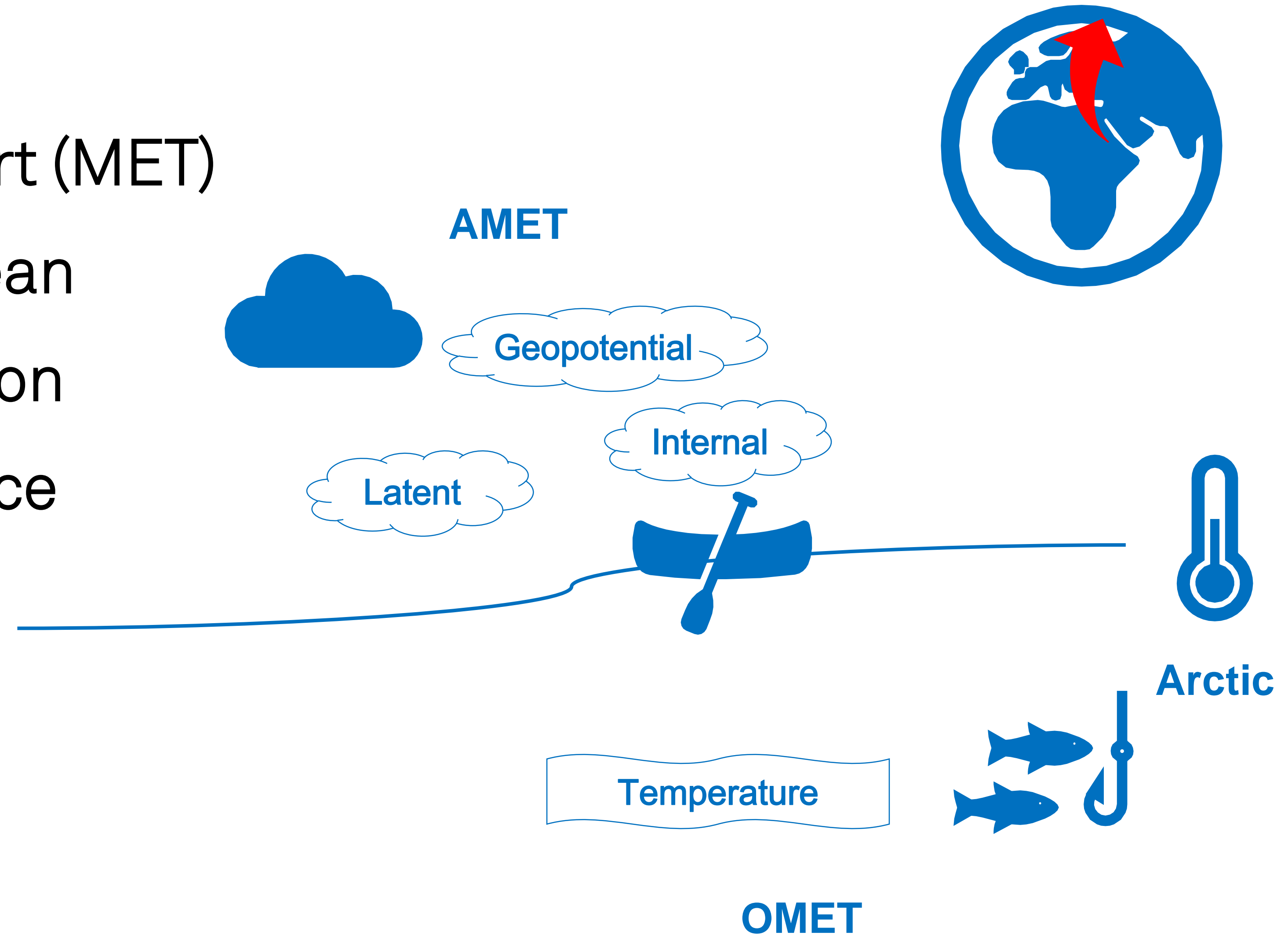


Synthesis and Evaluation of Meridional Heat Transport from Mid-Latitude towards the Arctic

Yang Liu, Jisk Attema, Ben Moat, Wilco Hazeleger
Earth Energy Imbalance workshop 2018

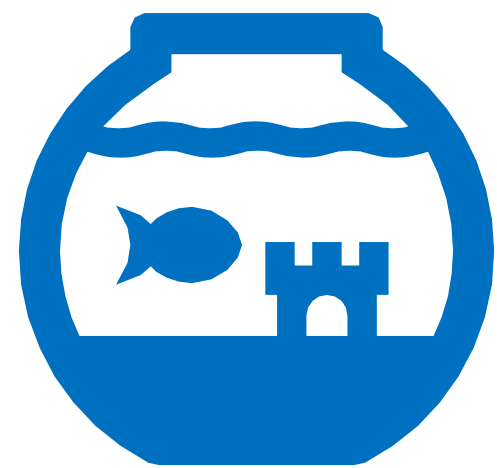
- Meridional Energy Transport (MET)
 - MET in Atmosphere & Ocean
 - Reanalysis Intercomparison
 - Impact on the Arctic Sea Ice



