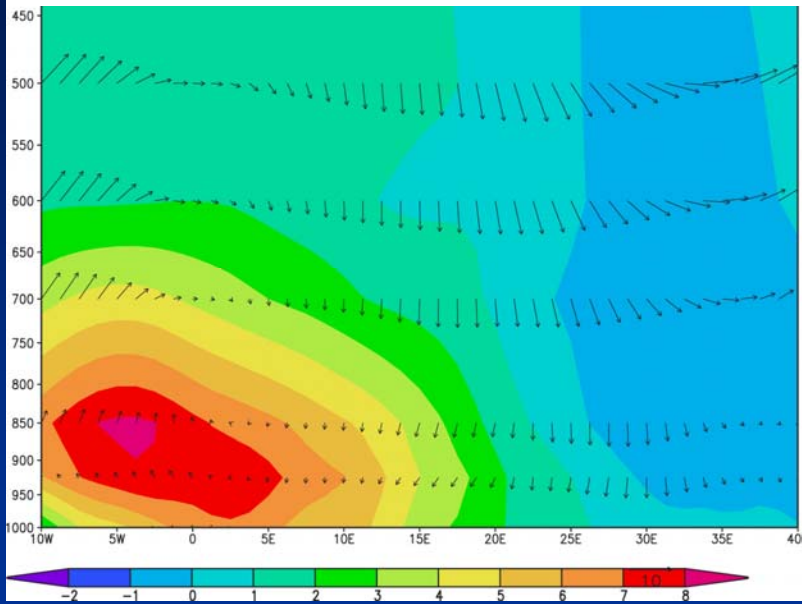
Surface temp and anomaly (K) Lat=40-50



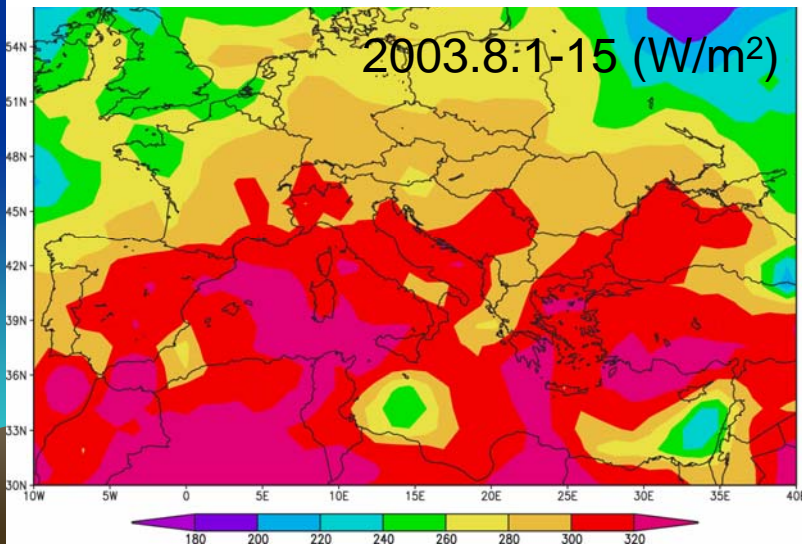
Heat Waves

Europe Aug2003

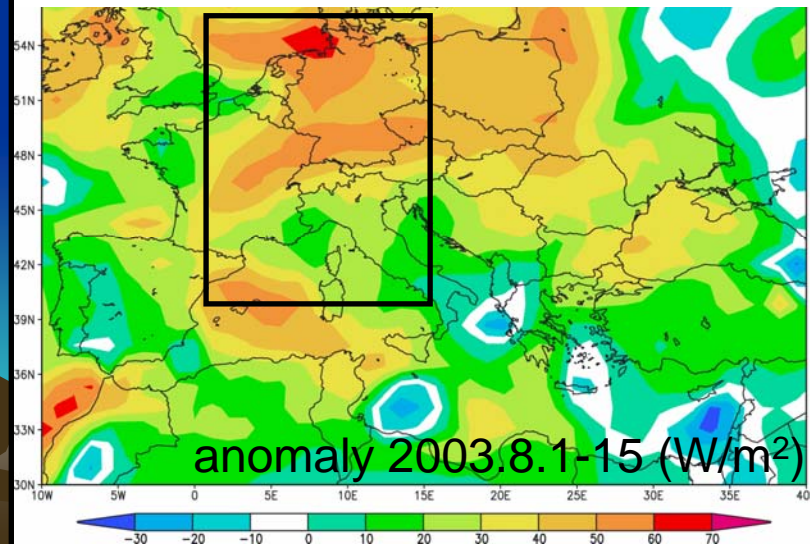
Temperature & wind 2003.8.1-15



Downward Solar Radiation at surface



Downward Solar Radiation at surface



Recent Improvement in Seasonal Forecast Model at JMA



Outline of Present Model at JMA

- Resolution : TL95L40
- Ensemble size : **51**
- Convective parameterization :
Prognostic Arakawa-Shubert
- Radiation : **Short wave** + Long wave
- PBL : Mellor-Yamada level 2
- Aerosol : **Climatology**
- SST : 2-tired (Persisted + Predicted)



Enhancement of Ensemble Size

- Ensemble size in forecast
31 --> 51 (from Sep2007)

- Methodology

including uncertainty of SST

previous : 31 atmosphere (SV) + 1 SST

present : combination of 5 atmosphere (SV)
and 11 SSTs

(SST: added perturbations based on
observed SSTs)

5 or 4 atmosphere (SV) for 1 SST

Enhancement of Ensemble Size

- Hindcast

5 --> 11

- Methodology

including uncertainty of SST

previous : 5 atmosphere (SV) + 1 SST

present : combination of 11 atmosphere (SV)
and 11 SSTs

(SST: added perturbations based on
observed SSTs)

1 atmosphere (SV) for 1 SST

Improvement in Physical Processes

- Shortwave absorption by water vapor
 - Previous : Line absorption
 - Present : Line + continuum
- Trigger of cumulus parameterization
 - Introducing trigger to suppress weak rain
- Aerosol climatology
 - Previous : Only land-sea contrast
 - Present : Realistic aerosol distribution



