Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Intercomparison of the water vapour data records

Fifth Workshop on the GEWEX water vapour assessment

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Intercomparison of the water vapour data records

- Data and Methods
- TCWV and WV mean and standard deviation of long term data records
- TCWV mean and stdd. dev. using full archive
- TCWV time series using full archive
- Tseries and stdd. dev. for data with different weather types (clear, cloudy, all sky)
- Seasonal zonals of TCWV
- Summary and Outlook

Data and Methods

Reanalysen (☀ ☁ 🌧):

- **MERRA:** 412 mo, TCWV, WV
- **ERAINT:** 408 mo, TCWV, WV
- **JRA55:** 300 mo , TCWV, WV
- **CFSR:** 372 mo, TCWV, WV

All Data Records: www.gewex-vap.org

Satellite data (ocean / land):

- **NVAPM:** 264 mo, TCWV ☀☁ / ☀
- **ATOVS:** 156 mo, TCWV ☀☁
- **GOMESCIAg:** 156mo, TCWV ☀
- **SSMIMERIS:** 72 mo, TCWV ☀☁ / ☀
- **NNHIRS:** 252 mo, TCWV,WV ☀

mo = month, clear sky(☀), cloudy sky(☀☁), all sky(☀🌧)

Satellite data (land)

- **MERIS:** 111 mo, TCWV ☀
- **MODISt:** 164 mo, TCWV ☀
- **MODISa:** 149 mo, TCWV ☀

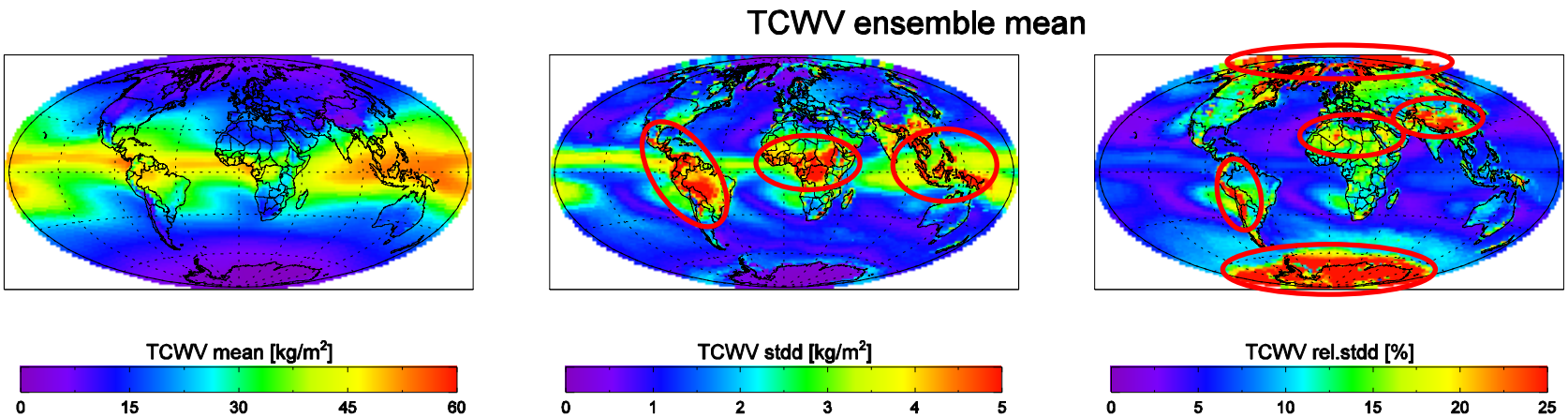
Satellite data (ocean)

- **AMSREj:** 113 mo, TCWV ☀☁
- **NVAPO:** 264 mo, TCWV ☀☁
- **HOAPS:** 258 mo, TCWV ☀☁
- **SSMIr:** 303 mo, TCWV ☀☁
- **AIRWAVE:** 245 mo, TCWV ☀
- **TMIr:** 205 mo, TCWV ☀☁
- **AMSREr:** 112 mo, TCWV ☀☁

Methods:

- Processed to a common grid of 2° x 2°
- Time series of monthly means for diff. reg.
- Absolute and relative standard deviation