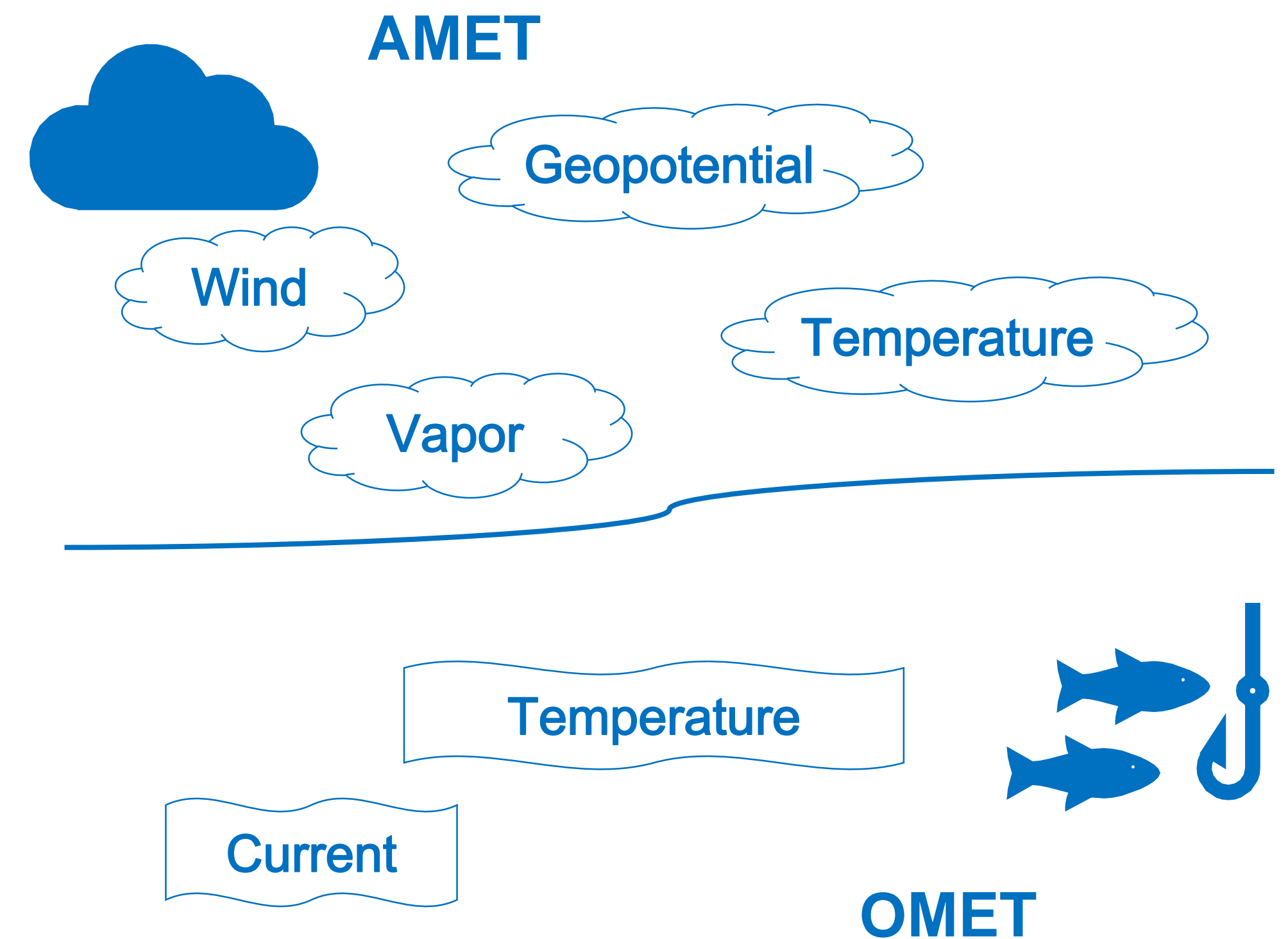
- Reanalysis Data



• ERA-Interim	1979 - 2016	6 hourly	0.75° x 0.75° x 60 lev
• MERRA2	1980 - 2016	3 hourly	0.5° x 0.667° x 70 lev
• JRA55	1979 - 2015	6 hourly	0.56° x 0.56° x 60 lev
• ORAS4	1979 - 2014	monthly	ORCA1
• GLORYS2V3	1993 - 2014	monthly	ORCA025
• SODA3	1980 - 2015	5 daily	MOM5



- Difficulties for the Quantification of AMET & OMET
 - Uncertainties in 3D fields
 - Mass budget imbalance

