

Use of satellite data in the JRA-55 reanalysis and related activities

Y.Harada, [Shinya Kobayashi](#), Y.Ota, H.Onoda, A.Ebita, M.Moriya, [Kazutoshi Onogi](#), H.Kamahori, C.Kobayashi, H.Endo, K.Miyaoka, R.Kumabe, K.Takahashi, and Shotaro Tanaka

CPD, Japan Meteorological Agency



Japanese Global Atmospheric Reanalysis

1st JRA-25

By JMA and CRIEPI (1979~2004)

(Central Research Institute for Electric Power Industry)



2nd JRA-55 (JRA Go! Go!)

By JMA (1958~2012)

JRA-55 is the first reanalysis which covers more than 50 years since 1958 with 4D-var data assimilation system.





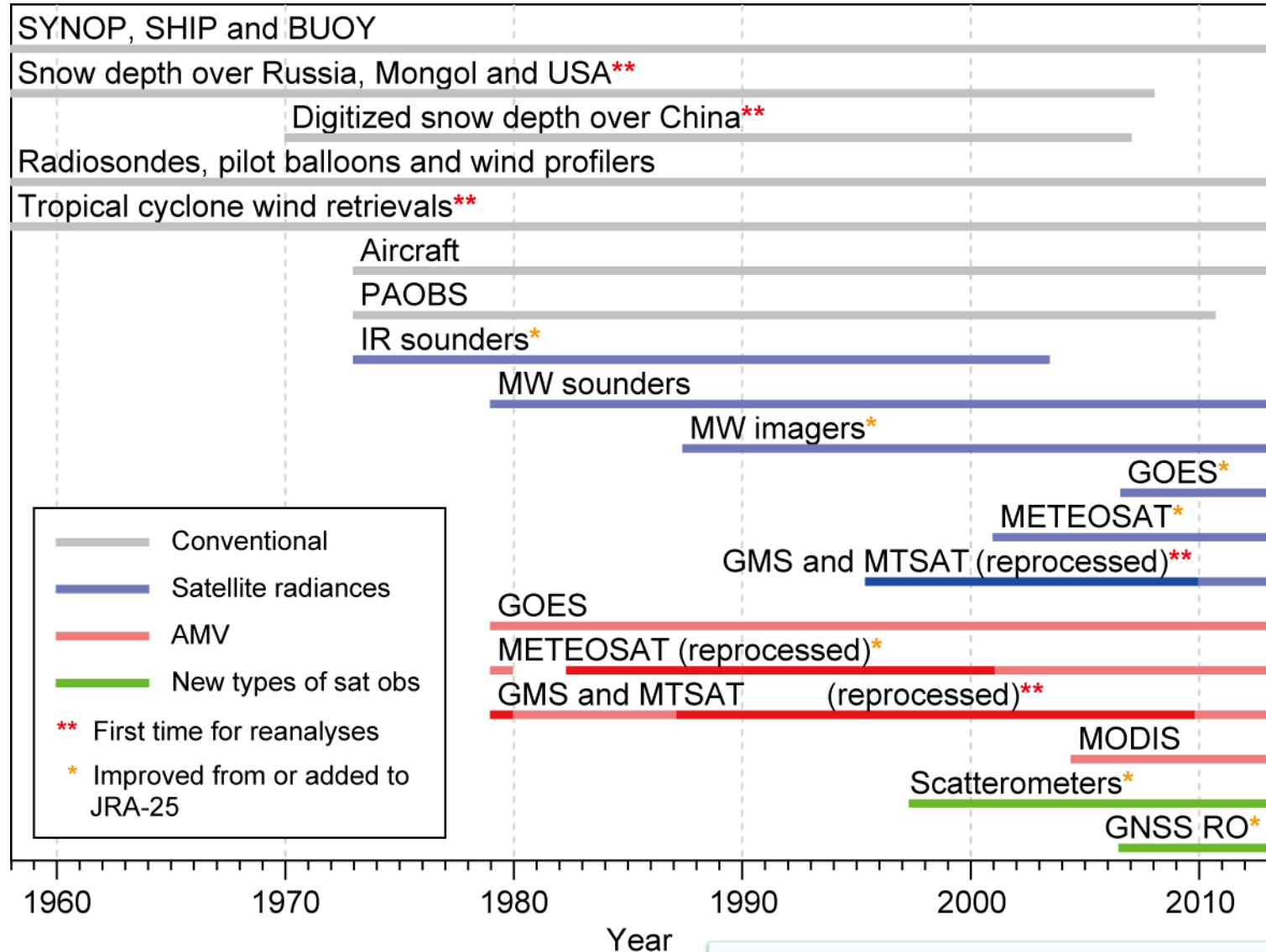
JRA-55 Reanalysis system



	JRA-25	JRA-55
Reanalysis years	1979-2004 (26 years)	1958-2012 (55 years)
Equivalent operational NWP system	As of Mar. 2004	As of Dec. 2009
Resolution	T106L40 (~110km) <i>(top layer at 0.4 hPa)</i>	TL319L60 (~55km) <i>(top layer at 0.1 hPa)</i>
Time integration	Eularian	Semi-Lagrangian
Assimilation scheme	3D-Var	4D-Var <i>(with T106 inner model)</i>
Bias correction (satellite radiance)	Adaptive method (Sakamoto et al. 2009)	Variational Bias Correction (Dee et al. 2009)
GHG concentrations	Constant at 375 ppmv (CO ₂)	Annual mean data are interpolated to daily data (CO ₂ ,CH ₄ ,N ₂ O)



Observational Data available for JRA-55



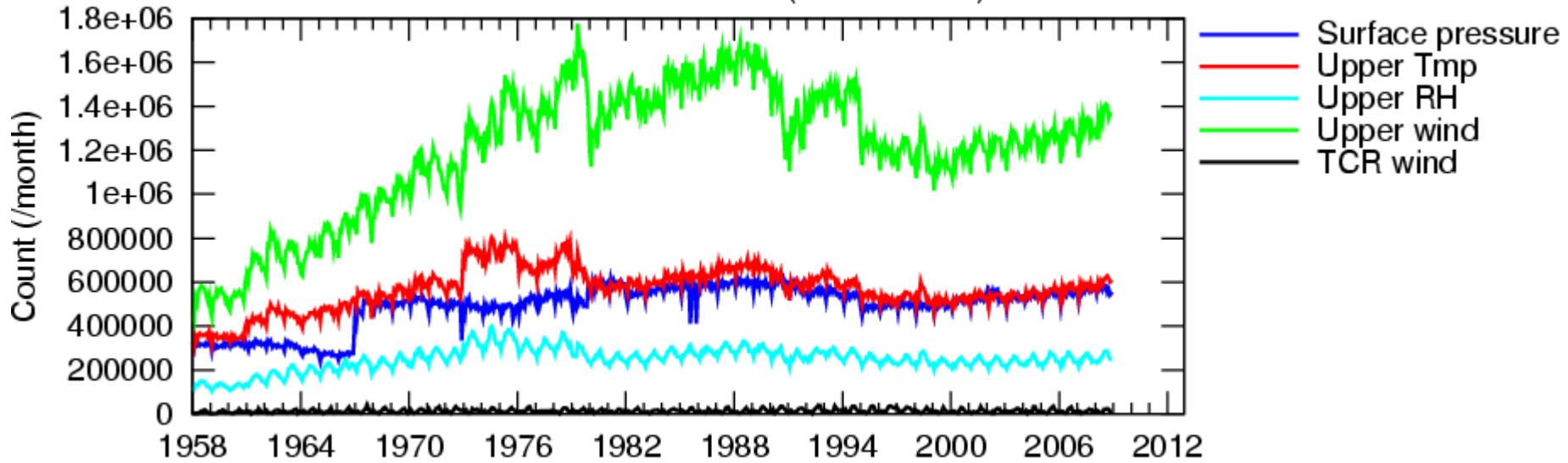
GNSS: Global Navigation Satellite System