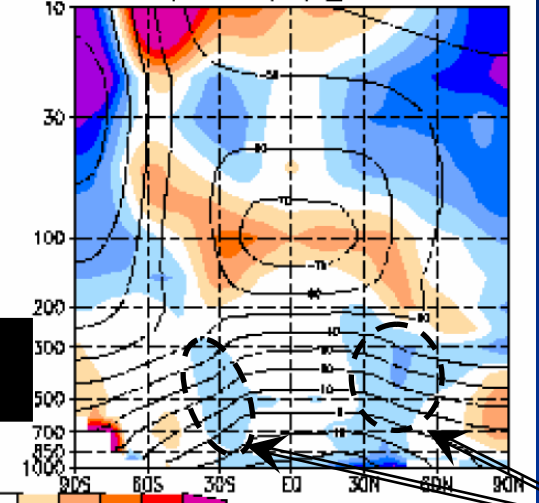
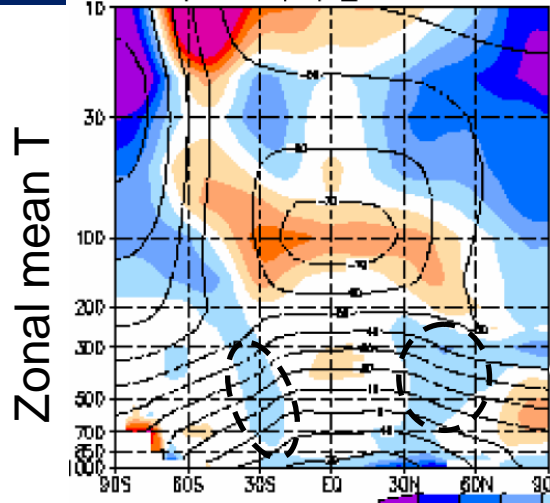
Shortwave absorption by water vapor

Present radiation (JJA)

Previous radiation (JJA)

T & error (-ERA40) cpd_060531.aer2swa3 JJA

T & error (-ERA40) cpd_060531.aer2 JJA

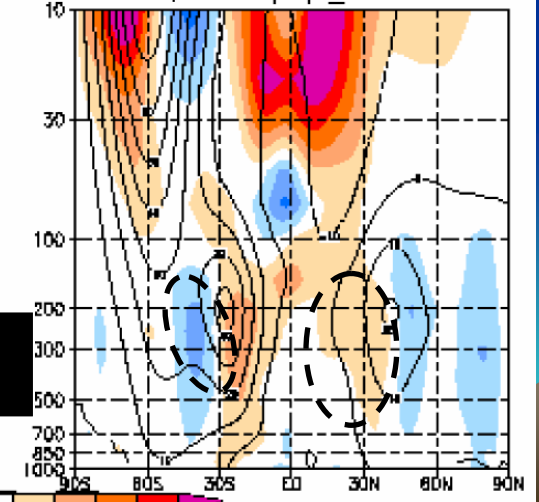
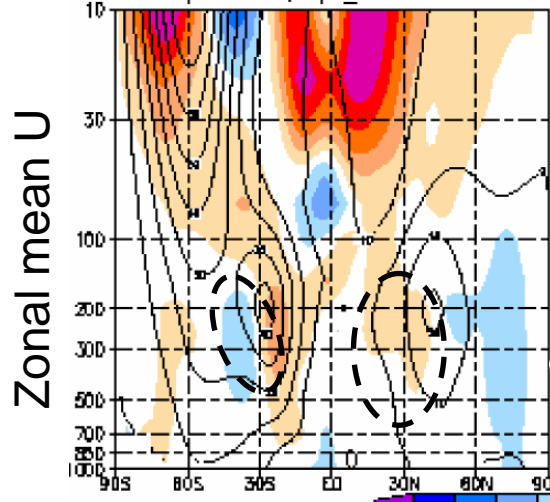


Previous : Line absorption
Present : Line+continuum

Low temperature bias is improved in lower/middle atmosphere.

U & error (-ERA40) cpd_060531.aer2swa3 JJA

U & error (-ERA40) cpd_060531.aer2 JJA



U-wind bias is also improved.

Trigger of cumulus parameterization

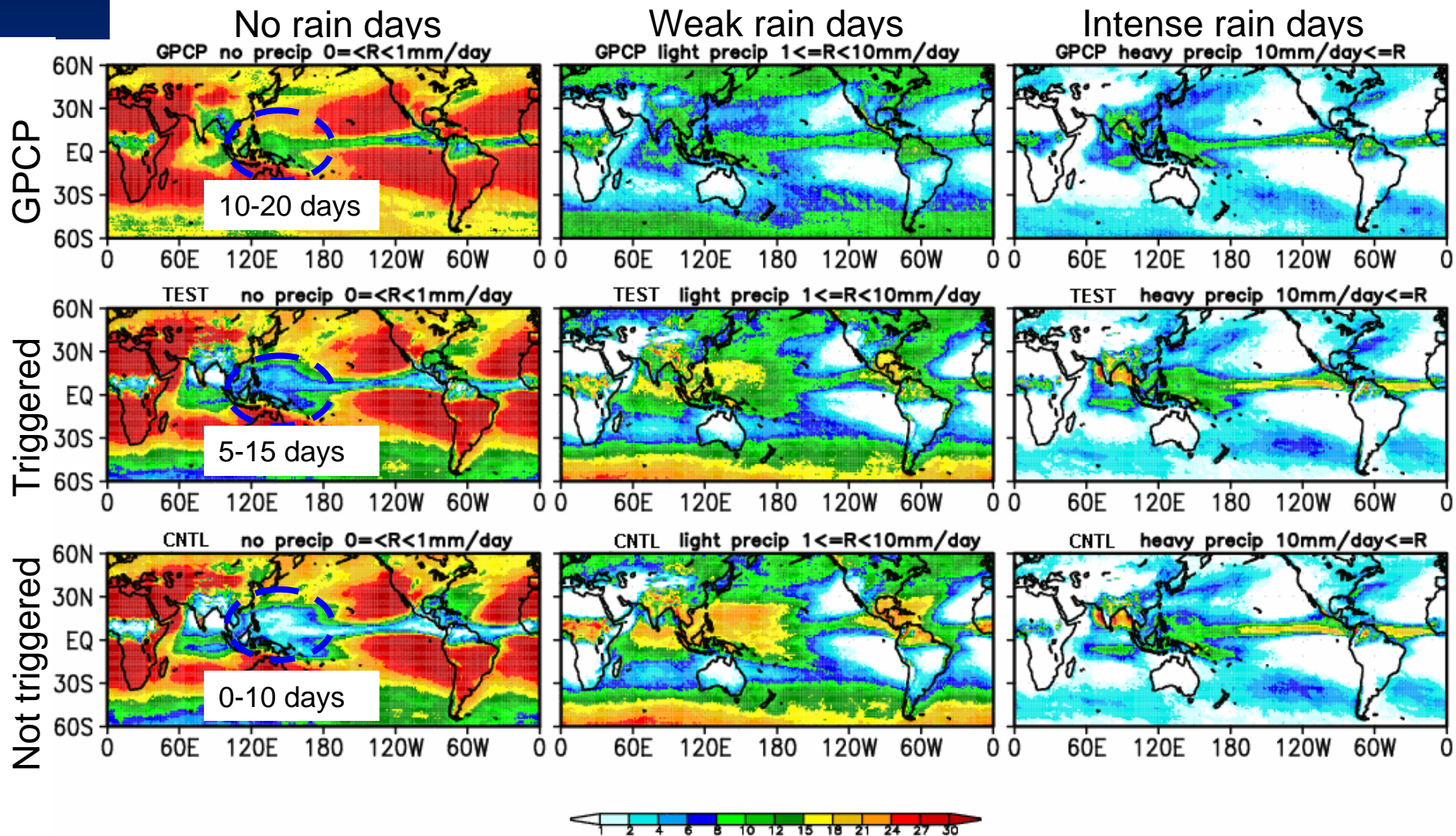
New model introduces 2 schemes in convection