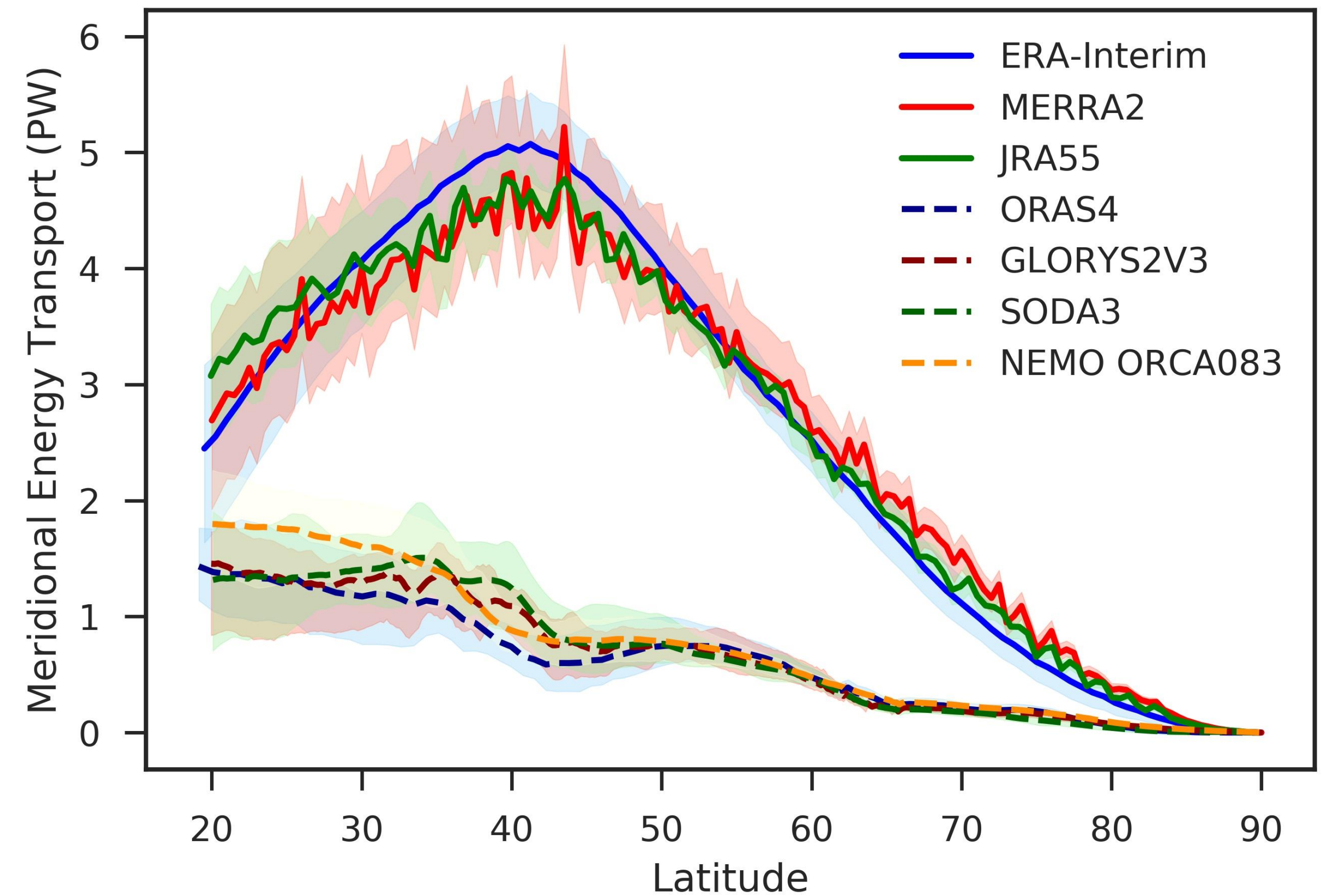


Trenberth, K. E., 1991. Climate diagnostics from global analyses: Conservation of mass in ecmwf analyses.

Trenberth, K.E. and Solomon, A., 1994. The global heat balance: Heat transports in the atmosphere and ocean.