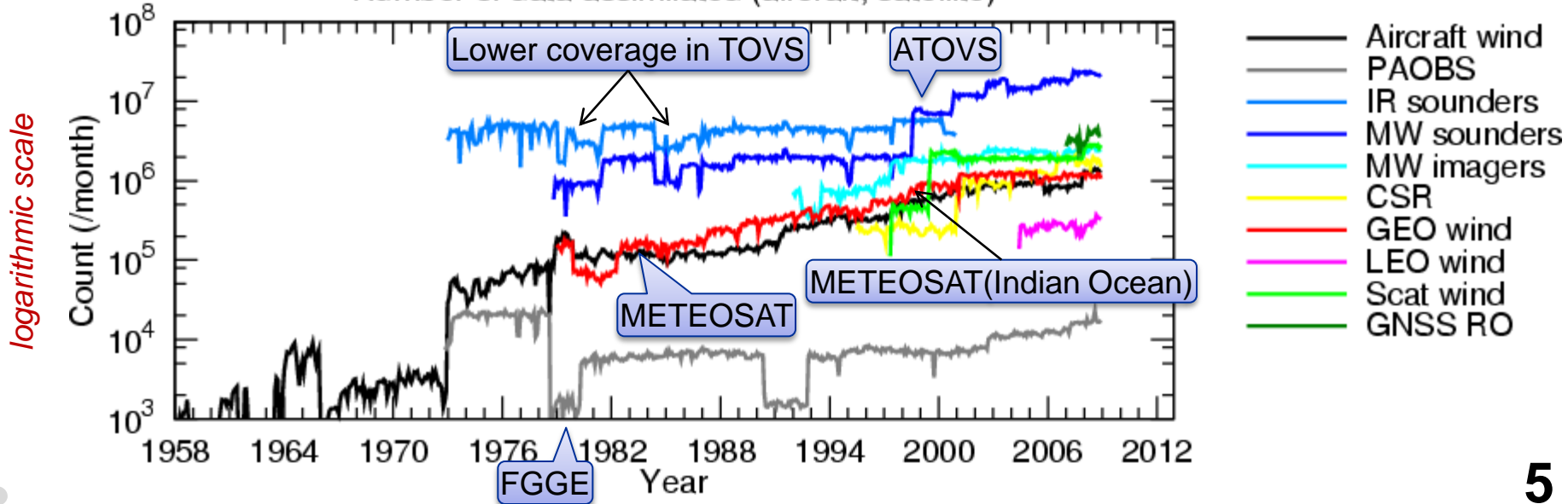
Number of observations assimilated (Global)



Number of data assimilated (conventional)



Number of data assimilated (aircraft, satellite)

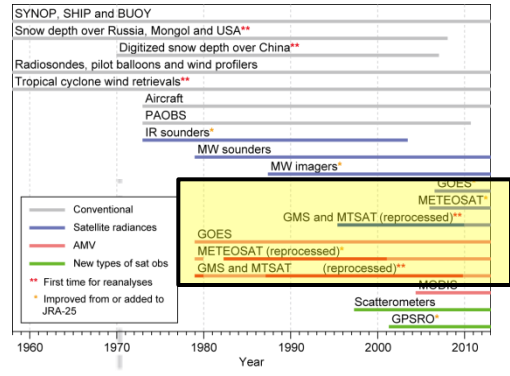




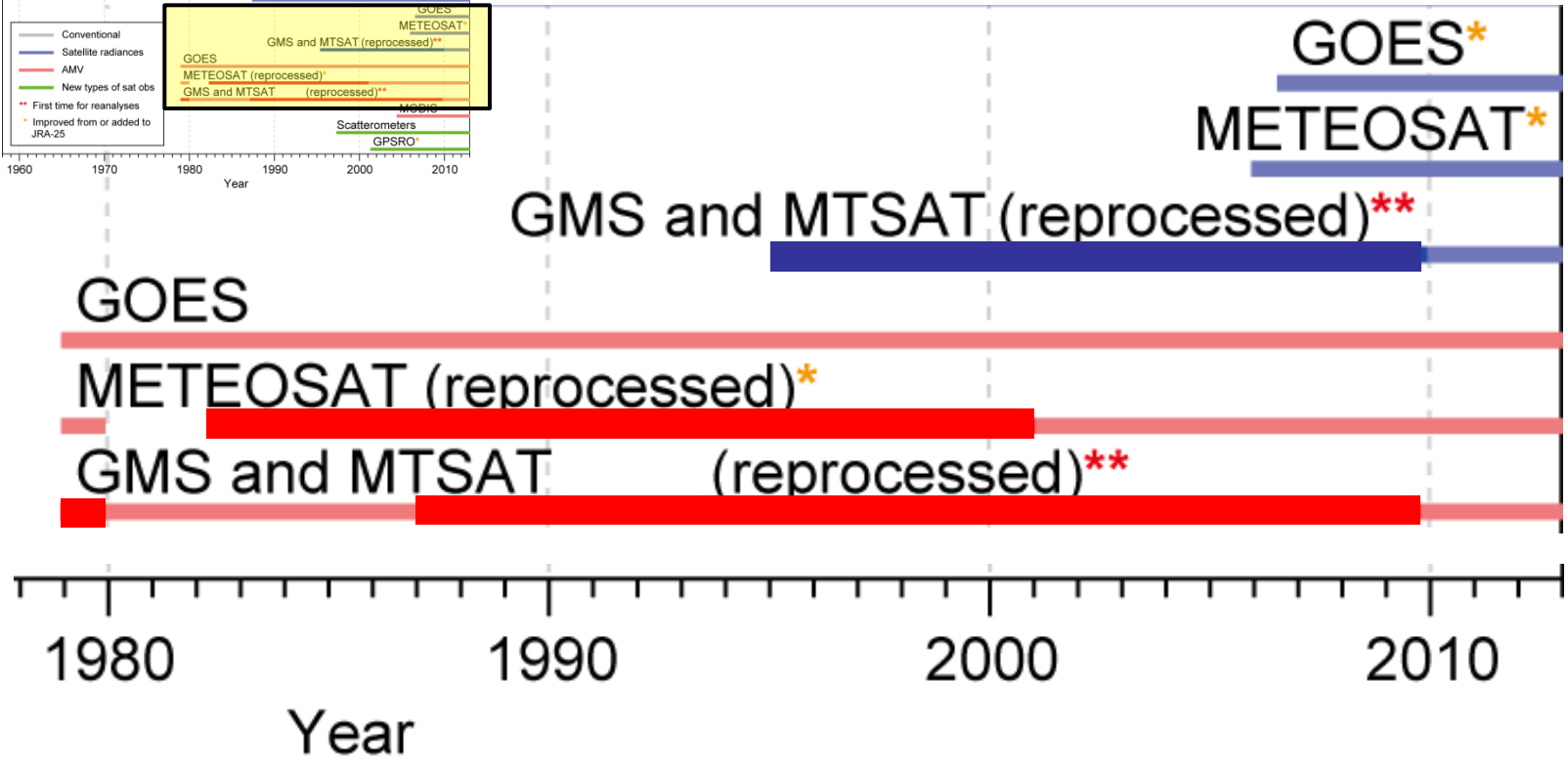
Reprocess of geostationary satellite data for reanalysis