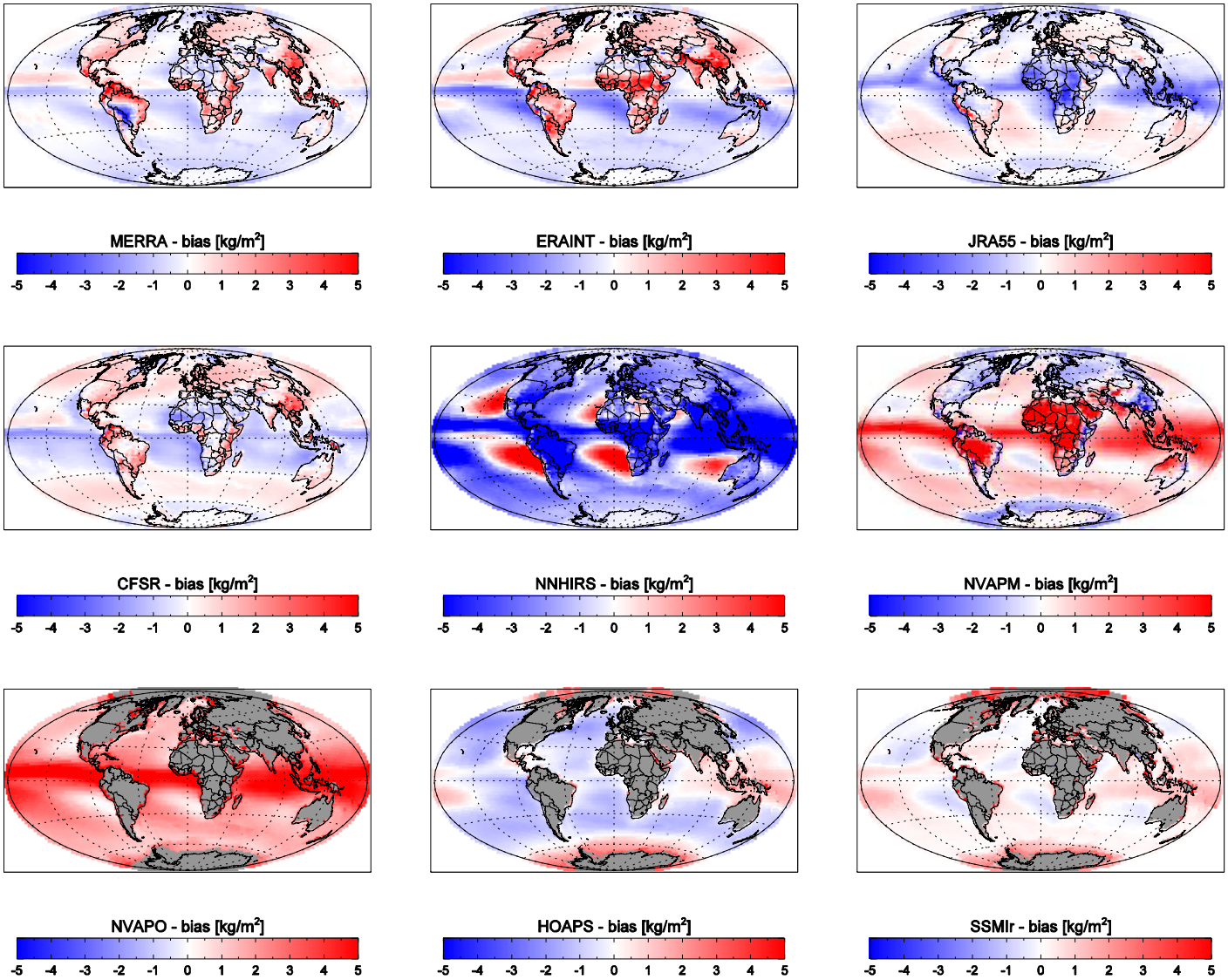
TCWV mean and stdd. of long term data records



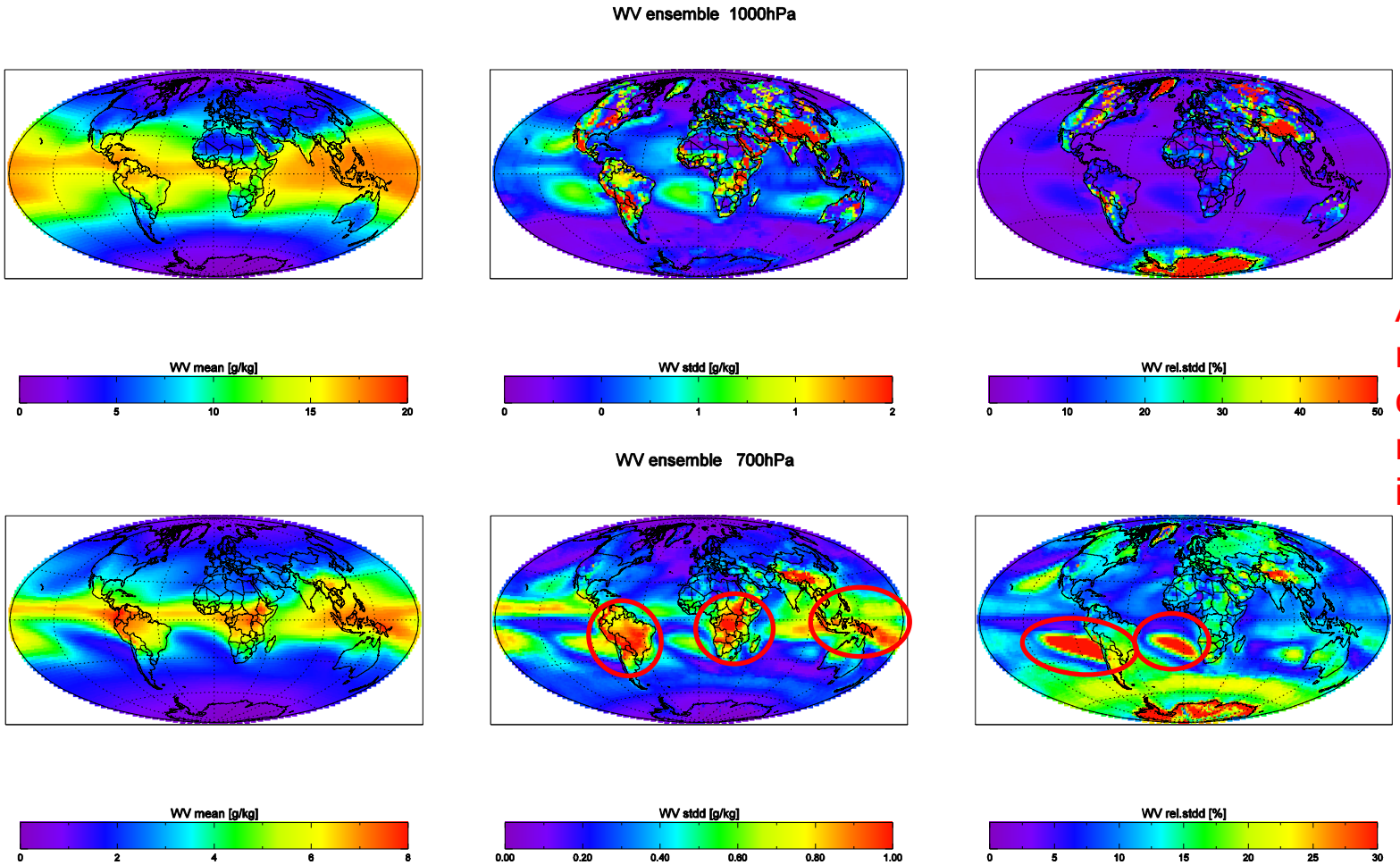
- ➔ Common time period 01/1988 – 12/2008
- ➔ 9 long term data records:
  - MERRA
  - ERAINT
  - JRA55
  - CFSR
  - NNHIRS
  - NVAPM
  - NVAPO
  - HOAPS
  - SSMIr

Regions with high amounts of water vapour exhibit the maximum standard deviation. (Amazonas, Centr. Afrika, TWP)

Deserts, mountainous and snow covered regions reveal the highest rel. stdd. dev.