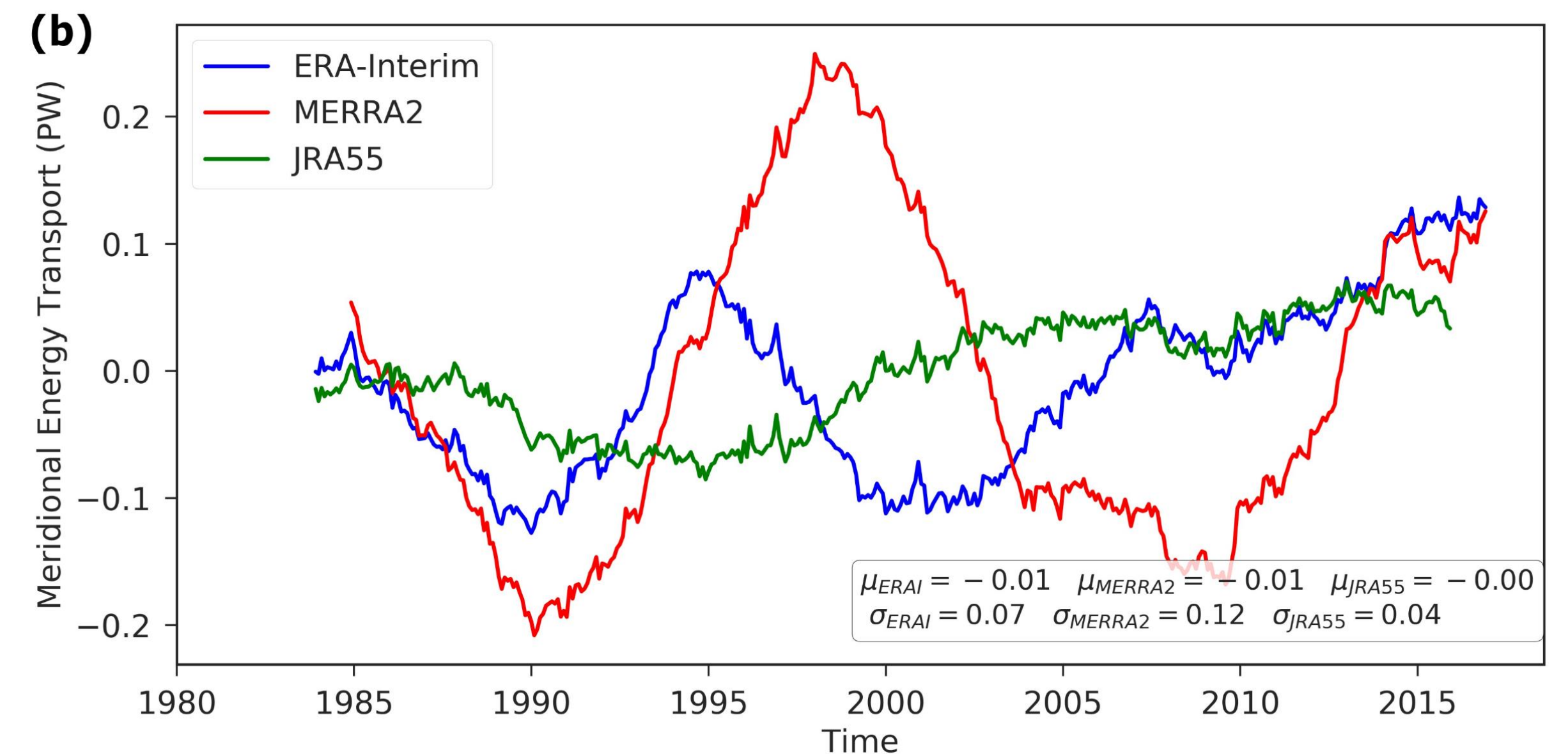
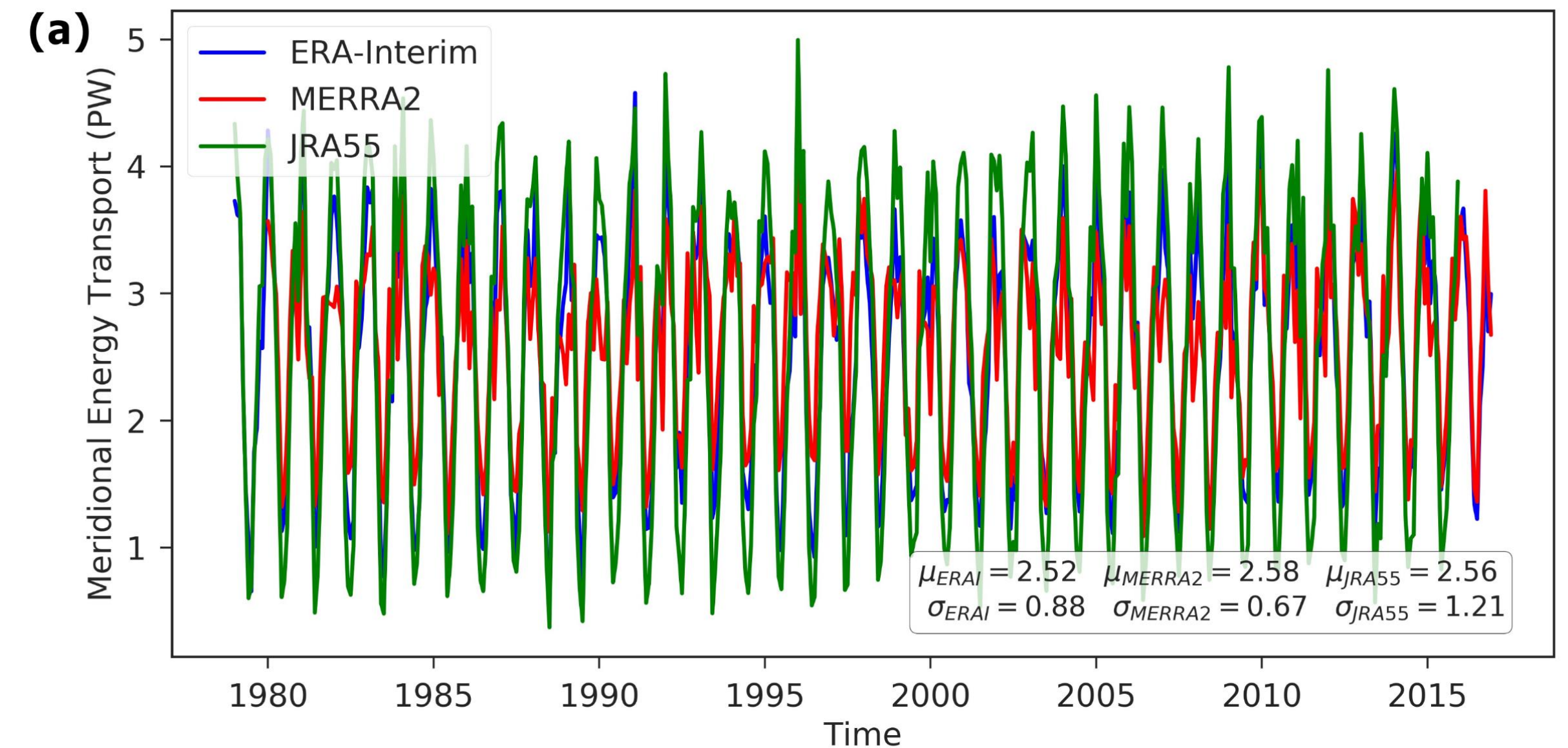
Trenberth, K. E., 1997. Using Atmospheric Budgets as a Constraint on Surface Fluxes.