Available Reprocessed AMV and CSR data



Expanding yellow part in the obs. data table



CSR

AMV

Thick line : reprocessed period

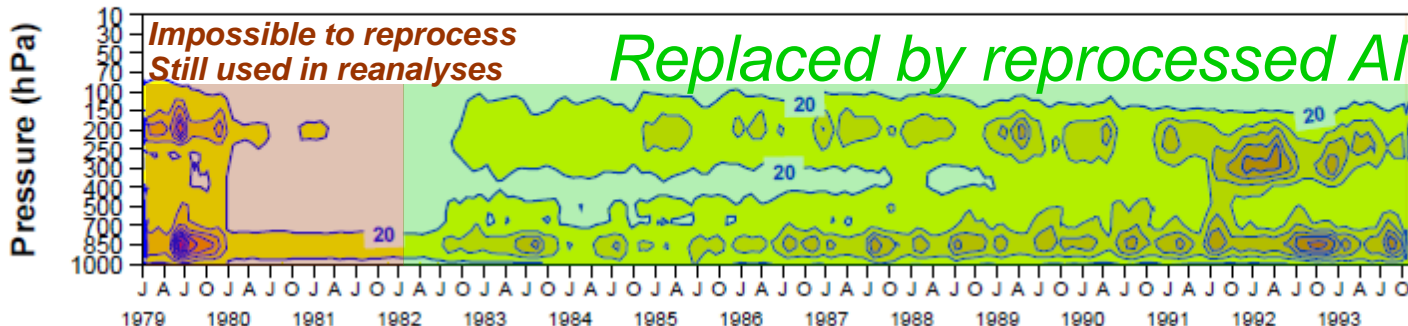




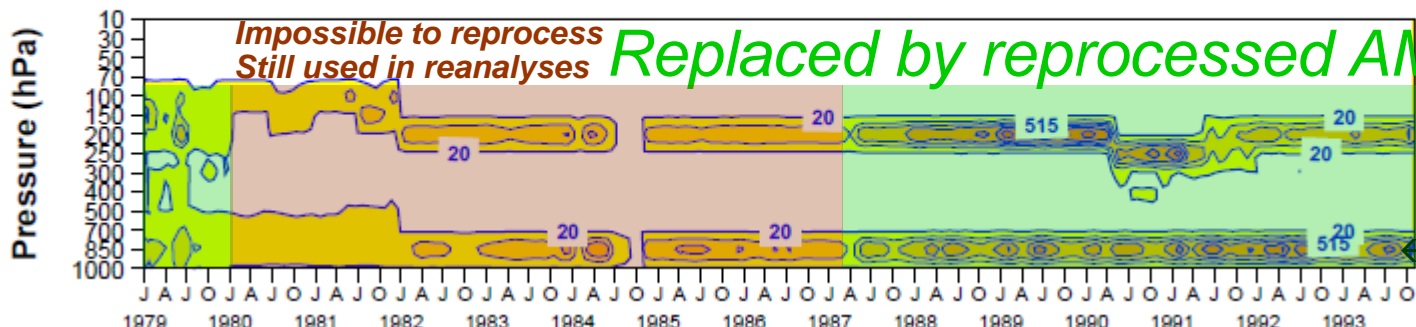
Height assignment of Operational AMVs used in ERA-15 (ERA-15 Report 3, Uppala, 1997)

University of Wisconsin has a plan to reprocess GOES AMVs.

Area: METEOSAT: (20N-20S,50W-50E) : N of used SATOB data per day



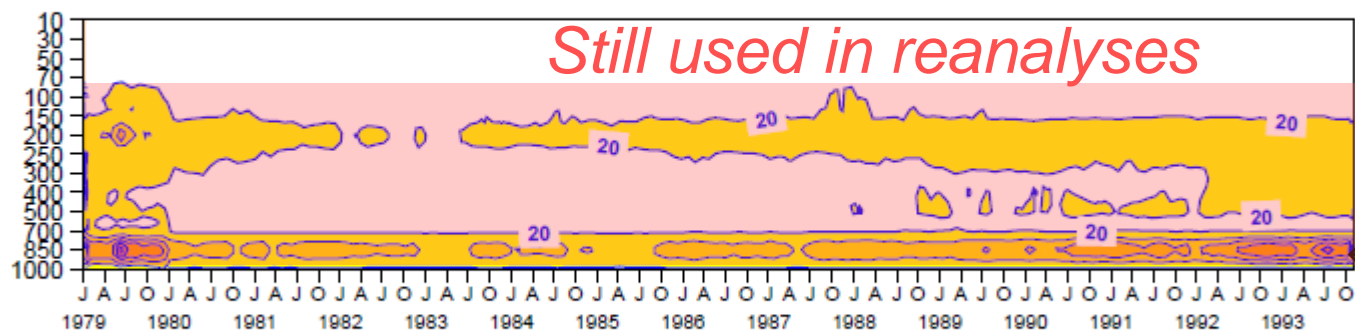
Area: GMS: (20N-20S,90E-160W) : N of used SATOB data per day



← Usually at 200hPa but sometimes changed

← Always at 850hPa

Area: GOES: (20N-20S,160W-50W) : N of used SATOB data per day



← Very small amount of data

← Always at 850hPa

Figure 70. Time-height variability of the 91-day moving average of the number of cloud motion winds used per day (00+06+12+18 UTC) in the ECMWF reanalysis in the Tropics.