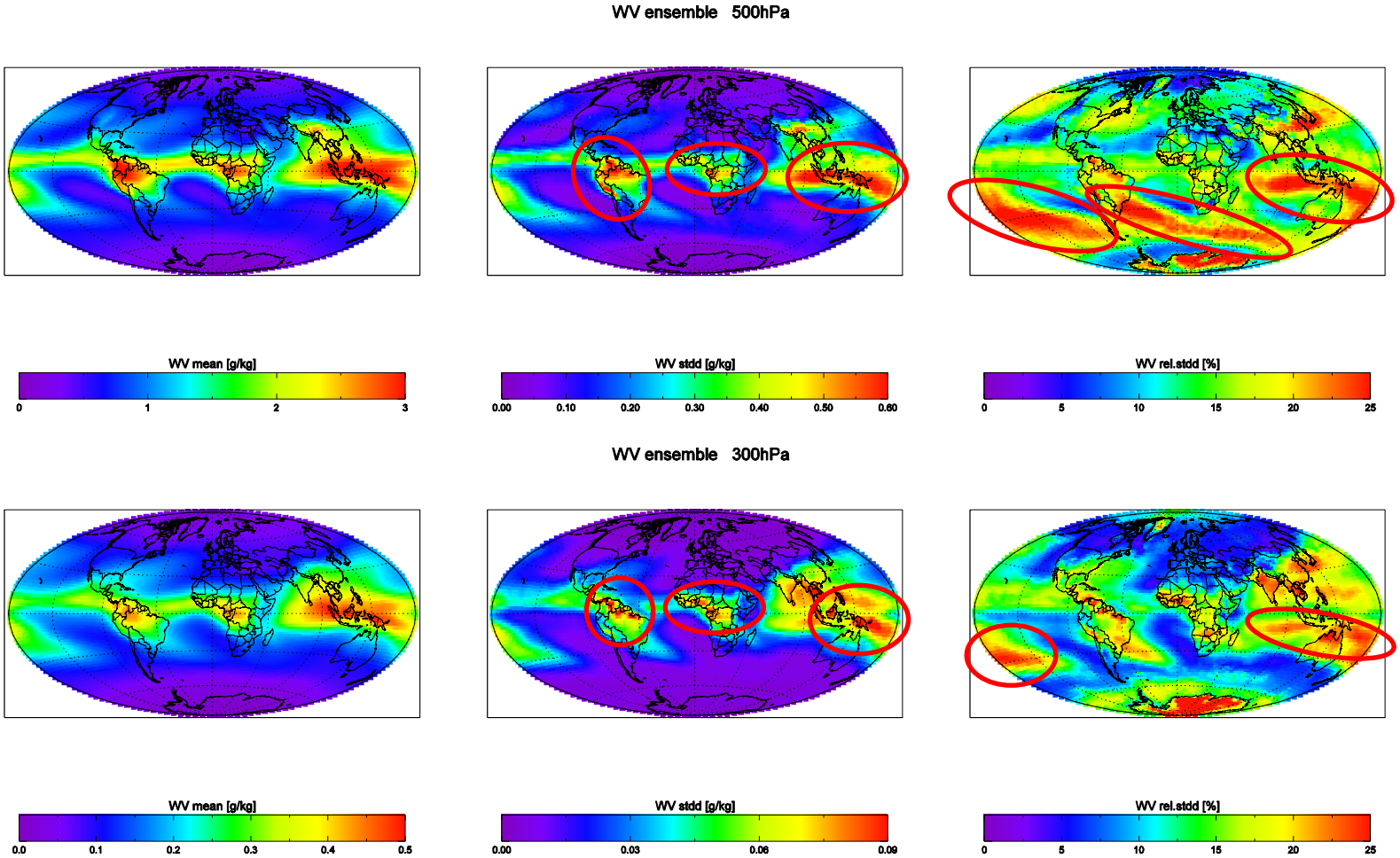

MERRA - bias [kg/m²]
ERAINT - bias [kg/m²]
JRA55 - bias [kg/m²]
CFSR - bias [kg/m²]
NNHIRS - bias [kg/m²]
NVAPM - bias [kg/m²]
NVAPO - bias [kg/m²]
HOAPS - bias [kg/m²]
SSMIr - bias [kg/m²]
-5 -4 -3 -2 -1 0 1 2 3 4 5

WV mean and stdd. of long term data records



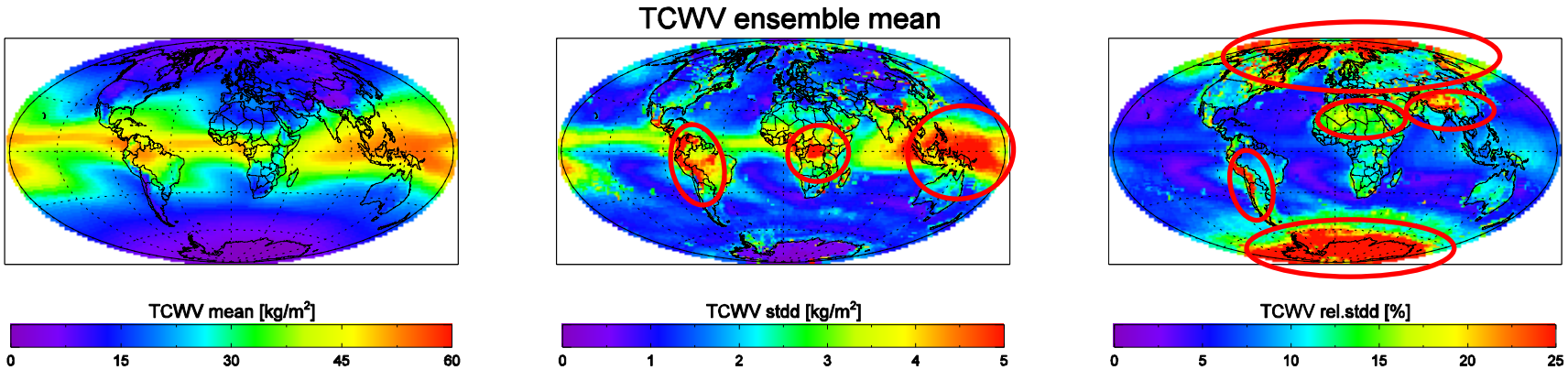
Additional regions over ocean, not seen in TCWV