- Trigger function : DCAPE (Dynamical CAPE)
DCAPE > threshold(=0) → convection
Trigger is expected to suppress weak rain.
- Re-evaporation of rain drops under cloud base



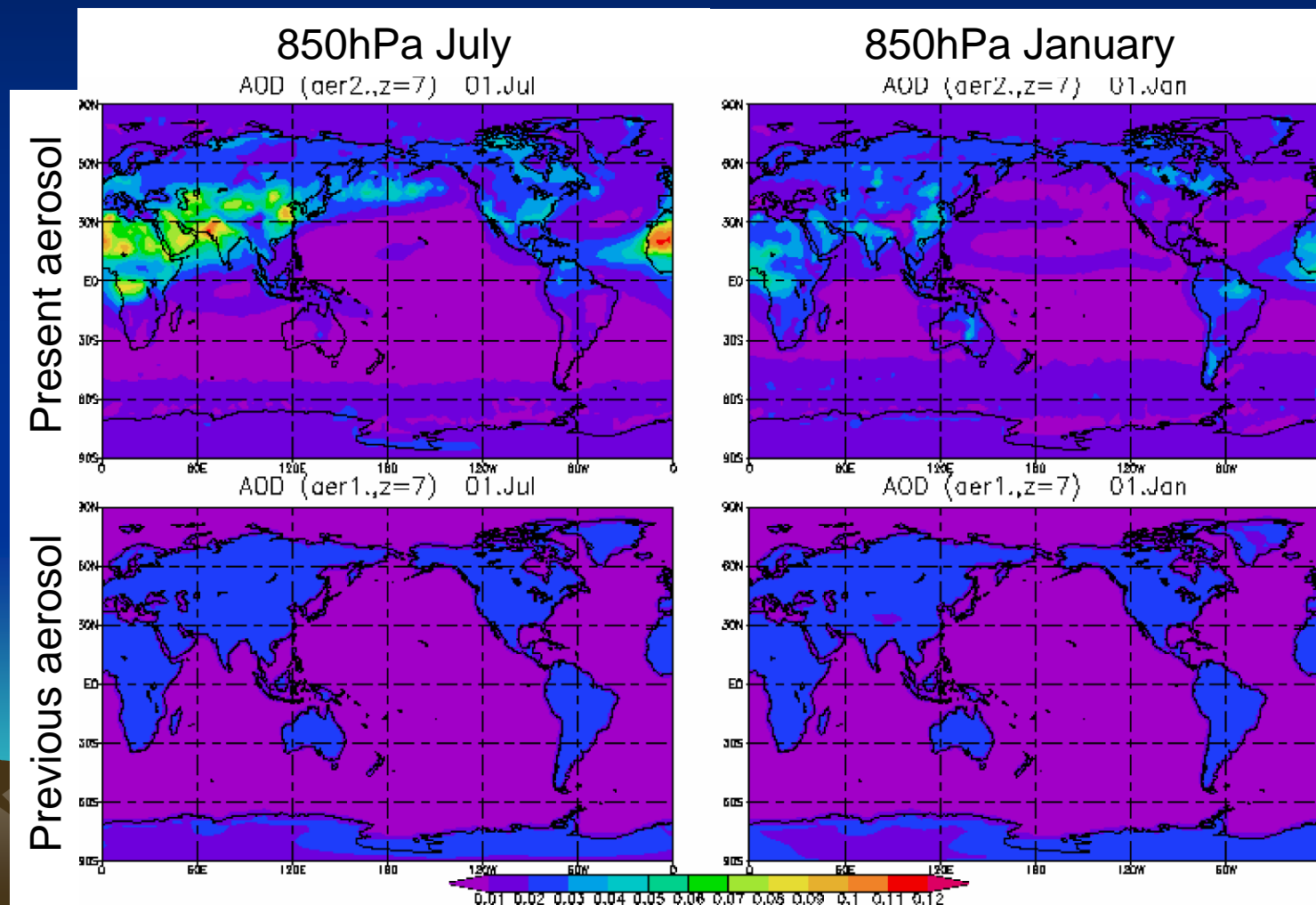
Trigger (Impact)