Reprocess of Japanese geostationary satellites data by MSC/JMA

- MSC of JMA reprocessed 2 times for the JRA reanalyses.
- 1st Reprocessed AMVs for JRA-25
 - GMS-3, 4, and 5.
- 2nd Newly reprocessed AMVs and CSRs for JRA-55
 - GMS-1 (1979 only), 3, 4, 5, GOES-9, and MTSAT-1R
 - As a pilot project of SCOPE-CM
 - JRA-25 reanalysis was used as a reference.
 - QI is allocated for each AMV.
 - Expansion of derivation area (from 50S-50N to 60S-60N).
 - Quality has been improved.

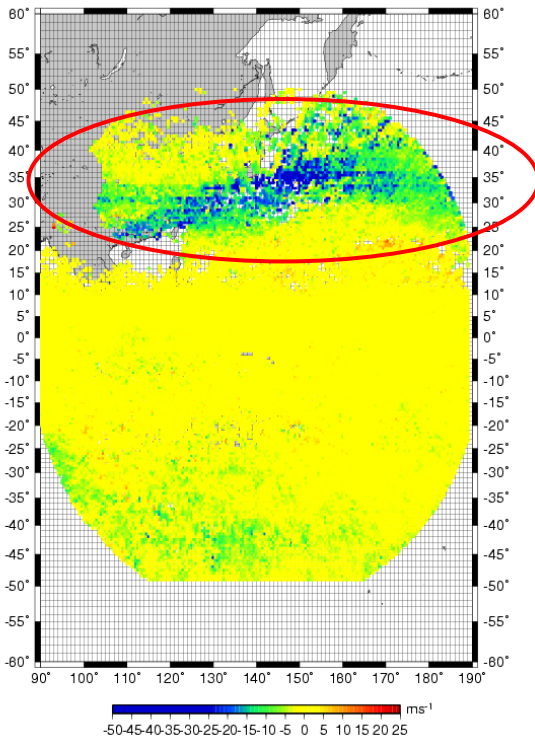


2nd reprocess by MSC for JRA-55

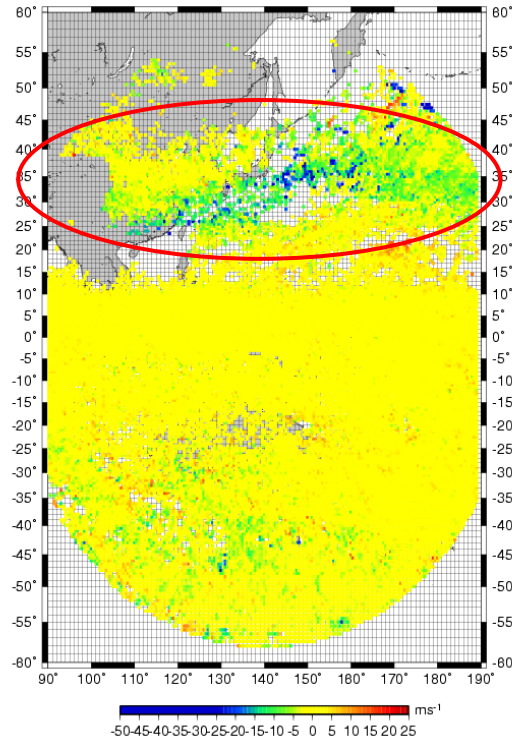


MSC/JMA has been computing AMVs from the past satellites (**GMS**, **GOES-9** and **MTSAT-1R** between 1979 and 2009) using the latest AMV derivation algorithms. The data set of AMVs is provided for **JRA-55** and **SCOPE-CM**.

for **JRA-25**
(Previous reprocess)



for **JRA-55**
(New reprocess)



Main quality difference between the previous reprocess (for JRA-25) and the new reprocess (for JRA-55).

- **Expansion of derivation area** (from 50S-50N to 60S-60N).
- **Mitigation of slow wind speed bias in the winter hemisphere**, owing to the improvement of height assignment scheme and resizing target box size.

Wind speed bias ($QI > 0.85$) of high-level IR-AMVs to JRA-25 analysis fields (Jan. 1990, GMS-4)

Meteorological Satellite Center Technical Note, No. 54

Information website: <http://mscweb.kishou.go.jp/product/reprocess/index.htm> Oyama(2010)



