

# The Japanese 55-year Reanalysis “JRA-55”

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~ Introduction ~  
**What is reanalysis?**

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# Required dataset for climate research



- For several decades
- Consistent and high quality for any time and any region
- Many meteorological variables
  - Pressure, temperature, wind, humidity, ...
    - They can be observed.
    - But these are not sufficient for climate research.
  - Variables at the top of atmosphere (i.e. radiation), surface fluxes, vertically accumulated variables (i.e. precipitable water), ...
    - They are difficult to observe.



# Approach for producing climate data



## 1. From observational data only

- Example) GSN, GUAN managed by GCOS
- High quality climate dataset can be generated at the observation station and surrounding region, but the regions and variables are limited.

## 2. Numerical data assimilation using observational data

- Uniformly distributed grid point values are generated based on consistent dynamics and physics.
- Advanced NWP model with high performance supercomputer.
- Many kind of variables are produced at every grid point.
- Numerical data assimilation cycle is performed for several decades. → **Long-term Reanalysis**

# Reanalysis



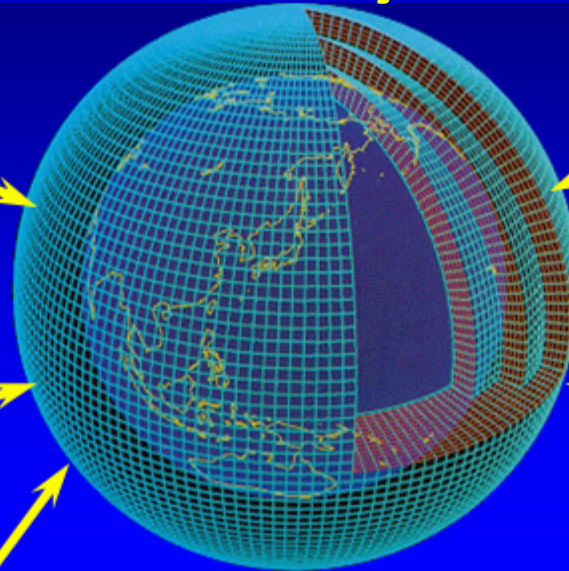
Satellite



Surface, Upper



Ship, aircraft  
Observation



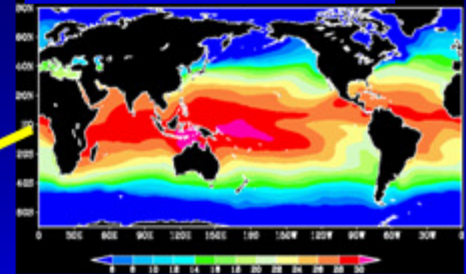
Assimilate past observational data

Data assimilation cycle

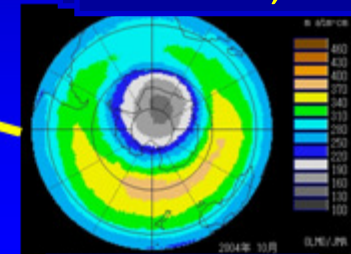
Consistent quality Reanalysis Product

- Provide Initial Condition and Verification data for seasonal forecast
- Climate Monitoring
- Research on climate system and water circulation etc.

Boundary



SST, sea ice



ozone



# The JRA-55 reanalysis

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# Japanese Global Atmospheric Reanalysis

## 1<sup>st</sup> JRA-25

By JMA and CRIEPI (1979~2004)  
(Central Research Institute for Electric Power Industry)



## 2<sup>nd</sup> JRA-55 ( JRA Go! Go! )

By JMA (1958~2012)

JRA-55 is the first reanalysis  
which covers more than 50 years since 19  
with 4D-var data assimilation system.



JMA operates JRA-55 continuously  
in real time basis after 2013.