No rain days increase consistent with GPCP in tropics

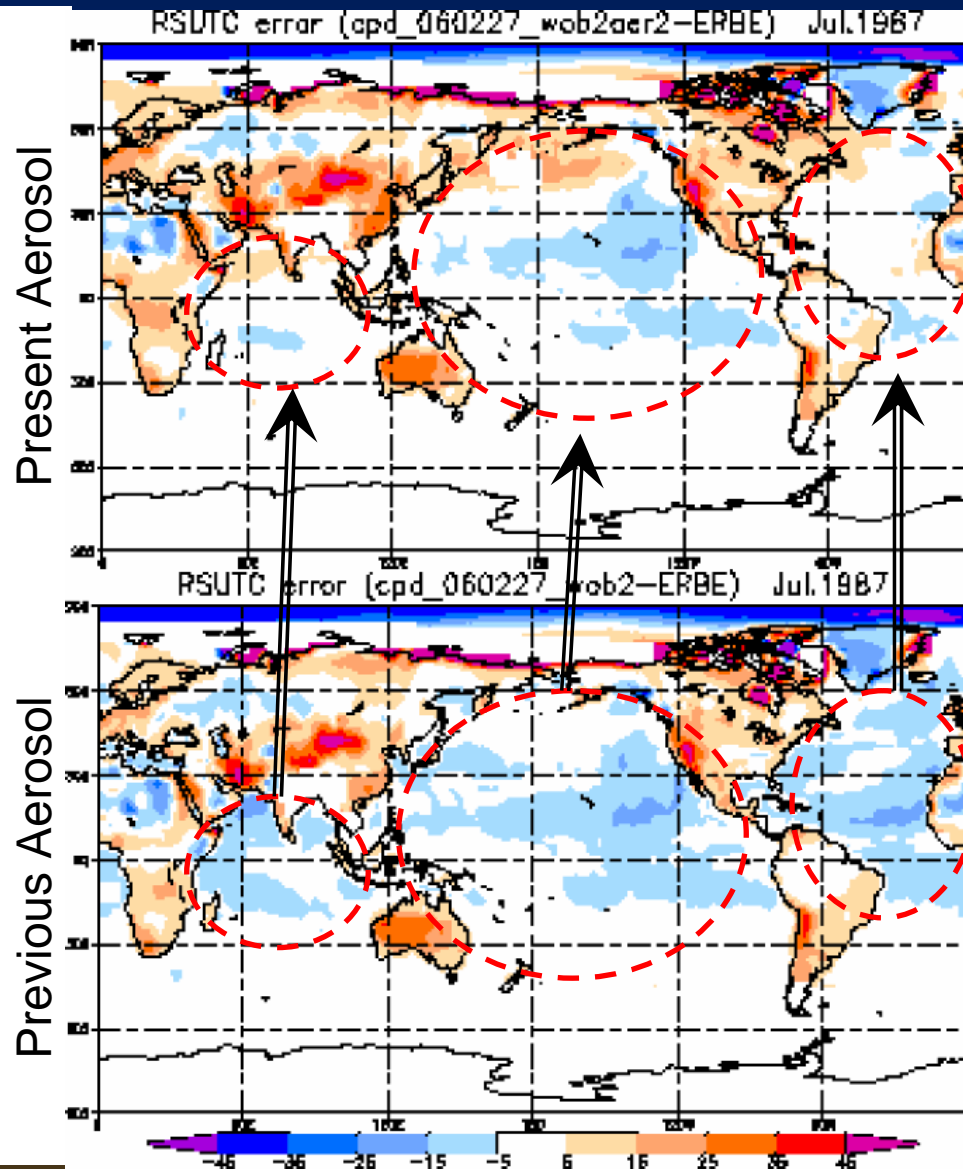


Aerosol Climatology

- Previous : Only land-sea contrast, no seasonal change.
- Present : Realistic aerosol distribution base on satellite observations with seasonal change.



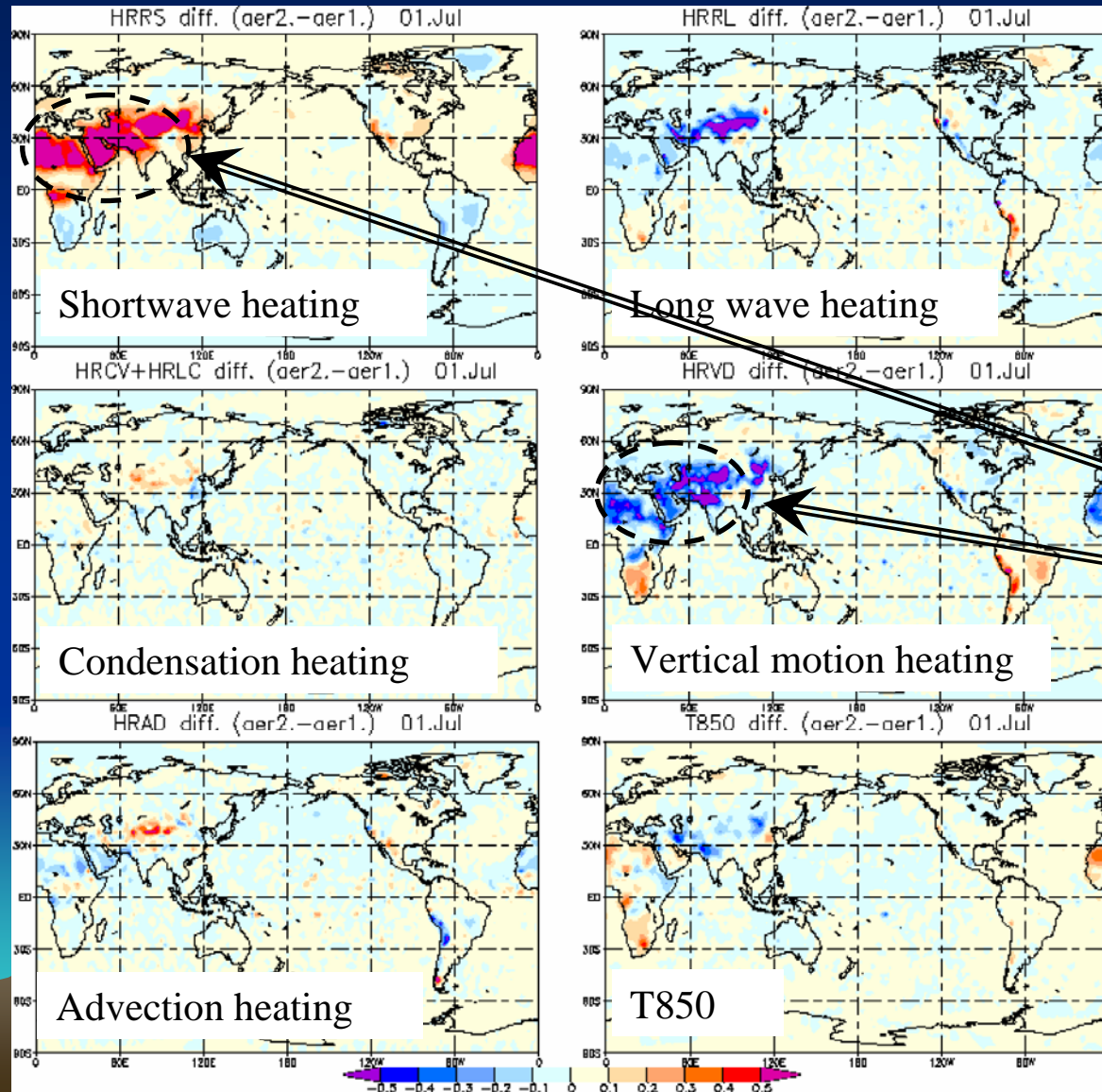
Aerosol Climatology (Impact-1)