WV mean and stdd. of long term data records



Further additional regions over ocean, not seen in TCWV

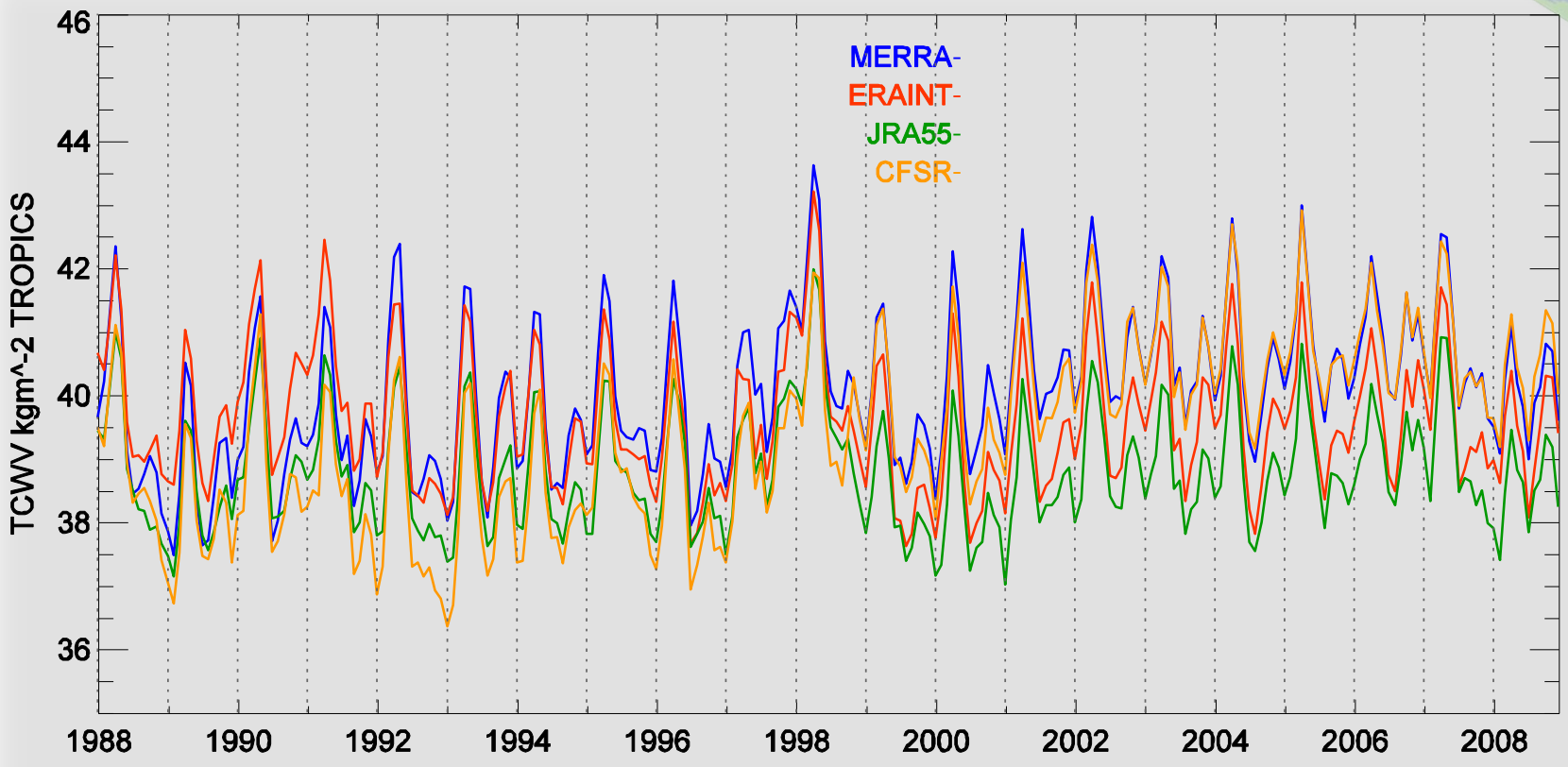
TCWV mean and stdd. of full archive (19 data records)



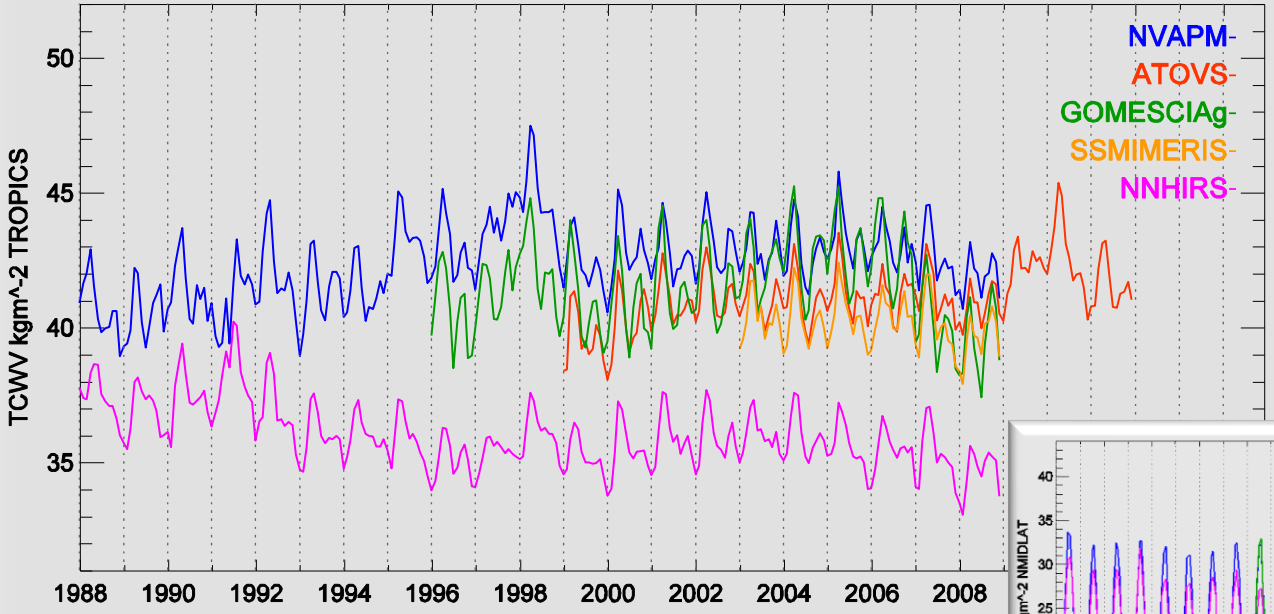
- ➔ For the overlapping period: 01/2003 – 12/2008
- ➔ Same striking regions as for long term data records:

  Amazonas, Central Africa, tropical warm pool, mountains, deserts as well as snow and ice covered regions.

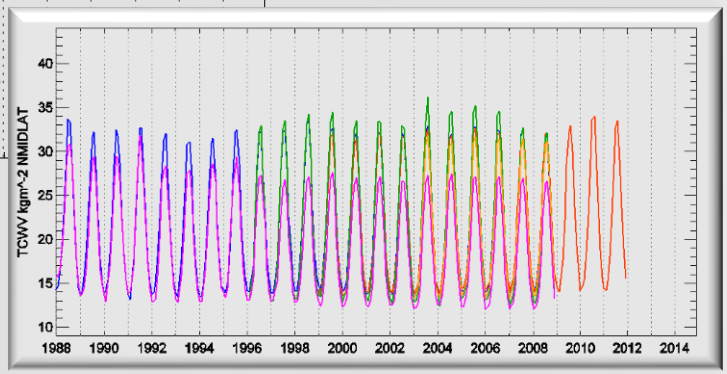
TCWV reanalyses data for the tropics (ocean+land)



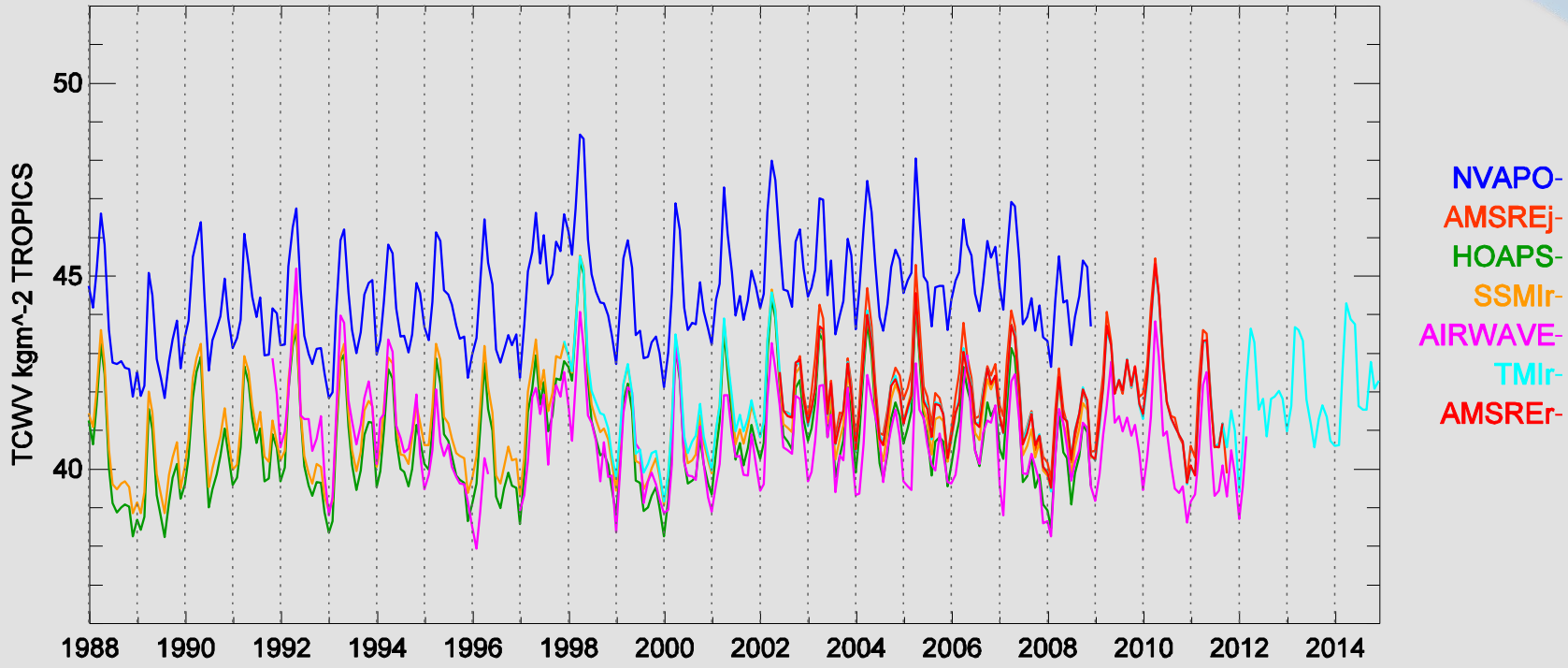
TCWV satellite data for the tropics (ocean + land)