# JRA-55 Reanalysis system

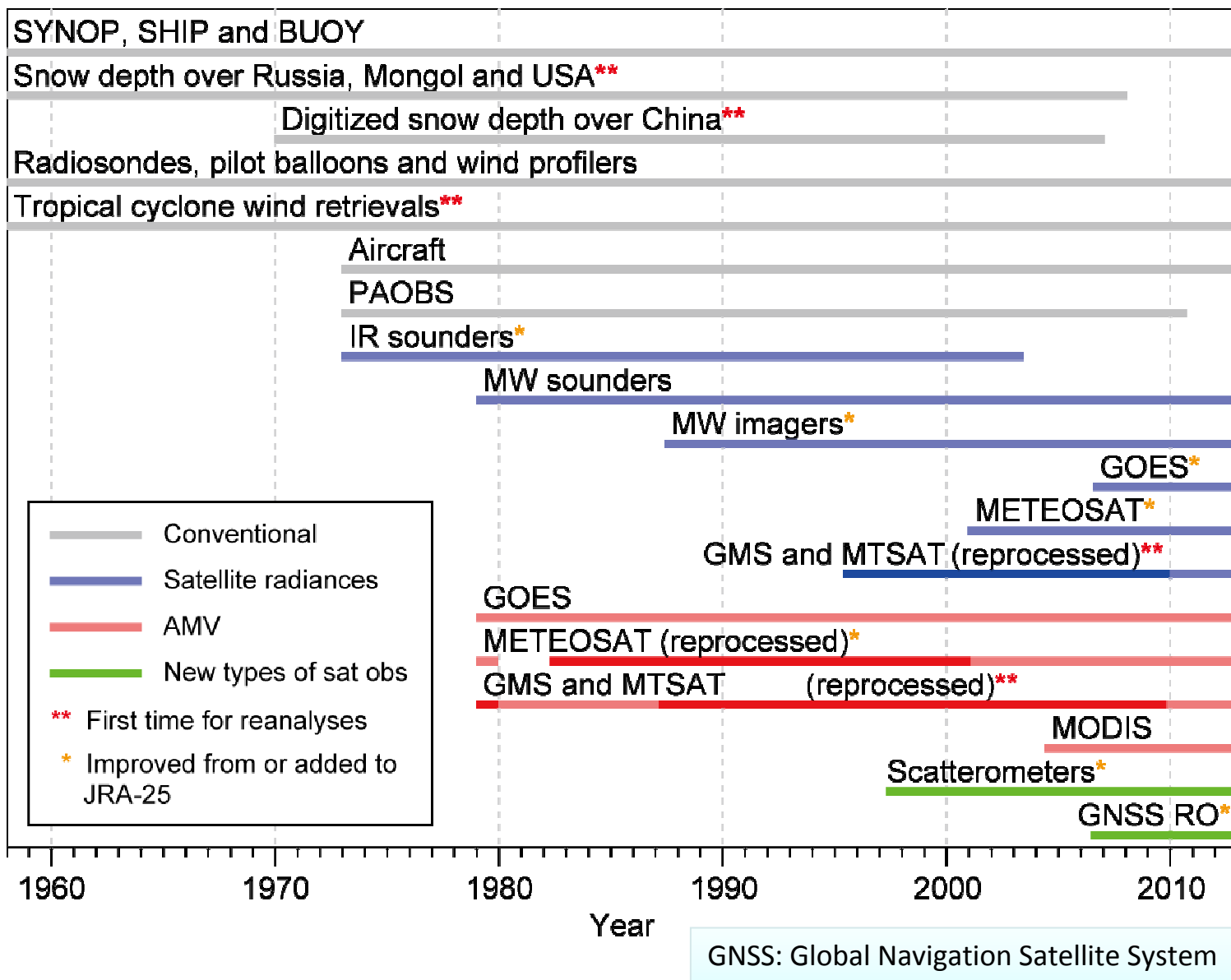


|                                      | JRA-25  | JRA-55  |
|--------------------------------------|---|---|
| Reanalysis years                     | 1979-2004 (26 years)                              | 1958-2012 (55 years)  |
| Equivalent operational NWP system    | As of Mar. 2004                 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