Impact of aerosol scattering

Improvement in bias of clear shortwave flux at model top on the ocean compared with ERBE (satellite observation).

Aerosol Climatology (Impact-2)



Impact of aerosol absorption at 850 hPa.
Difference in heating
Present - Previous

Shortwave heating
Vertical motion cooling

SVSLRF

Standard Verification System for Long Range Forecast

- WMO standard tool to verify skill in seasonal models
- Two kind of verification
 - 1) Deterministic : MSSS
 - 2) Probabilistic : ROC, Reliability diagram (BSS)
- Verification data
 - T2m(Surface 2m temp.) : CRU or ERA-40
 - Precipitation : GPCP
 - If recommended data is not available, the center can use the center own reanalysis. → JRA-25 in the case of JMA



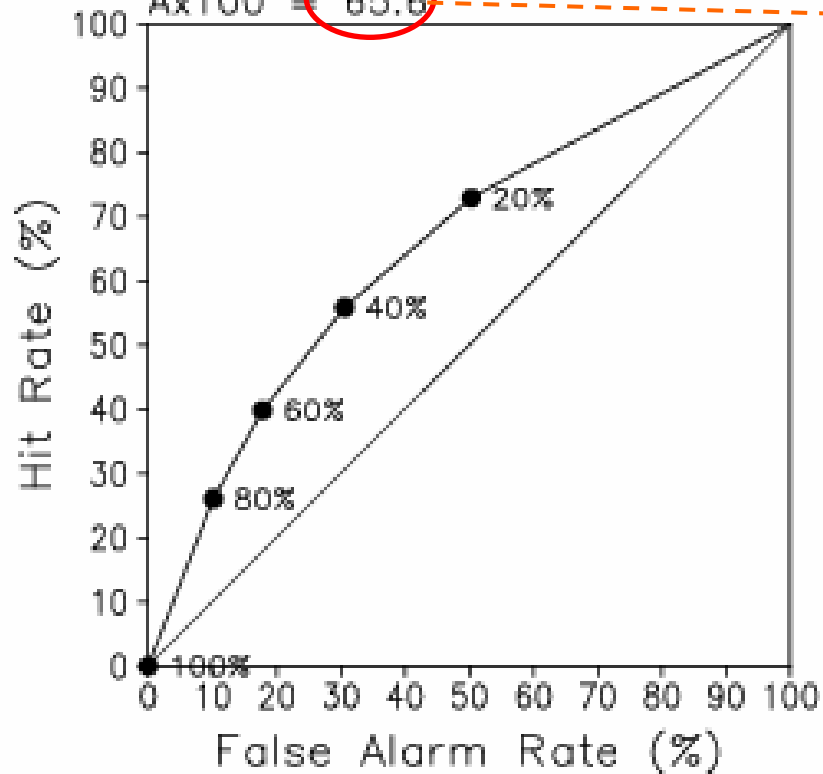
Skill in Hindcast of Present Model

ROC in above normal T2m for NH/JJA

Previous Model

NH (0.0-360.0,20.0N-90.0N)