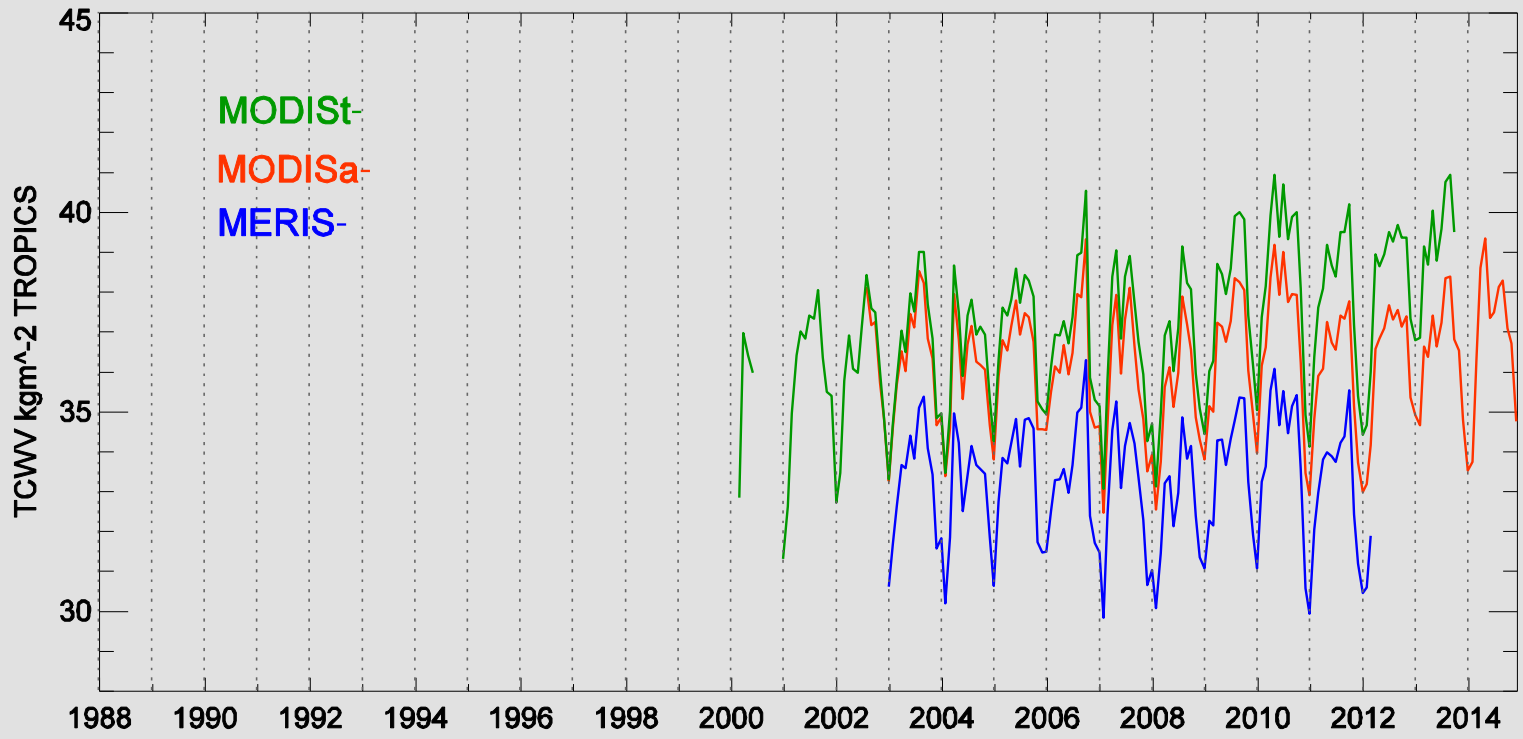
and for the northern midlatitudes:



TCWV satellite data for the tropics (ocean)



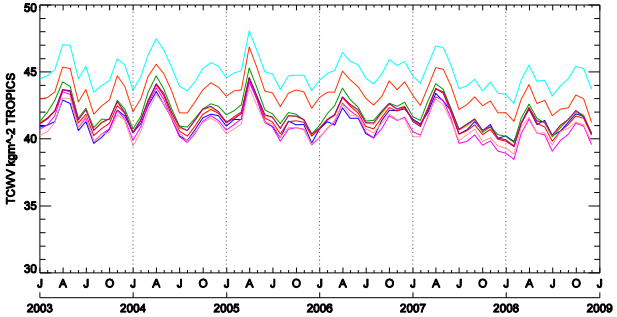
TCWV satellite data for the tropics (land)



TCWV differences due to different weather types

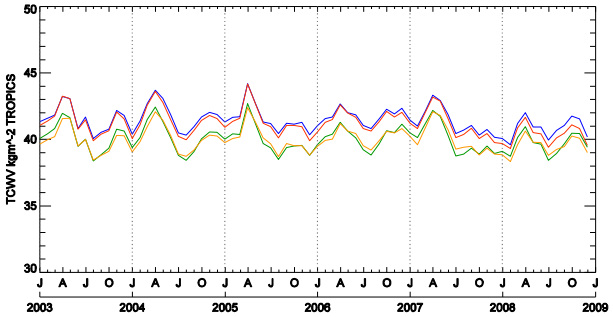
➔ Time series (01/2003 – 12/2008) of TCWV for the tropics (±20°), **only over ocean**

cloudy sky (☀ ☁)



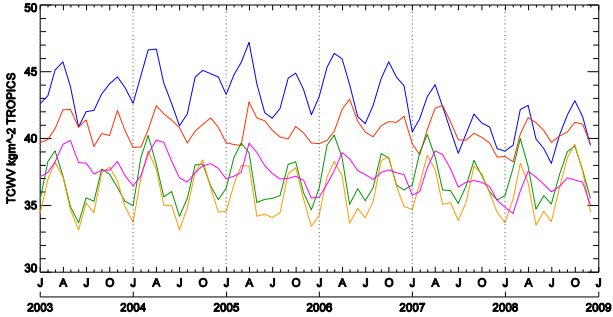
ATOVS-
NVAPM-
AMSREj-
AMSREr-
HOAPS-
NVAPO-
SSMIr-
SSMIMERIS-
TMIr-

all sky (☀ ☁🌧)