- Meridional Energy Transport
 - AMET & OMET
 - Mean over entire time span
 - from 20N to 90N

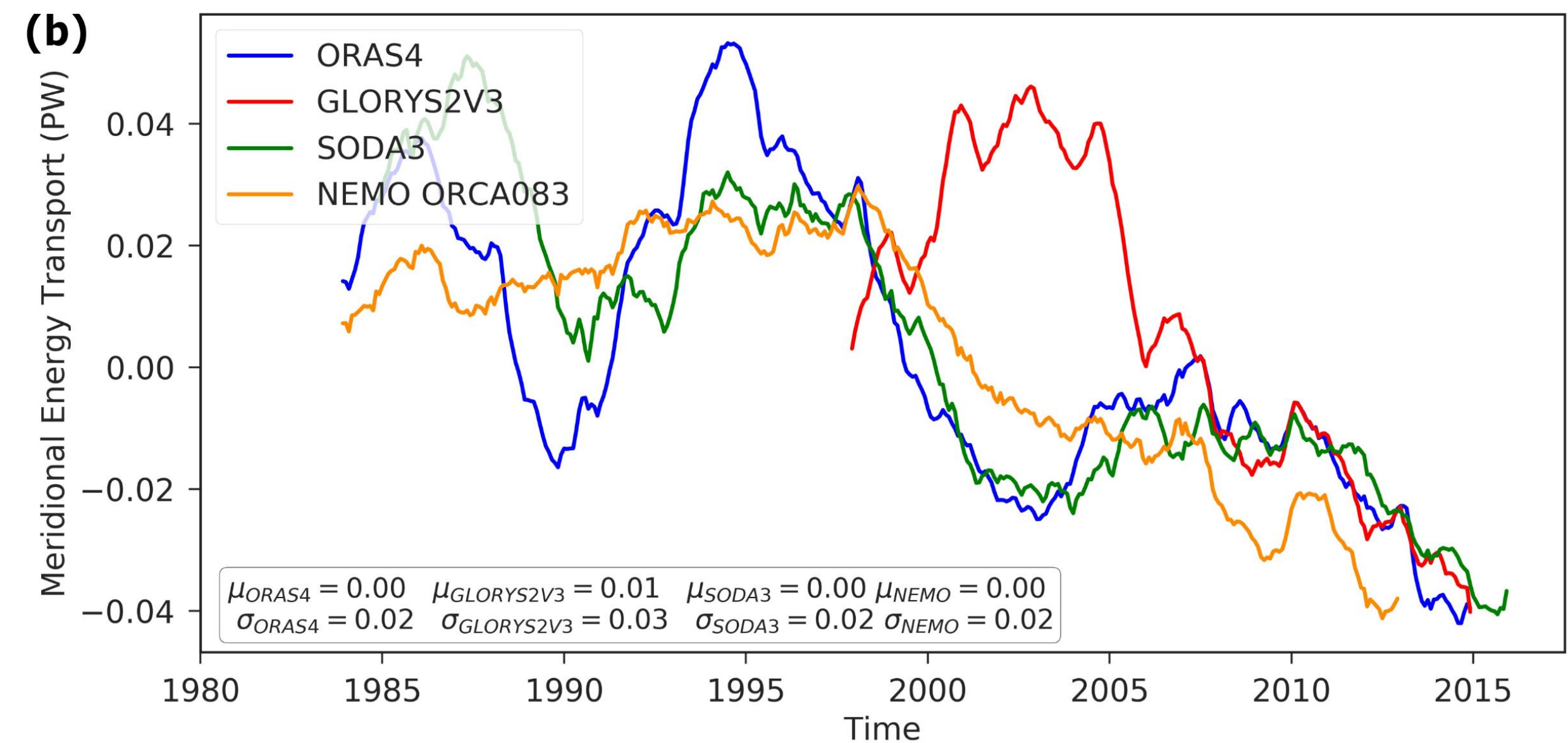
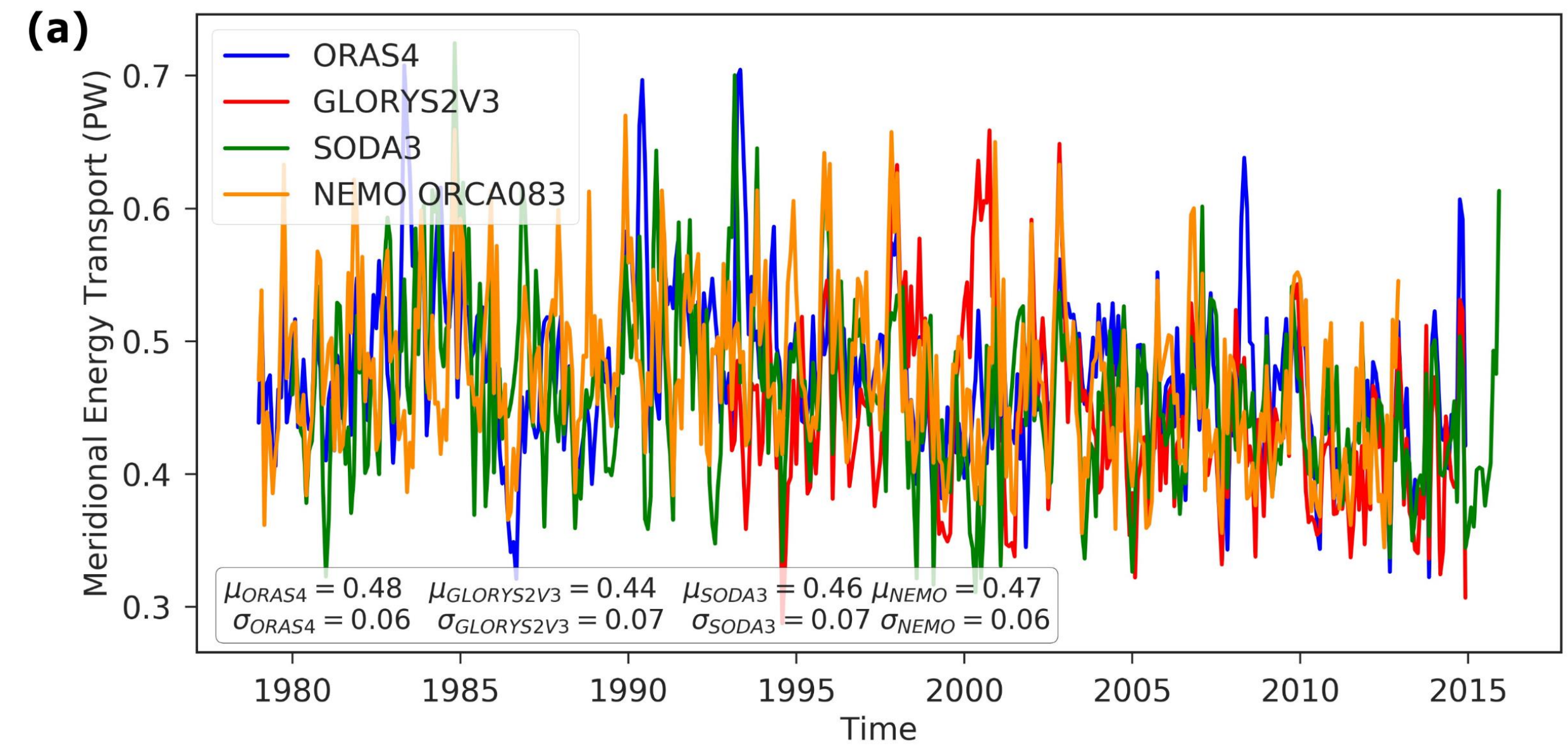