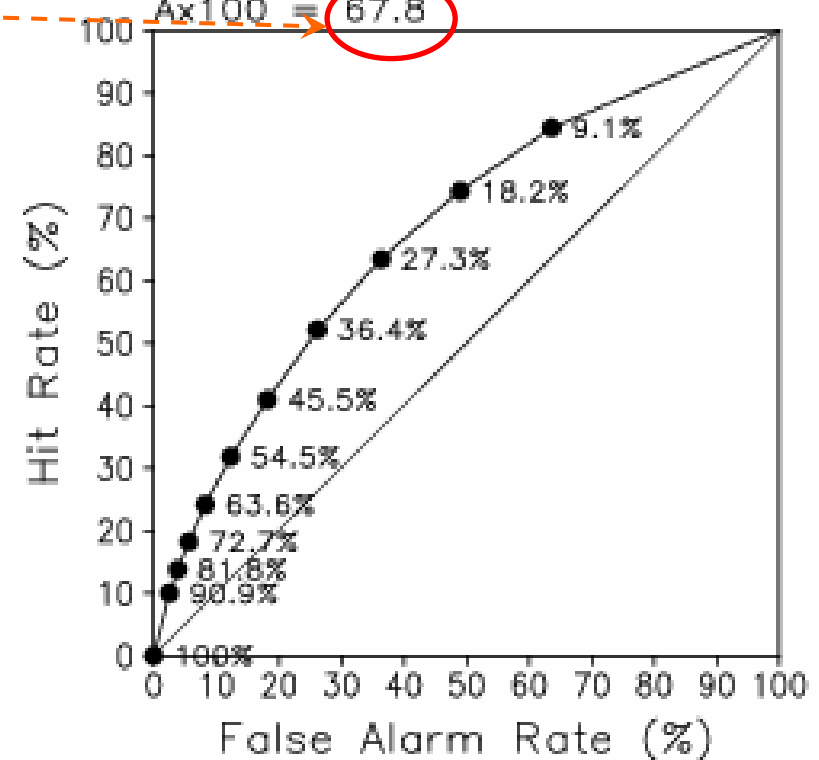
Ax100 = 65.6



Present Model

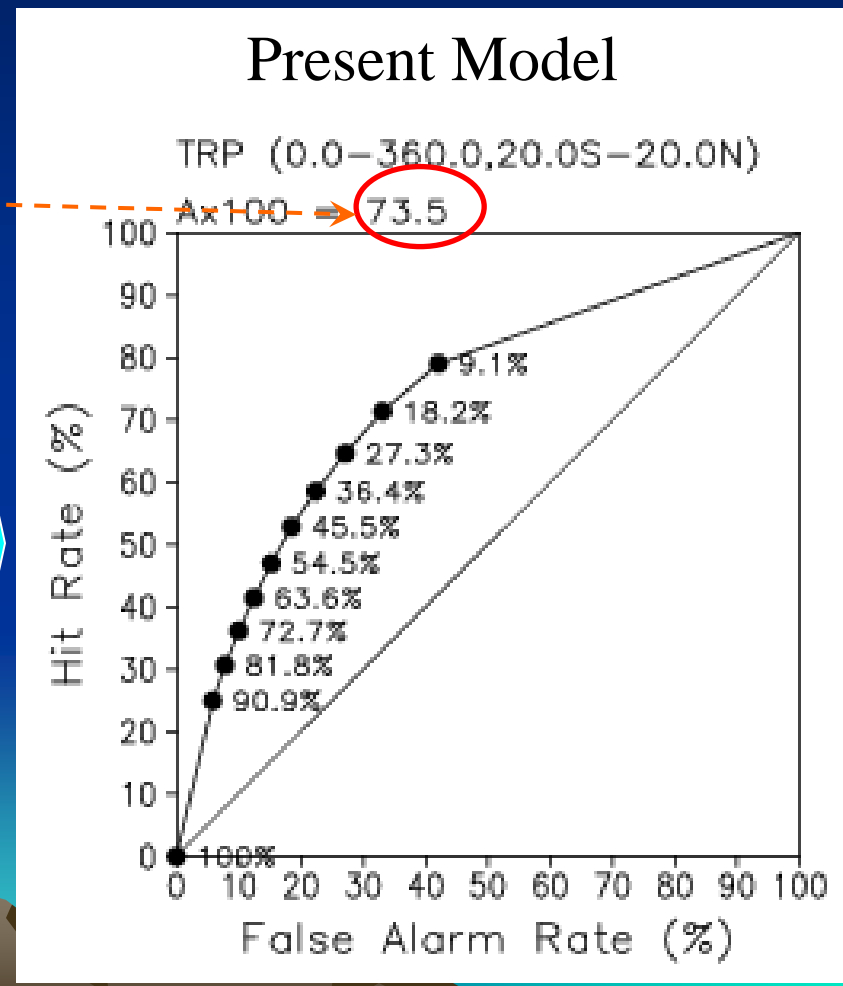
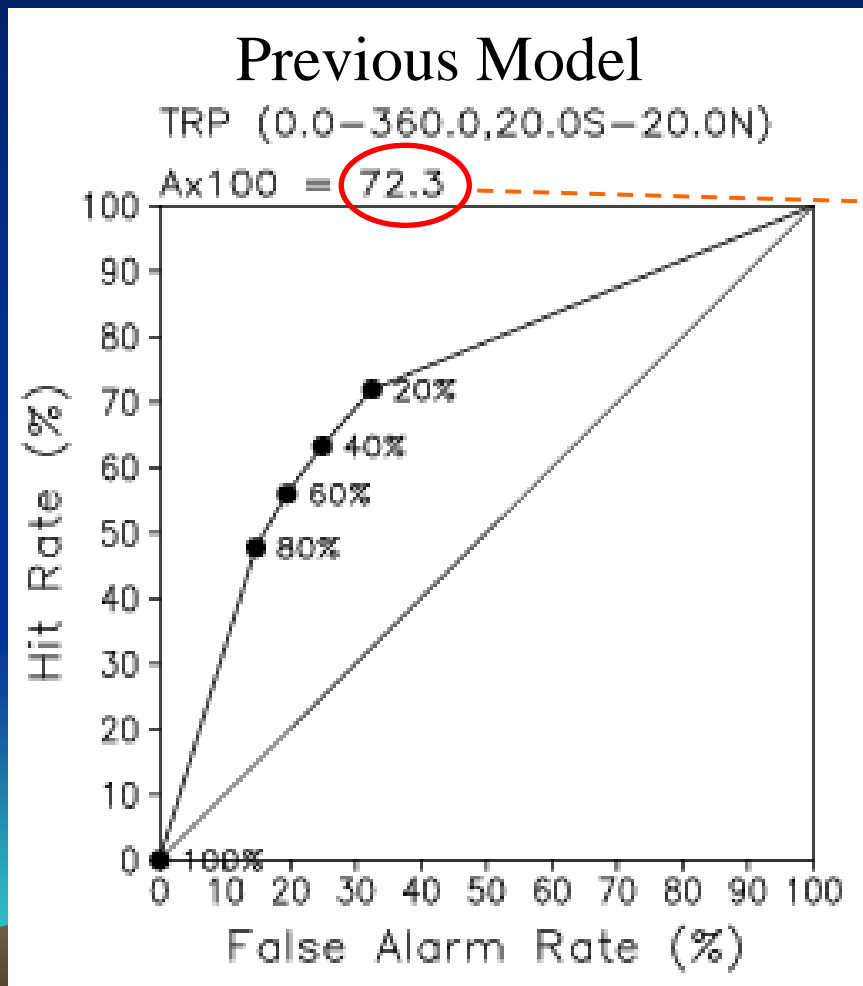
NH (0.0-360.0,20.0N-90.0N)