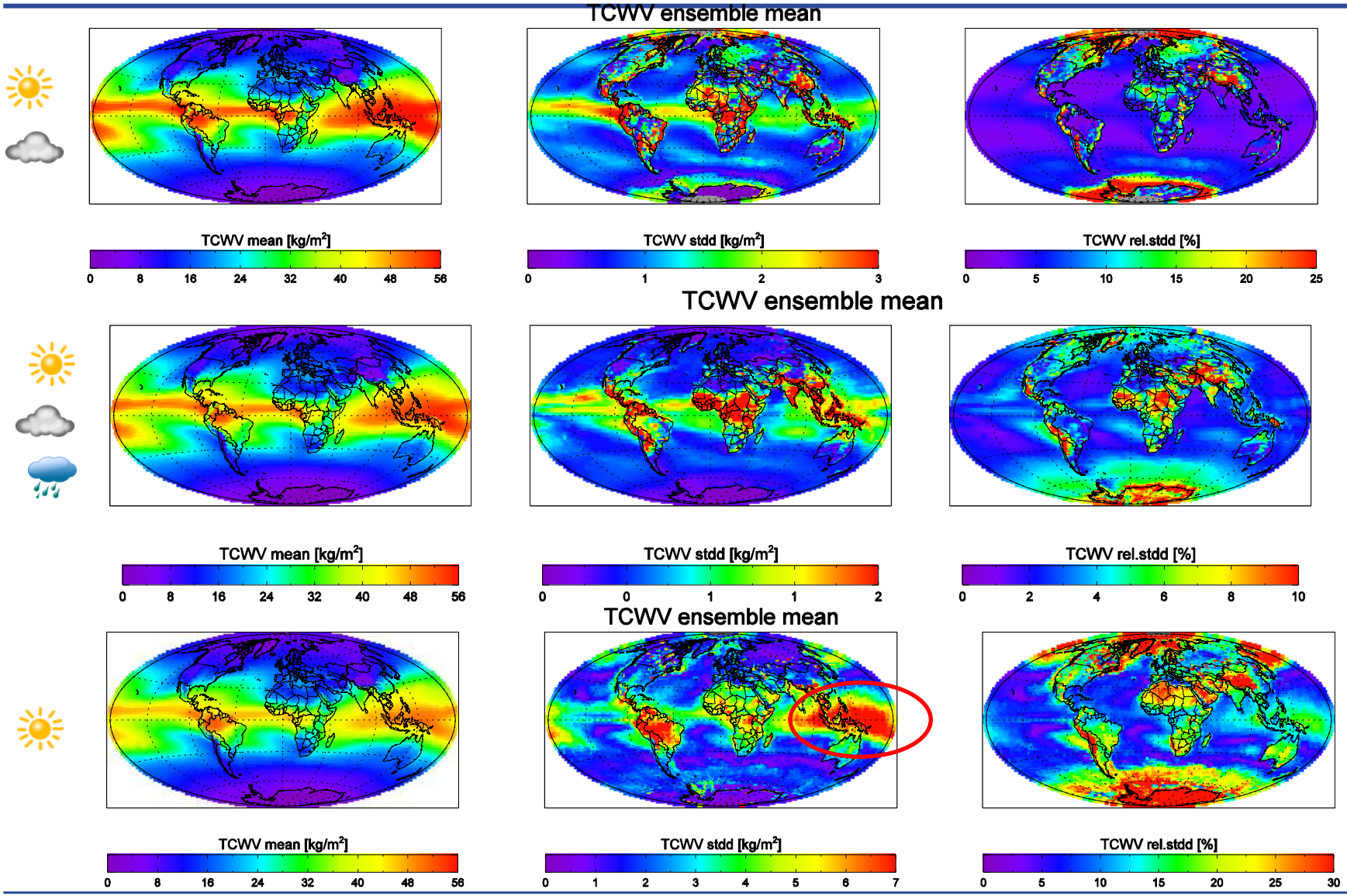
CFSR-
MERRA-
ERAINT-
JRA55-

clear sky (☀)

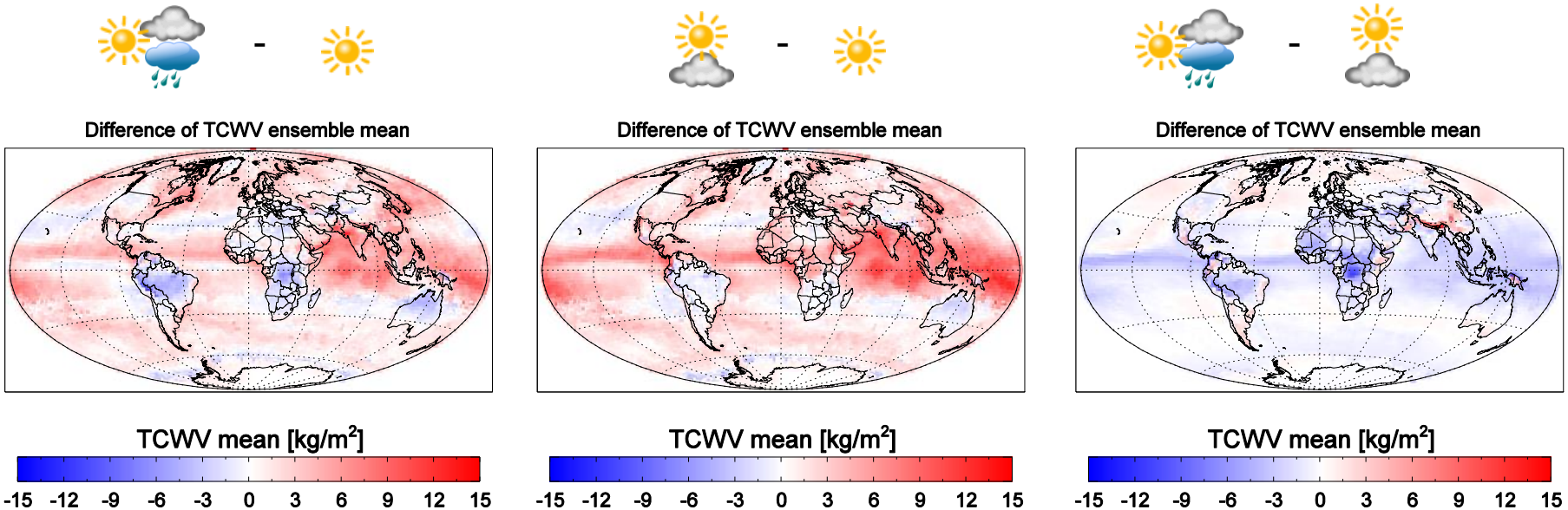


GOMESCIAg-
AIRWAVE-
MODISt-
MODISa-
NNHIRS-

TCWV in kg/m2 (☀ ☁)	>	TCWV in kg/m2(☀ ☁🌧)	>	TCWV in kg/m2 (☀)
38.4 < **42.0** < 48.0		38.3 < **40.6** < 44.2		33.1 < **38.7** < 47.2
min **mean** max		min **mean** max		min **mean** max