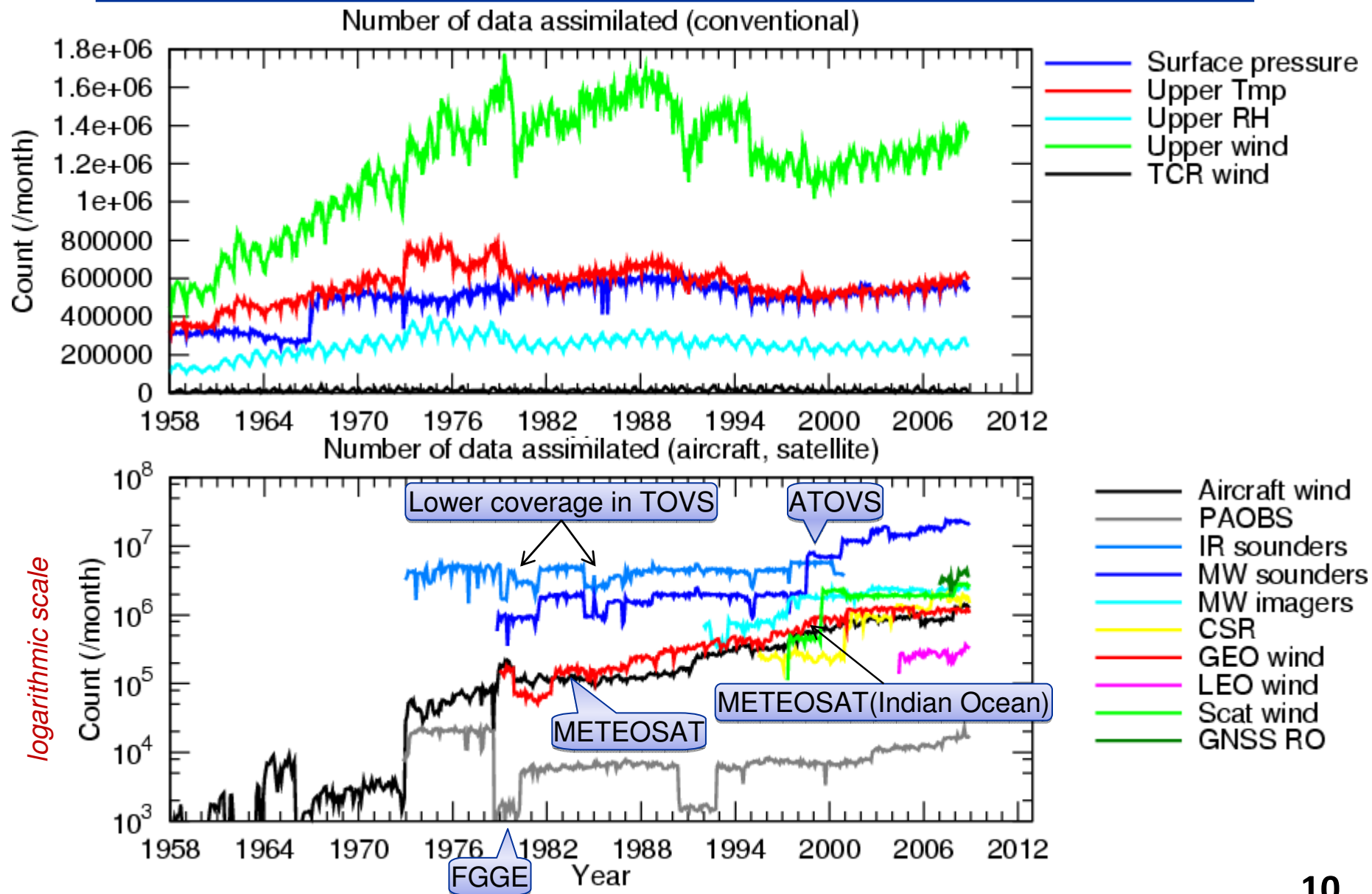


# Observational Data available for JRA-55





# Number of observations assimilated (Global)





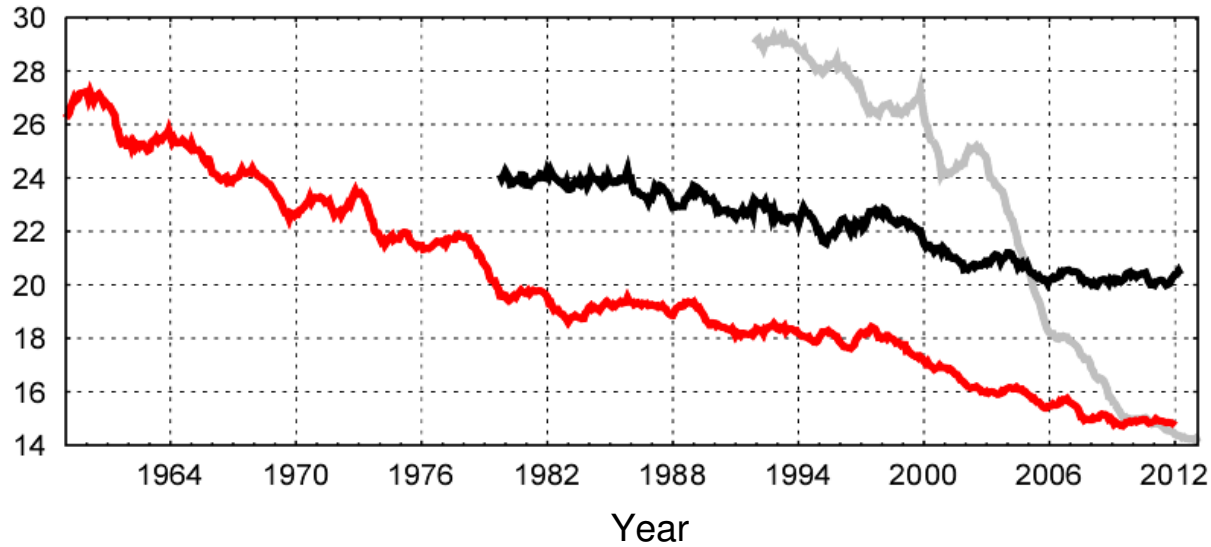