Ax100 = 67.8



Skill in Hindcast of Present Model

ROC in above normal T2m for Tropics/JJA



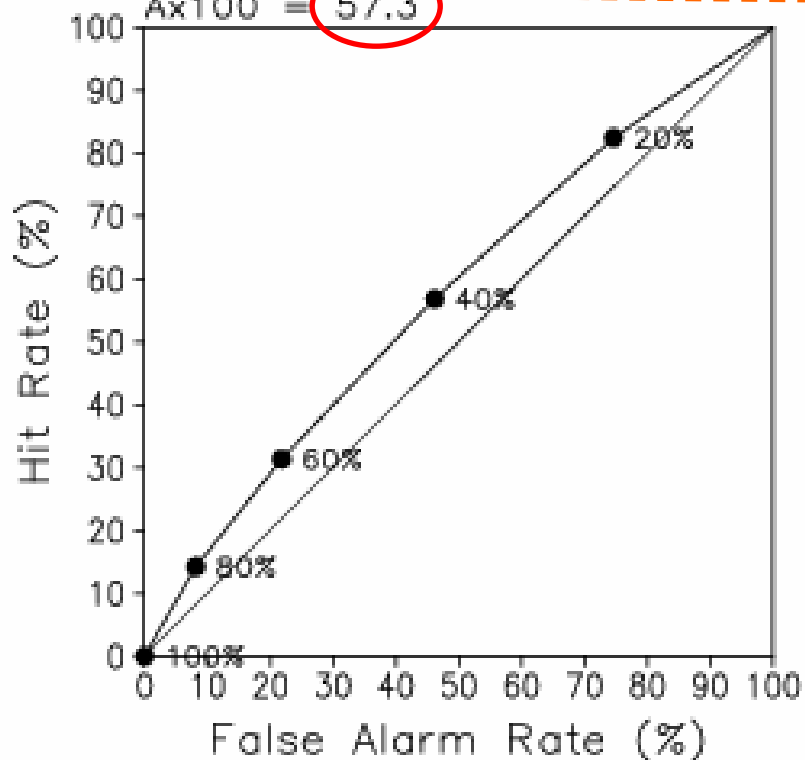
Skill in Hindcast of Present Model

ROC in above normal precipitation for NH/JJA

Previous Model

NH (0.0-360.0,20.0N-90.0N)

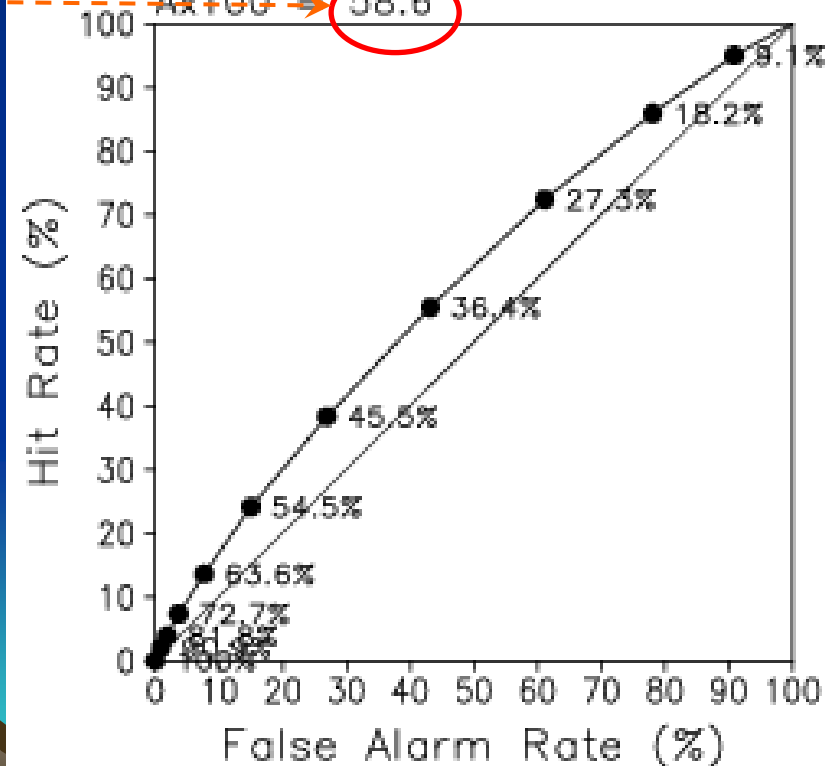
$A_{x100} = 57.3$



Present Model

NH (0.0-360.0,20.0N-90.0N)

$A_{x100} = 58.6$



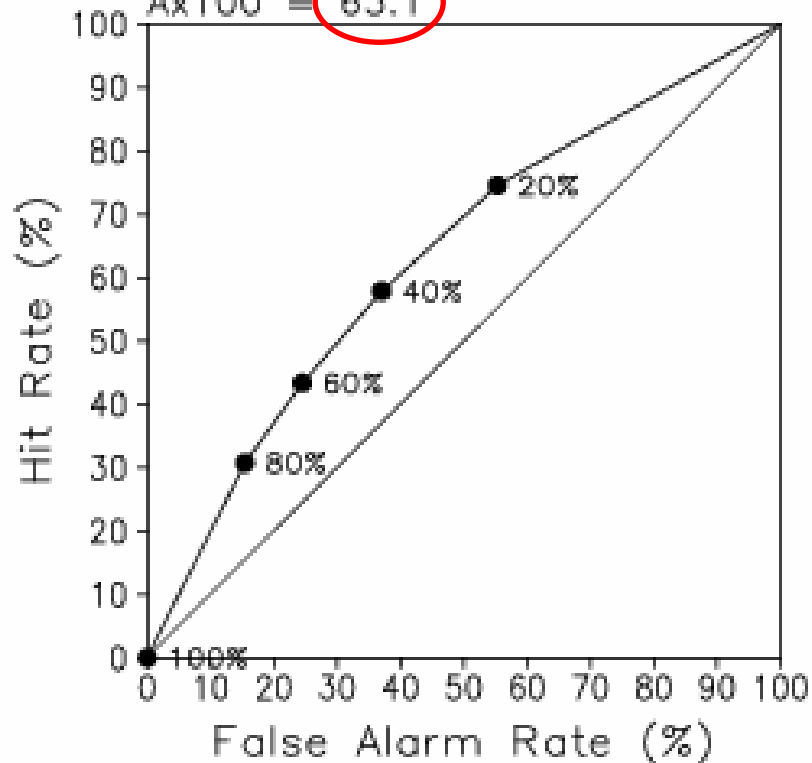
Skill in Hindcast of Present Model

ROC in above normal precipitation for Tropics/JJA

Previous Model

TRP (0.0-360.0,20.0S-20.0N)