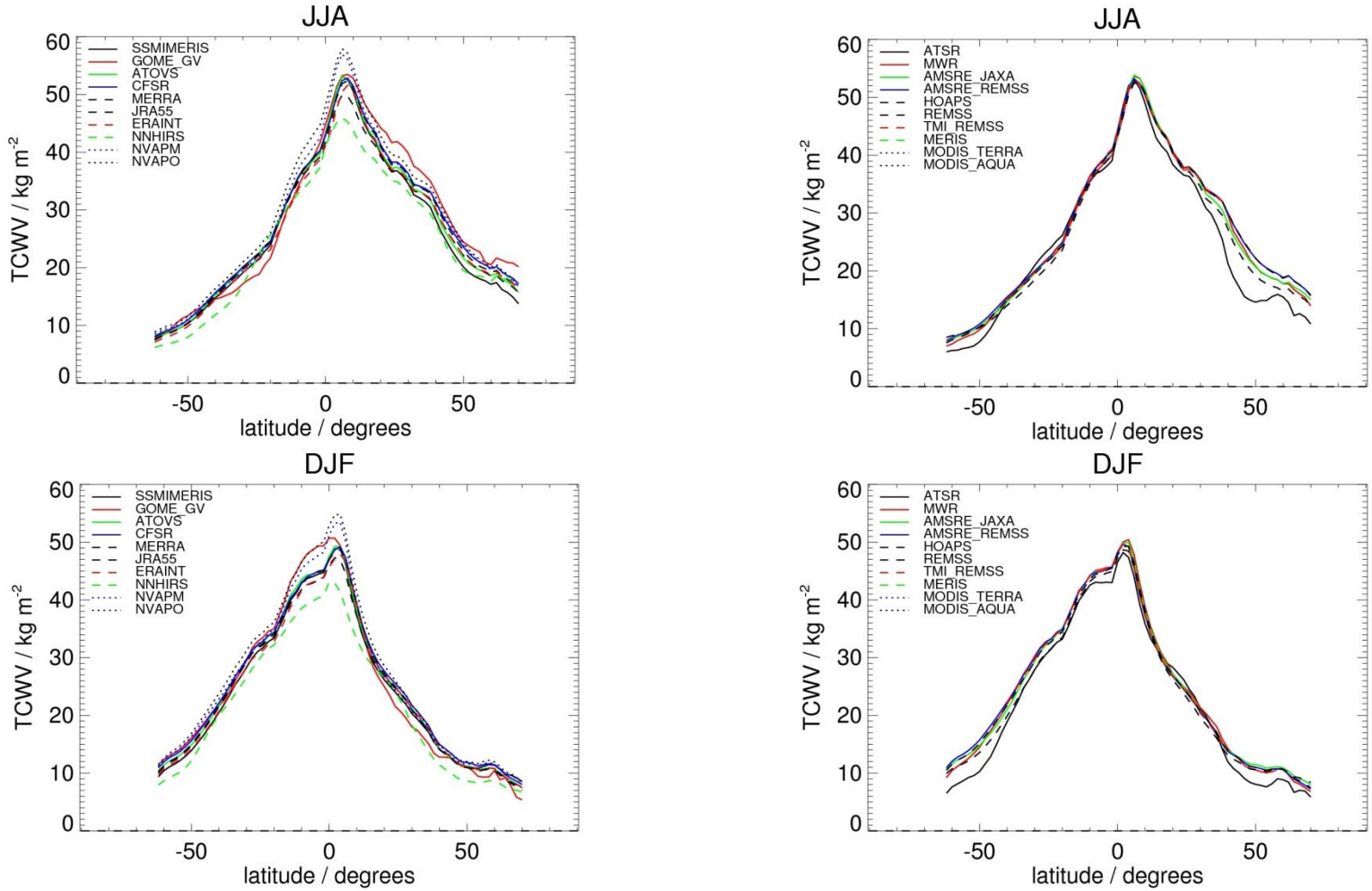

TCWV ensemble mean
TCWV mean [kg/m²]
0 8 16 24 32 40 48 56
TCWV stdd [kg/m²]
0 1 2 3
TCWV rel.stdd [%]
0 5 10 15 20 25
TCWV ensemble mean
TCWV mean [kg/m²]
0 8 16 24 32 40 48 56
TCWV stdd [kg/m²]
0 0 1 1 2
TCWV rel.stdd [%]
0 2 4 6 8 10
TCWV ensemble mean
TCWV mean [kg/m²]
0 8 16 24 32 40 48 56
TCWV stdd [kg/m²]
0 1 2 3 4 5 6 7
TCWV rel.stdd [%]
0 5 10 15 20 25 30

Differences of TCWV means



- ➔ TCWV of all sky ( ) or of cloudy sky ( )is mostly > TCWV of clear sky ( )
- ➔ TCWV ( ) is mostly > TCWV ( )

Zonals (ocean)



Summary and Outlook

- There are noticeable regional differences within all intercomparisons.
- One reason for the differences are the different classes of data records.
  - Classes are: all sky, cloudy sky and clear sky conditions
  - TCWV (cloudy sky) > TCWV (all sky)
  - TCWV (all sky) > TCWV (clear sky)

- Add NOAAHIRS data record to long term archive
- Finalize long term analysis for TCWV, WV, T for report
- GVAP future:
  - Full archive intercomparison
  - PDF
  - Weather type