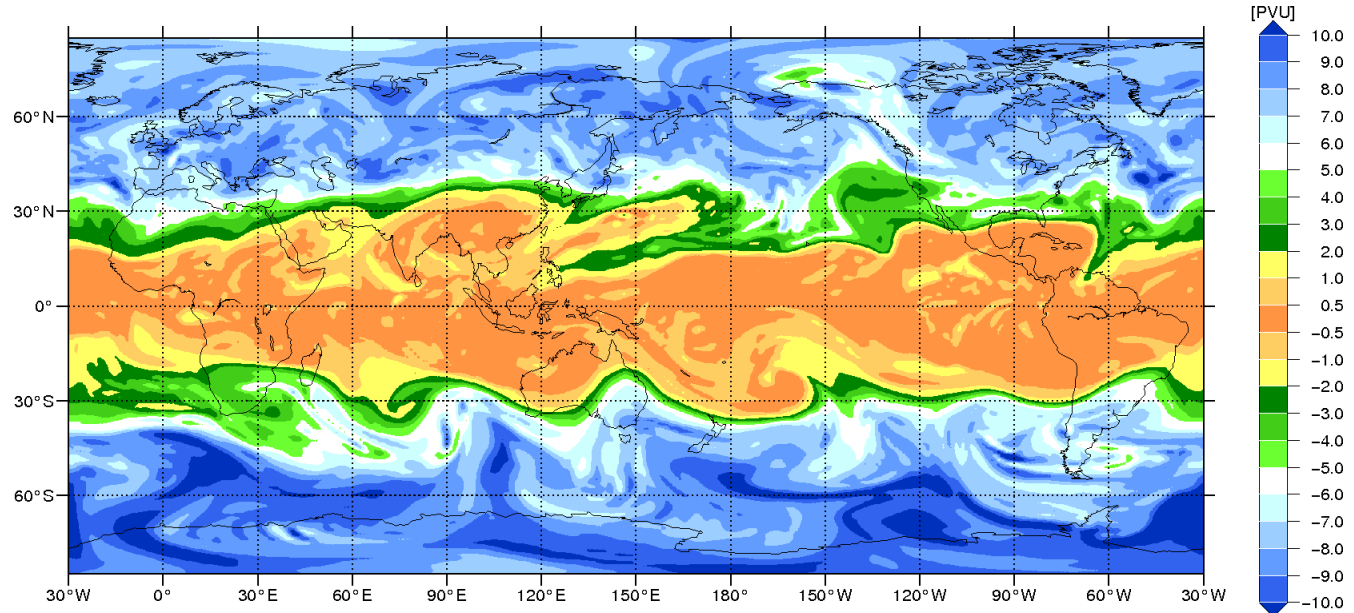
Performance of JRA-55



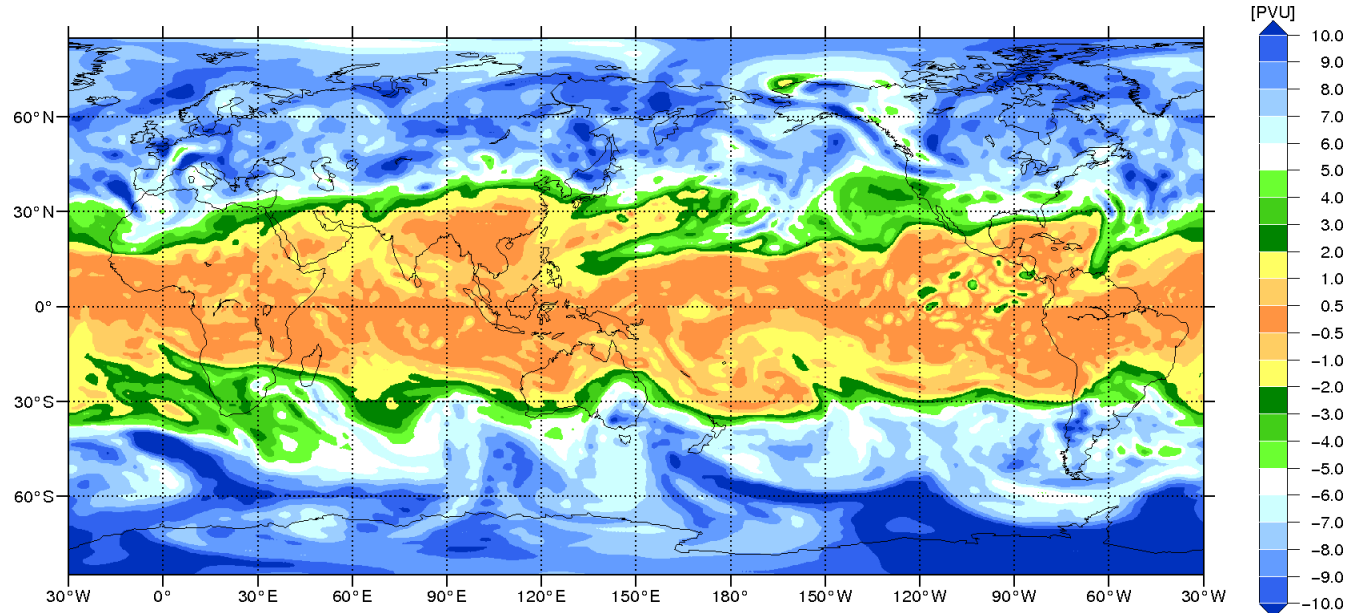
Isentropic Potential Vorticity (at 360 K) 1 June 1983 00UTC – 6 June 1983 00UTC



JRA-55
(4D-var)



JRA-25
(3D-var)

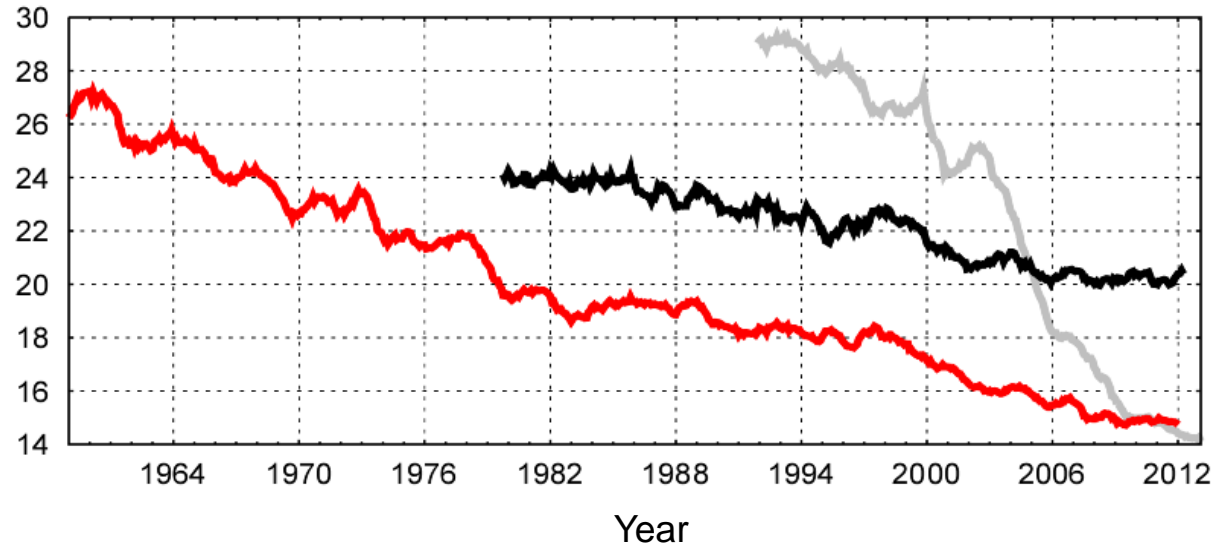




Forecast [FT=48] Scores RMSE of Z500 for N.H. and S.H. [gpm]



N.H.

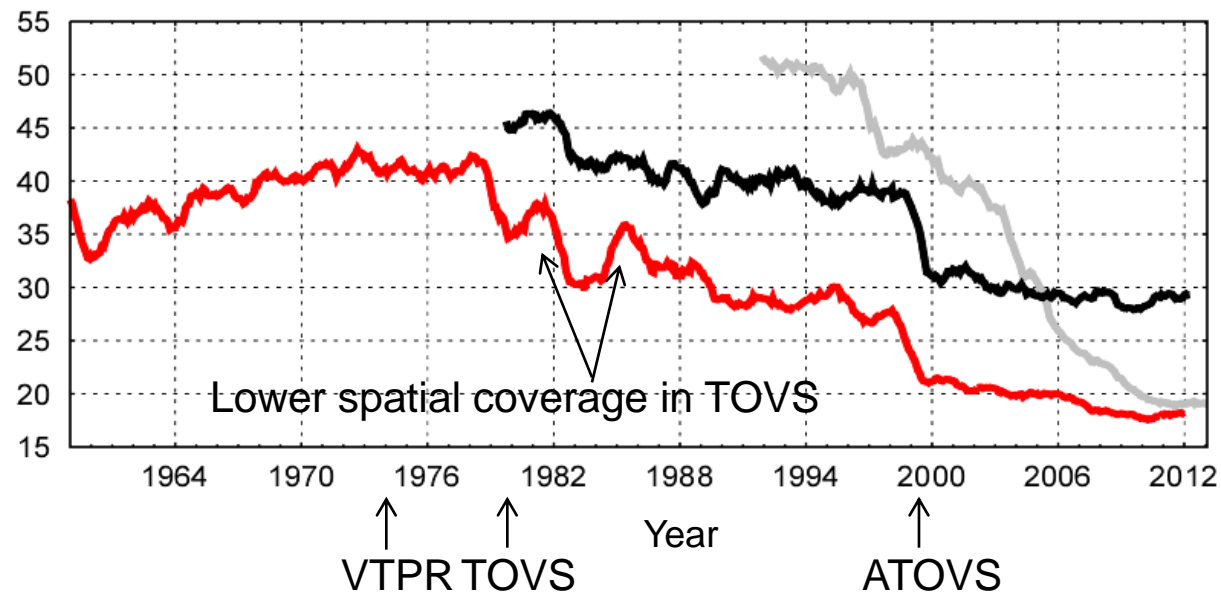


JRA-55

JRA-25

Operation

S.H.