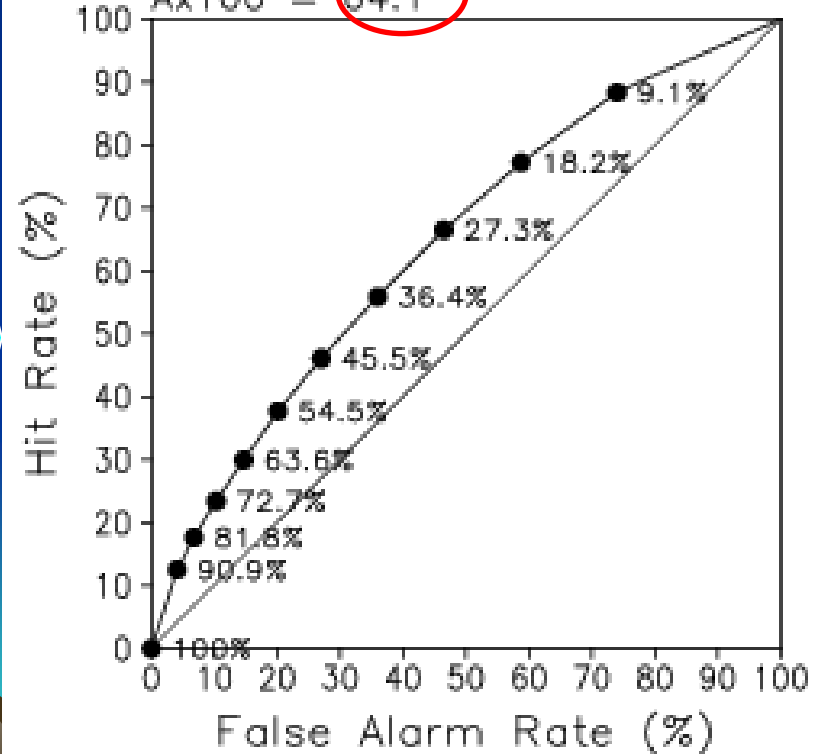
$A \times 100 = 63.1$



Present Model

TRP (0.0-360.0,20.0S-20.0N)

$A \times 100 = 64.1$



JRA-25 vs CRU in SVSLRF (1)

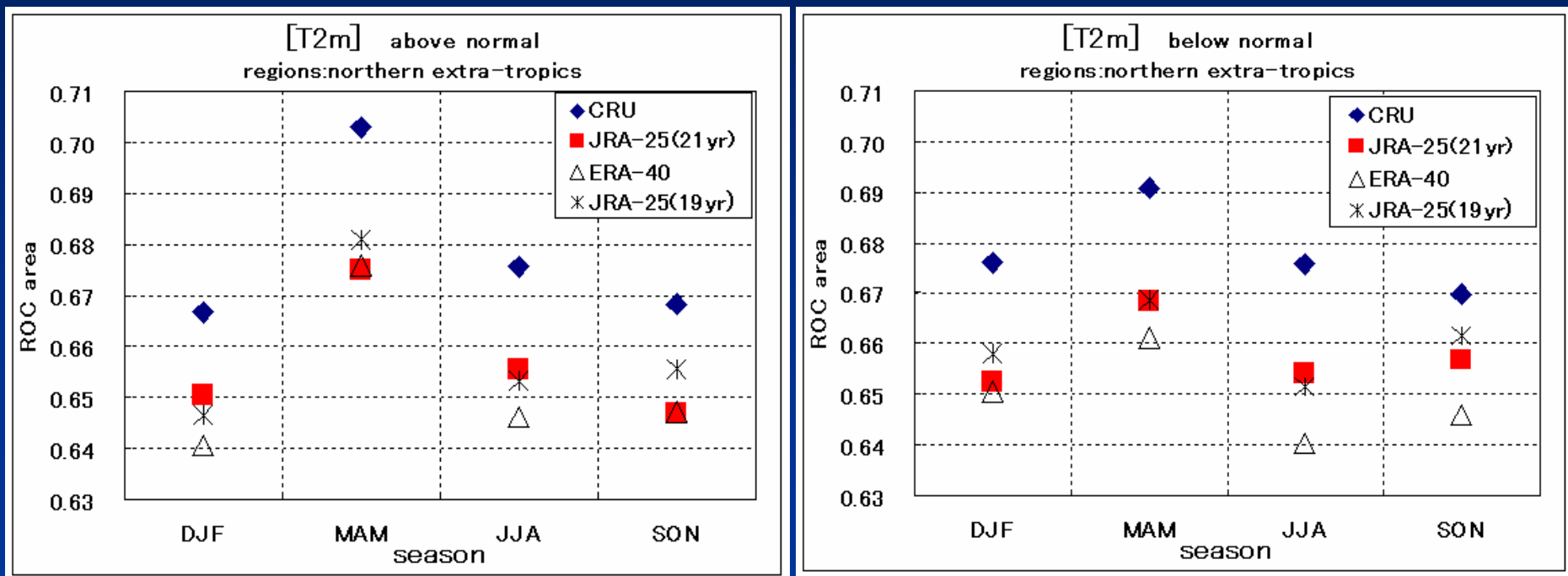
- In SVSLRF, preferred verification data is CRU or ERA-40 for T2m.
- If CRU or ERA-40 are not available, the center can use the center own reanalysis.
- Shortcomings in CRU = not available in real time.
- Shortcomings in ERA-40 = not available after 2001.
- JRA-25 is available in real time from 1979 to present.

If we use JRA-25 for verification, how about SVS scores dependency on verification data ?



JRA-25 vs CRU in SVSLRF (2)

T2m ROC score dependency on verification data



The ROC scores using CRU are the highest.

The ROC scores using JRA-25 are comparable with one using ERA-40.

21yr : Verification period = 1983-2003

19yr : Verification period = 1983-2001

Thank you very much
H.Kamahori/JMA