Trenberth, K. E., Caron, J. M. 2001. Estimates of Meridional Atmosphere and Ocean Heat Transports.

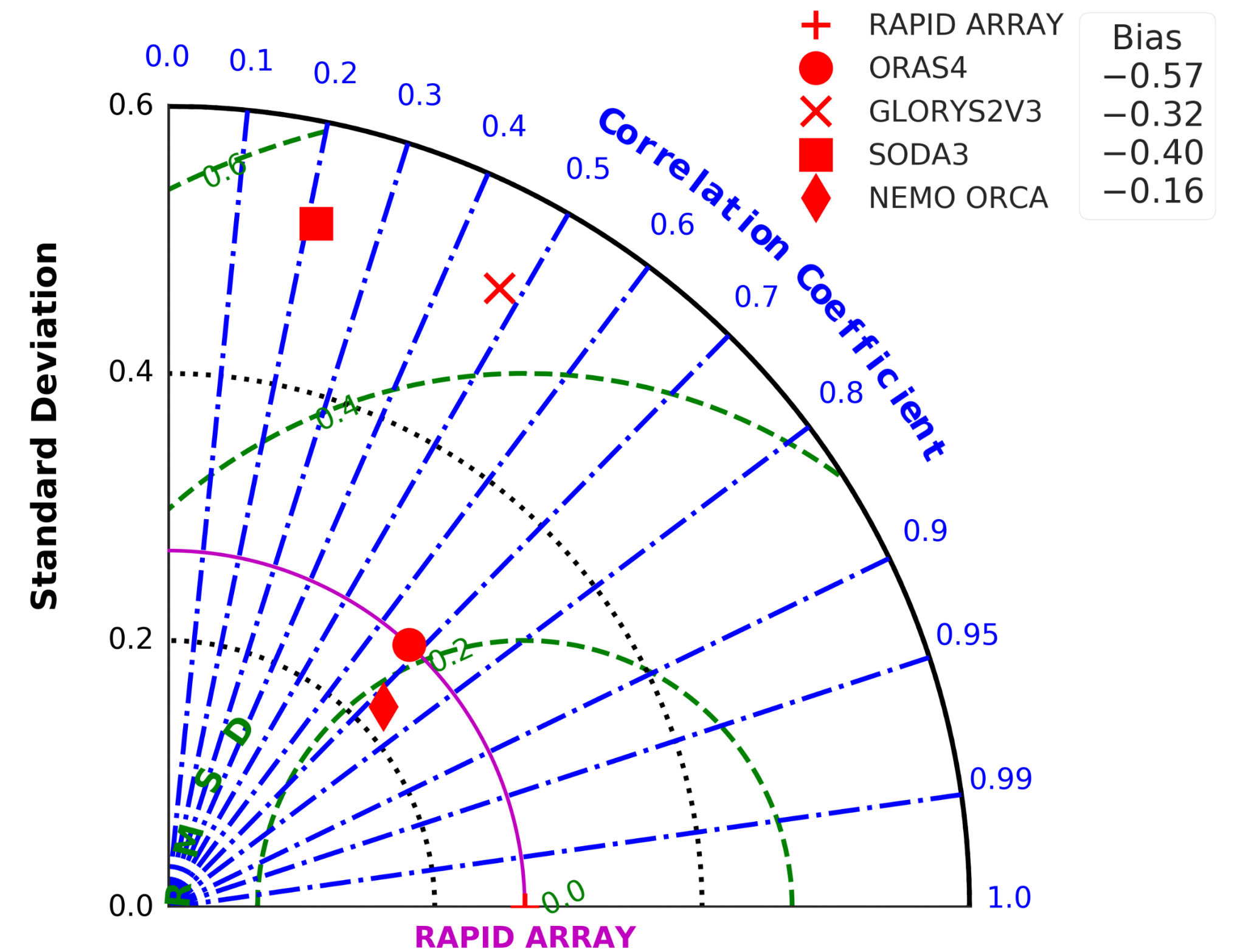