# Quality of JRA

## Forecast [FT=48] Scores



### RMSE of Z500 for N.H. and S.H. [gpm]

N.H.

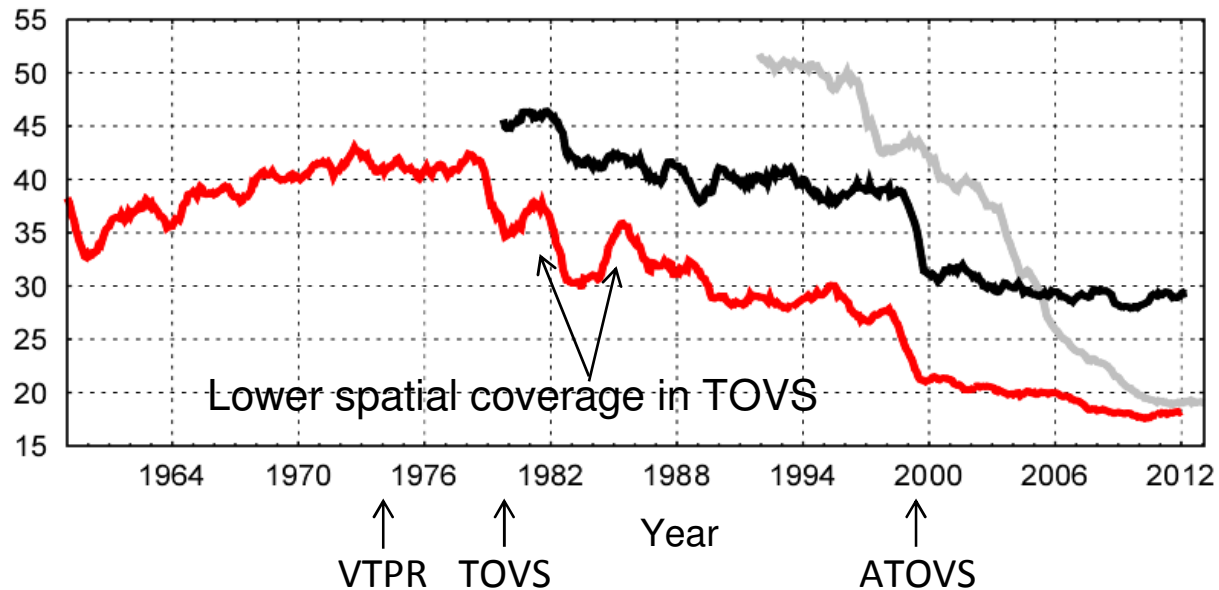


JRA-55

JRA-25

Operation

S.H.