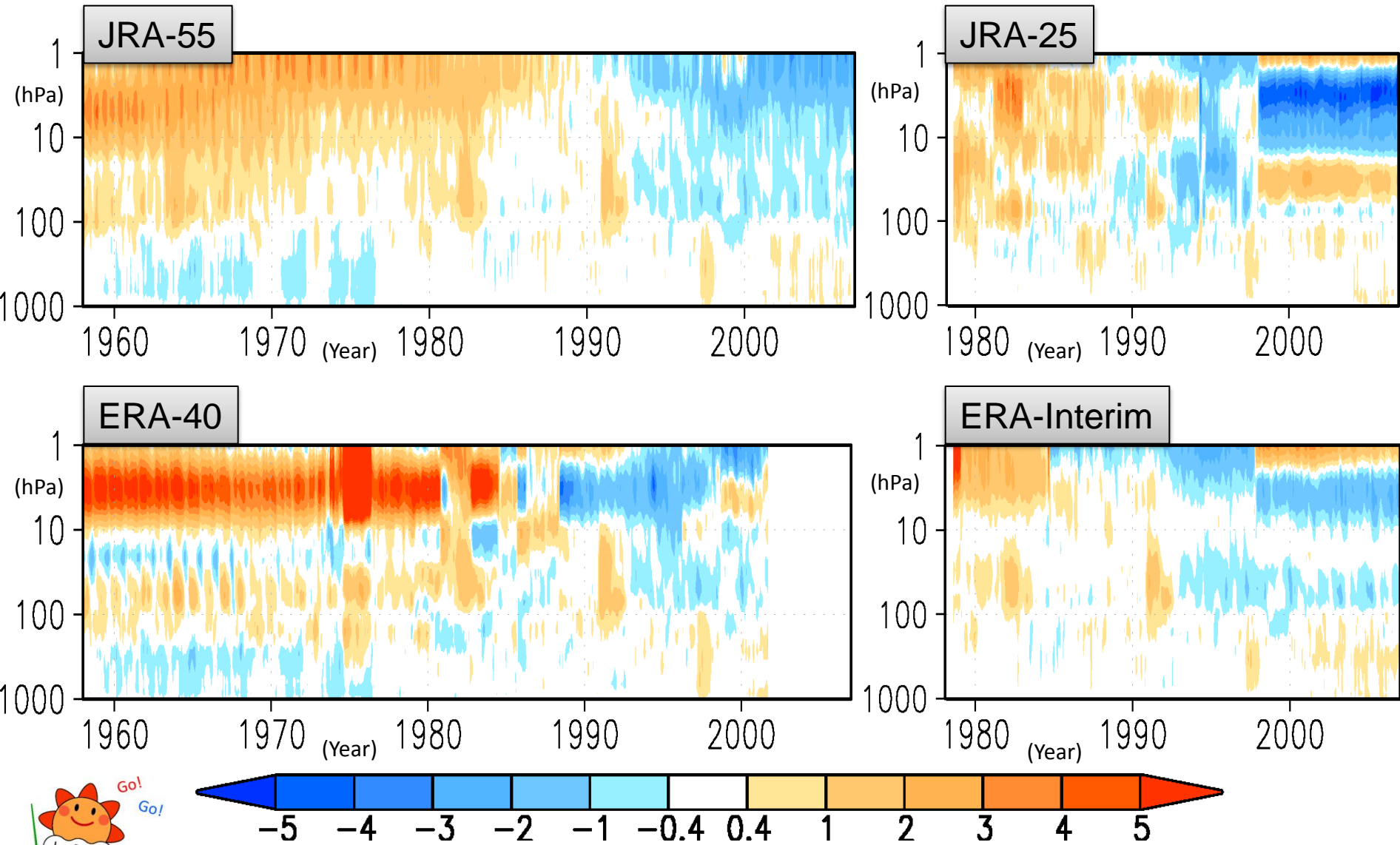
Lower spatial coverage in TOVS

↑ VTPR TOVS

↑ ATOVS

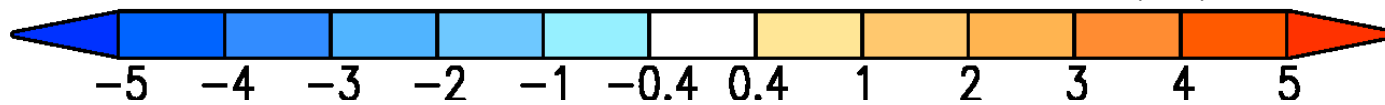
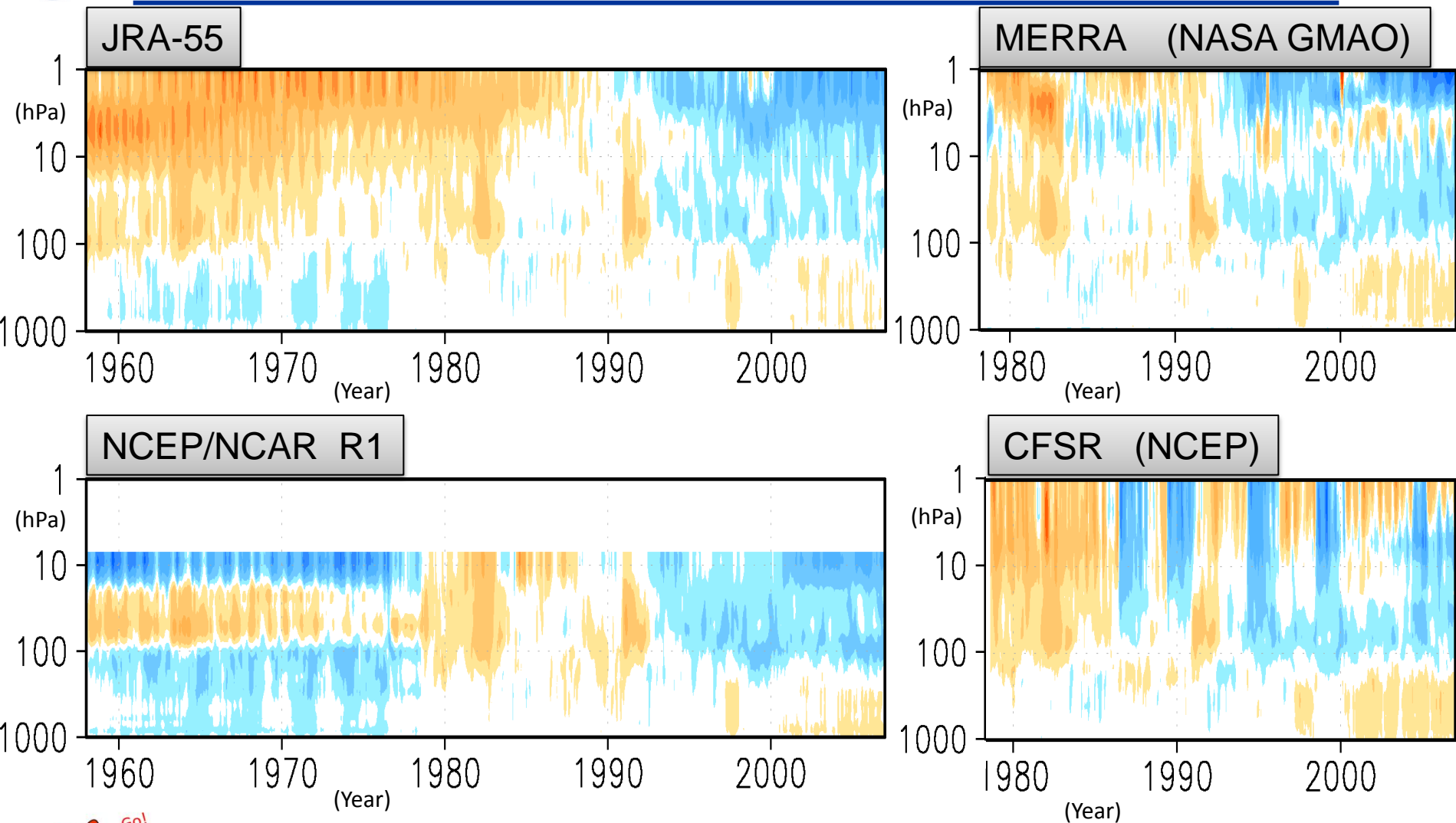


Time-Height Cross Sections of global mean Temperature [K] anomalies in JRA and ERA reanalyses



Anomalies from the mean temperature at each pressure level for years 1980 to 2001 of each reanalysis, JRA-55, ERA-40, JRA-25 and ERA-Interim, respectively.

Time-Height Cross Sections of global mean Temperature [K] anomalies in JRA-55, R1, MERRA and CFSR





Summary and plan of JRA-55



- **Observational Data for JRA-55**
 - Improvement in both quality and quantity from JRA-25
 - Many reprocessed Satellite Data
 - Newly available data
- **Validation of JRA-55**
 - JRA-55 has much better quality than JRA-25.