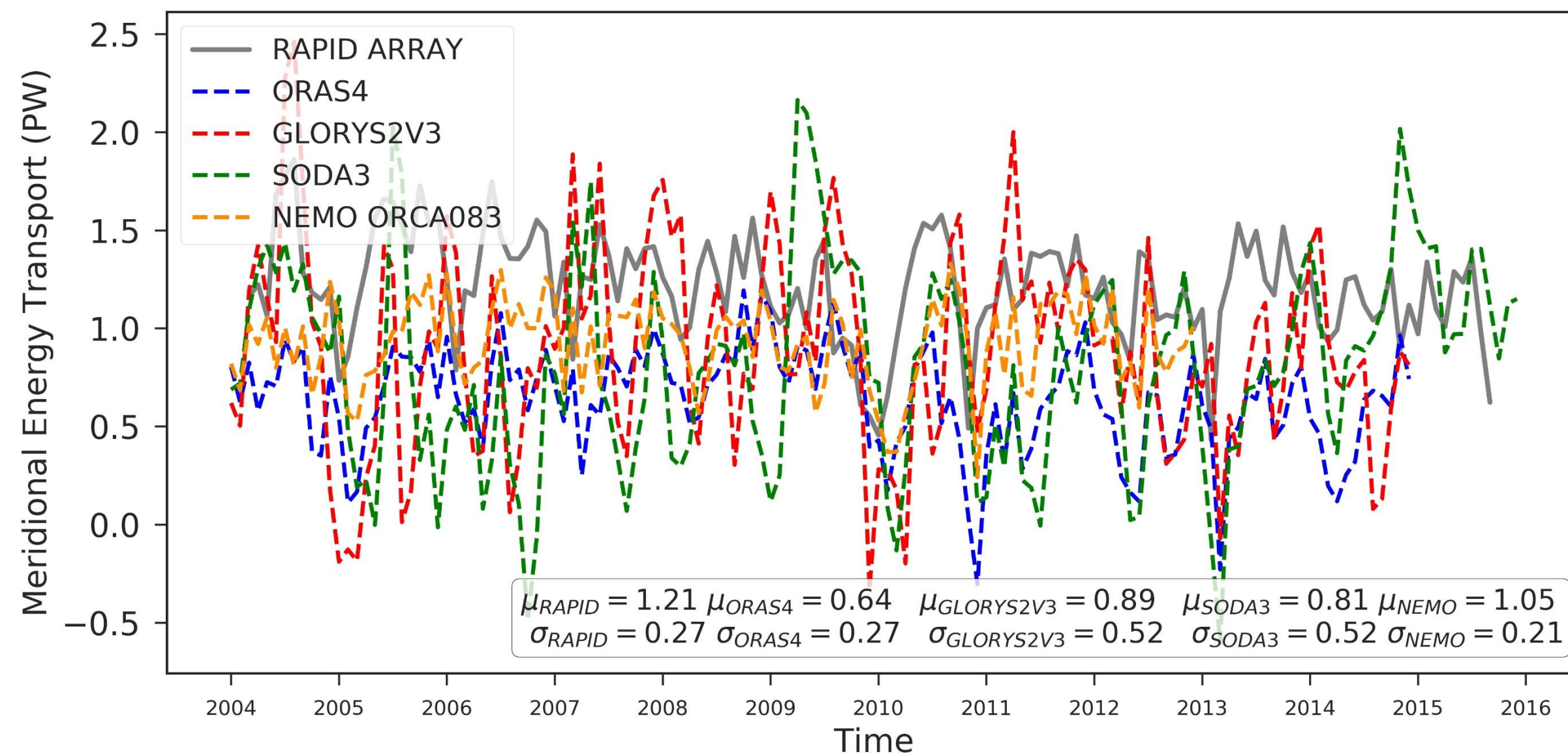
- Atmospheric Meridional Energy Transport
 - AMET time series at 60N
 - AMET Anomaly at 60N
 - Low-pass filter (5 yr)