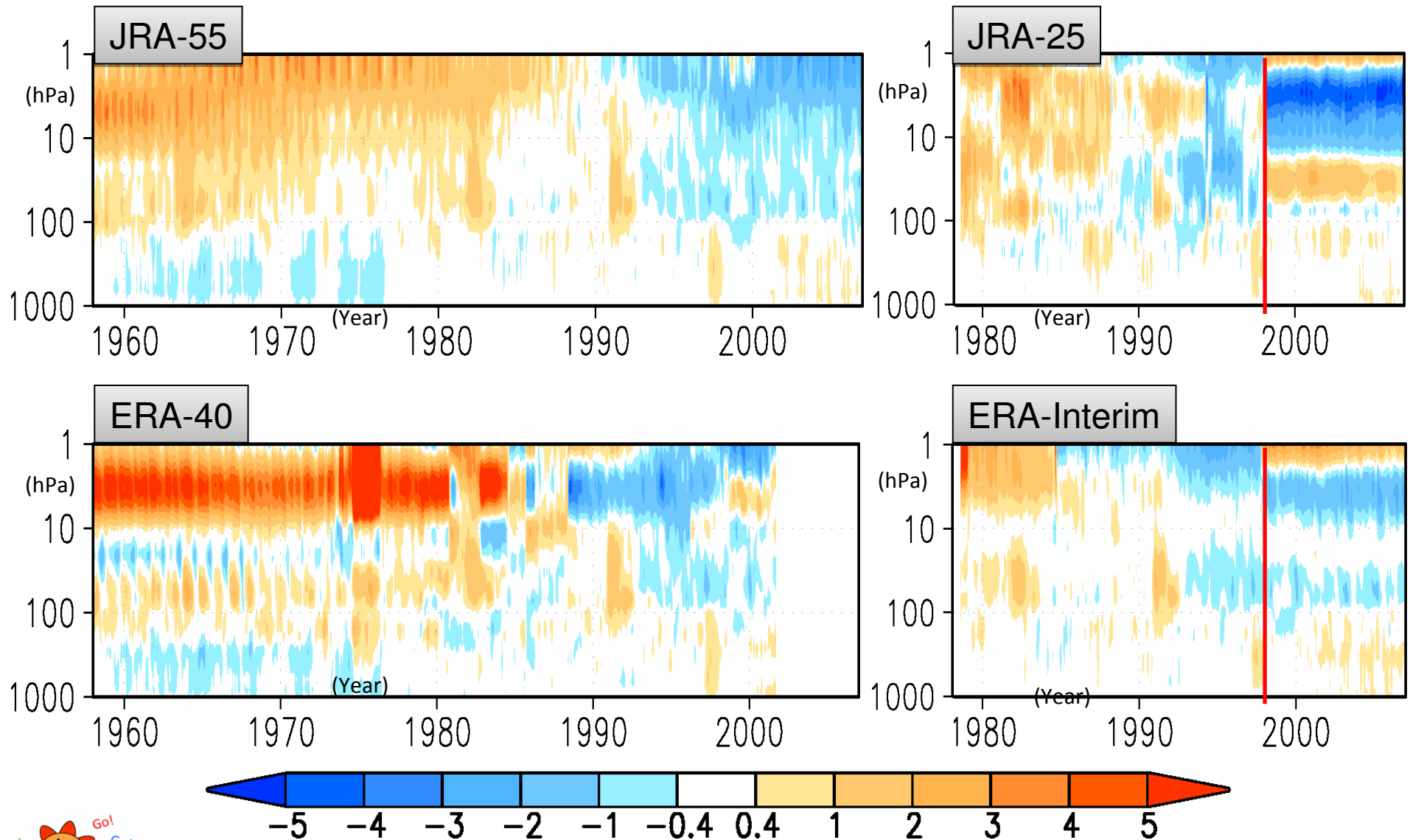
Lower spatial coverage in TOVS

↑ VTPR ↑ TOVS

↑ ATOVS



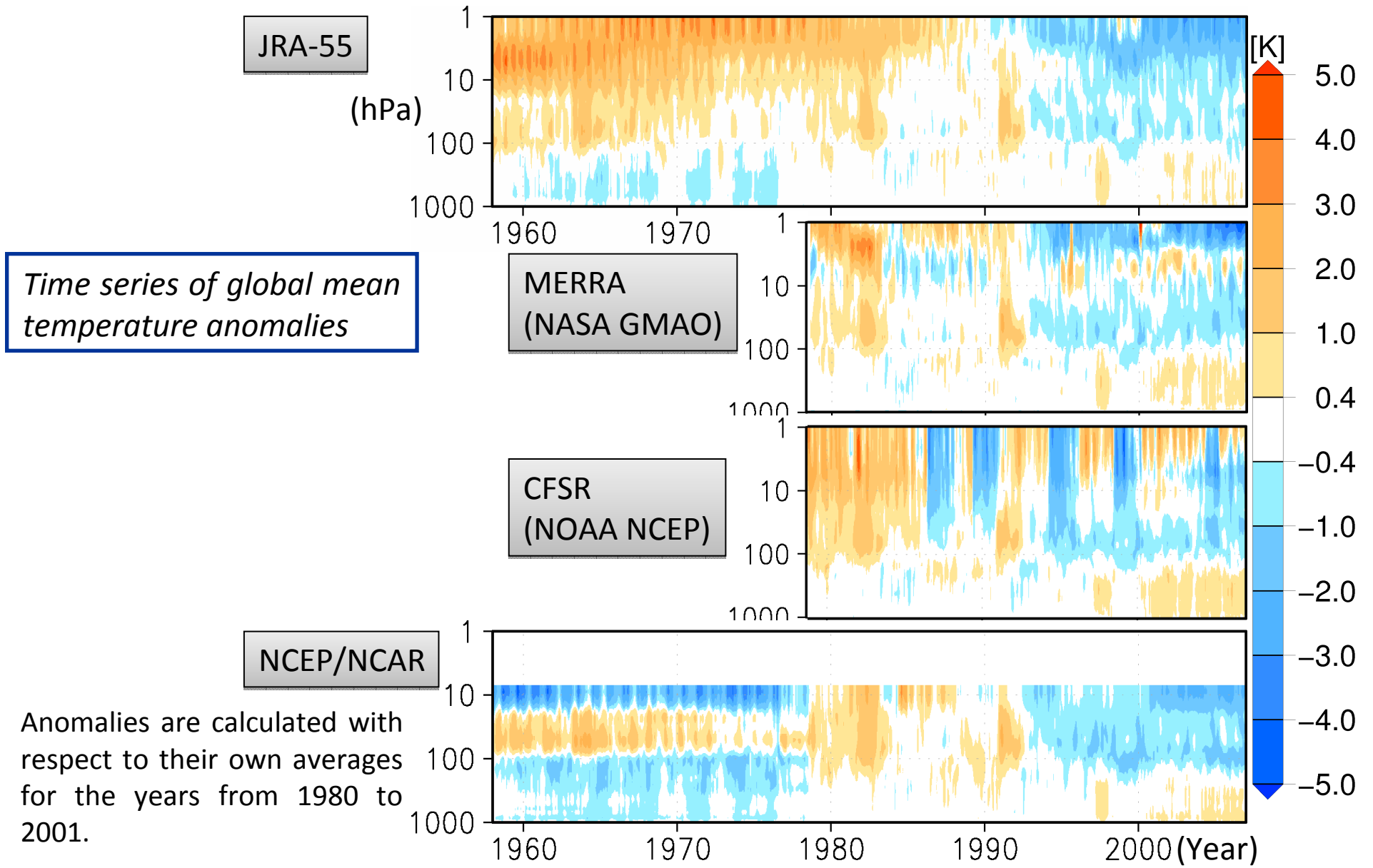
# Time-Height Cross Sections of global mean Temperature [K] anomalies in JRA and ERA reanalyses



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.



# Temporal consistency of temperature analysis (Part 2)



*Time series of global mean temperature anomalies*

Anomalies are calculated with respect to their own averages for the years from 1980 to 2001.



# JRA-55 data available



JMA <http://jra.kishou.go.jp/>

DIAS <http://dias-dss.tkl.iis.u-tokyo.ac.jp/acc/storages/filelist/dataset:204>

JRA project

JRA-55 : Japanese 55-year Reanalysis



**気象庁55年長期再解析**

1958年以降を対象とした、気象庁による日本で2回目の長期再解析プロジェクト。

**Japanese 55-year Reanalysis**

The second Japanese reanalysis project conducted by the Japan Meteorological Agency (JMA), which covers the period from 1958 onward.

日本語

**JRA-55**

English

**JRA-55**



# Summary



- **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.
  - Unnatural gaps have been significantly reduced.
- **References**
  - Ebita et al. (2011) SOLA, 2011, 7, 149-152
    - The Japanese 55-year Reanalysis “JRA-55”: An Interim Report
    - Interim report as of 2011
  - **Comprehensive reports are under preparation.**



# Thank you for your attention



Red leaves of Japanese maple in autumn  
at Heirinji temple in Niiza city on 23 Nov. 2009