 - Less unnatural gaps than other reanalyses
- **Autumn 2013**
 - JRA-55 products will be released for research use.
 - The data will be available from JMA, DIAS...
- **Comprehensive reports are in preparation.**



Use of satellite data in JMA's operational Climate Monitoring Services (Related activities)

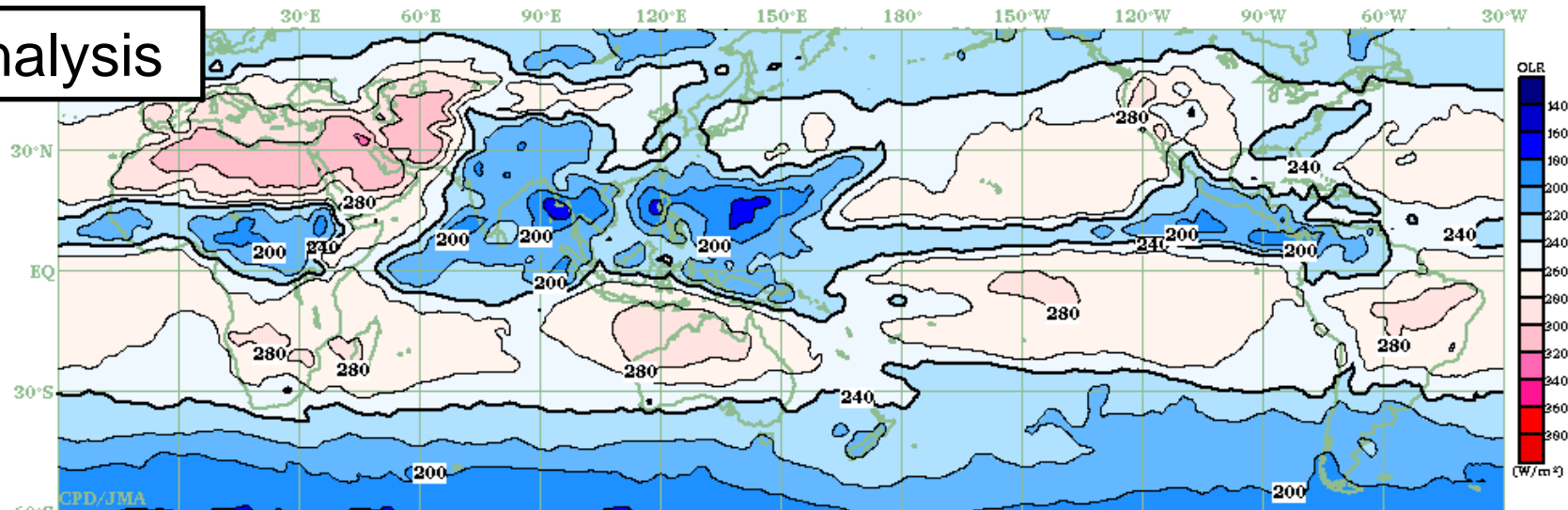
- CPD of JMA operates climate monitoring services.
 - JRA reanalysis data are basic climate data.
 - Anomalies from JRA climate are evaluated.
 - Satellite data contribute to improve reanalysis quality.
- Satellite data are directly used as well.
 - Convection active area (OLR)
 - Snow coverage (SSM/I, SSMIS)



Satellite data used in JMA's climate monitoring

OLR (Outgoing Long-wave Radiation)

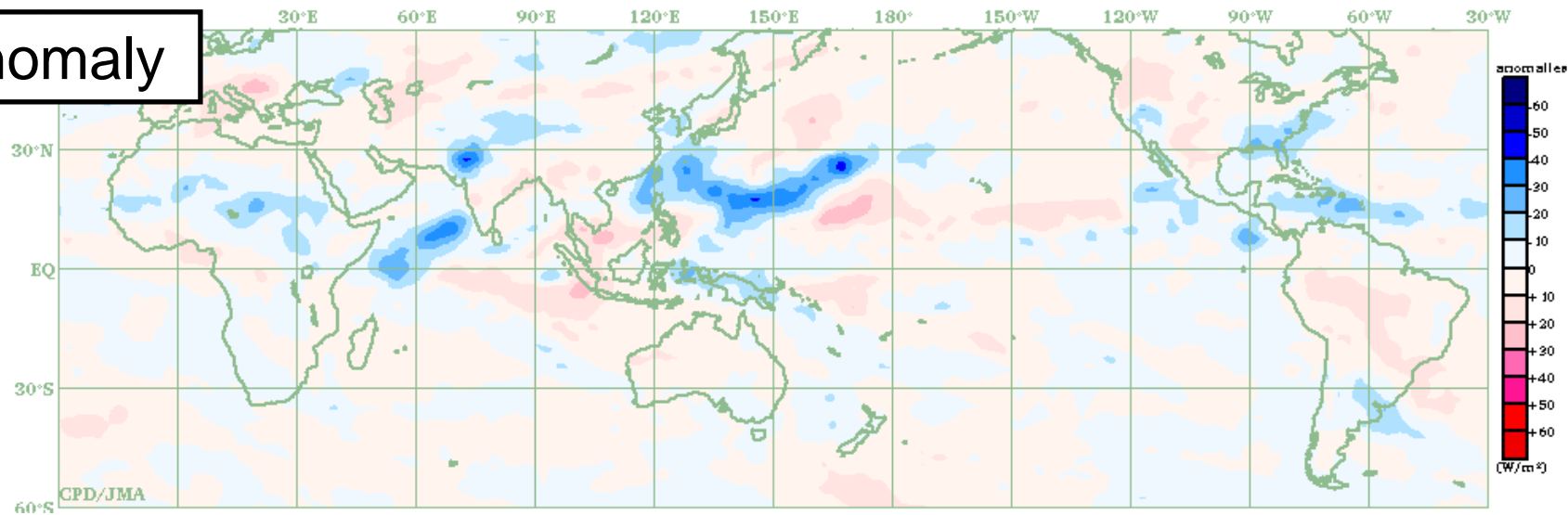
Analysis



MONTHLY MEAN OUTGOING LONGWAVE RADIATION (OLR)
The contour interval is 20 W/m². Original data provided by NOAA.

(Aug. 2012)

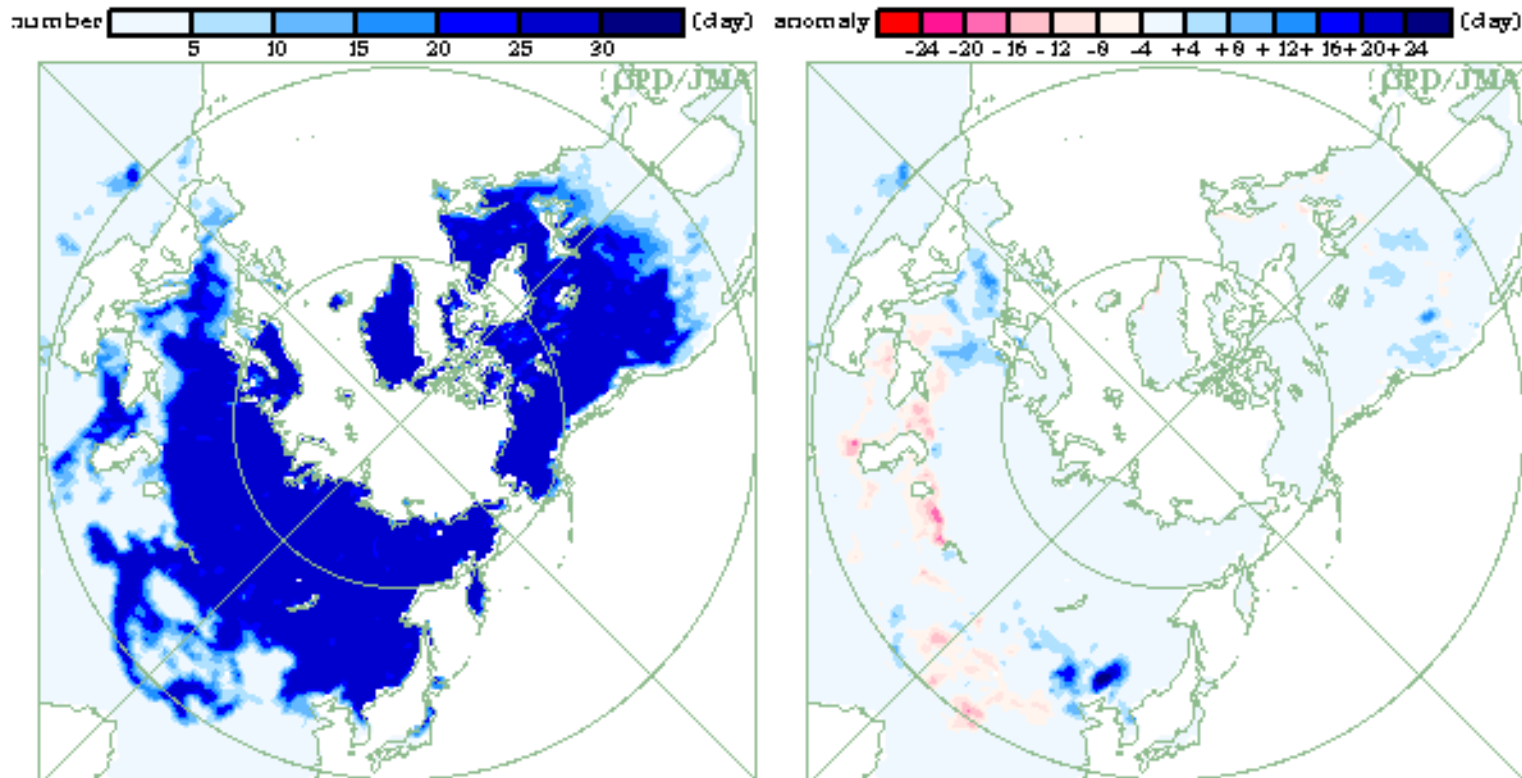
Anomaly





Satellite data used in JMA's climate monitoring

Snow covered days analyzed from SSM/I & SSMIS data



**NUMBER OF DAYS OF SNOW COVER AND ANOMALY
BY SSM/I IN THE NORTHERN HEMISPHERE (Feb. 2013)**

The left and right panels show the number of days of snow cover and anomalies, respectively. Analysis performed by JMA using its own algorithm based on observations carried out with SSM/I and SSMIS provided by NCDC. The base period for the normal is 1989-2010.



Thank you for your attention