- Oceanic Meridional Energy Transport
 - OMET time series at 60N
 - OMET Anomaly at 60N
 - Low-pass filter (5 yr)

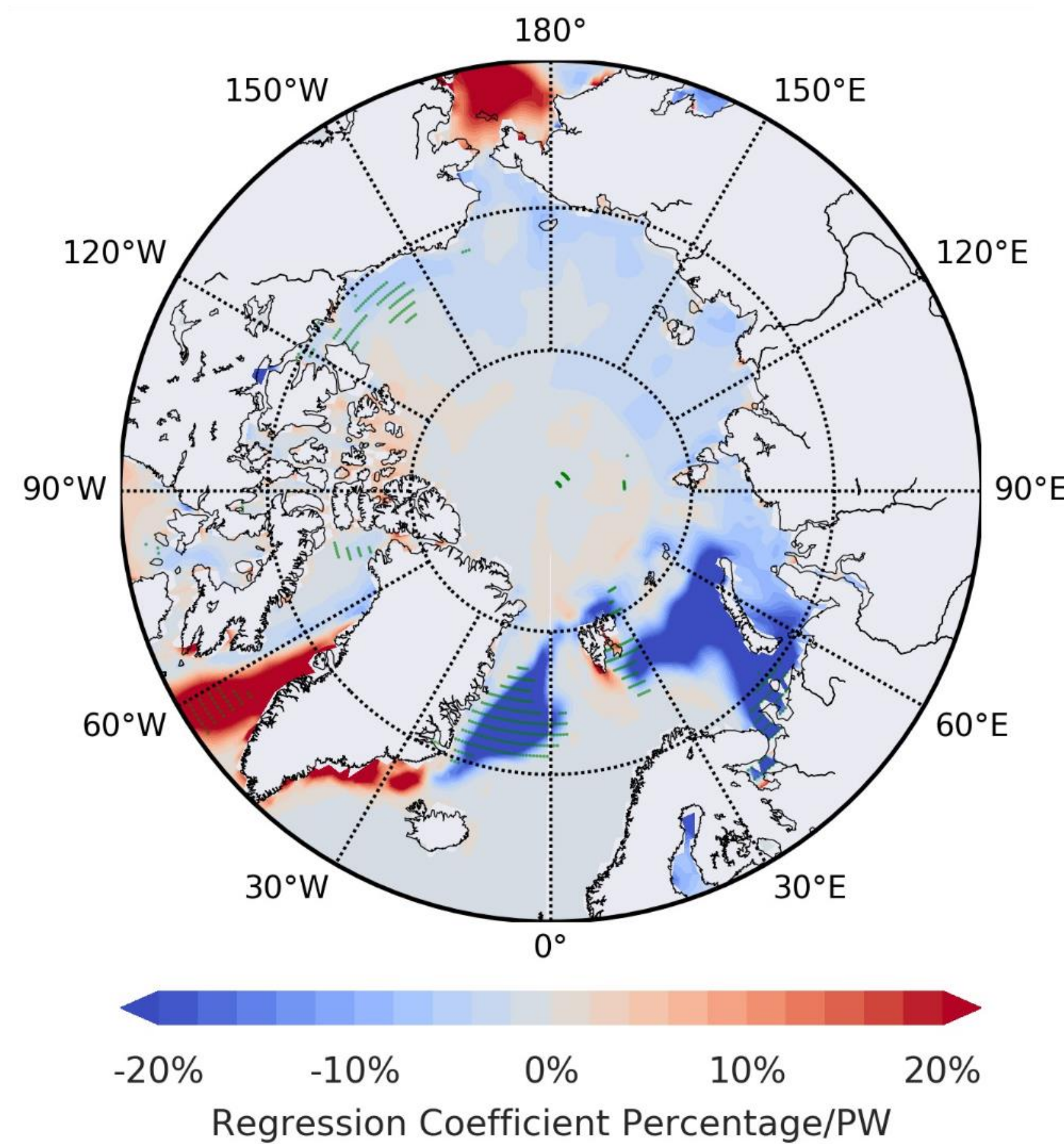


- Observation of OMET from RAPID ARRAY
- OMET at 26N

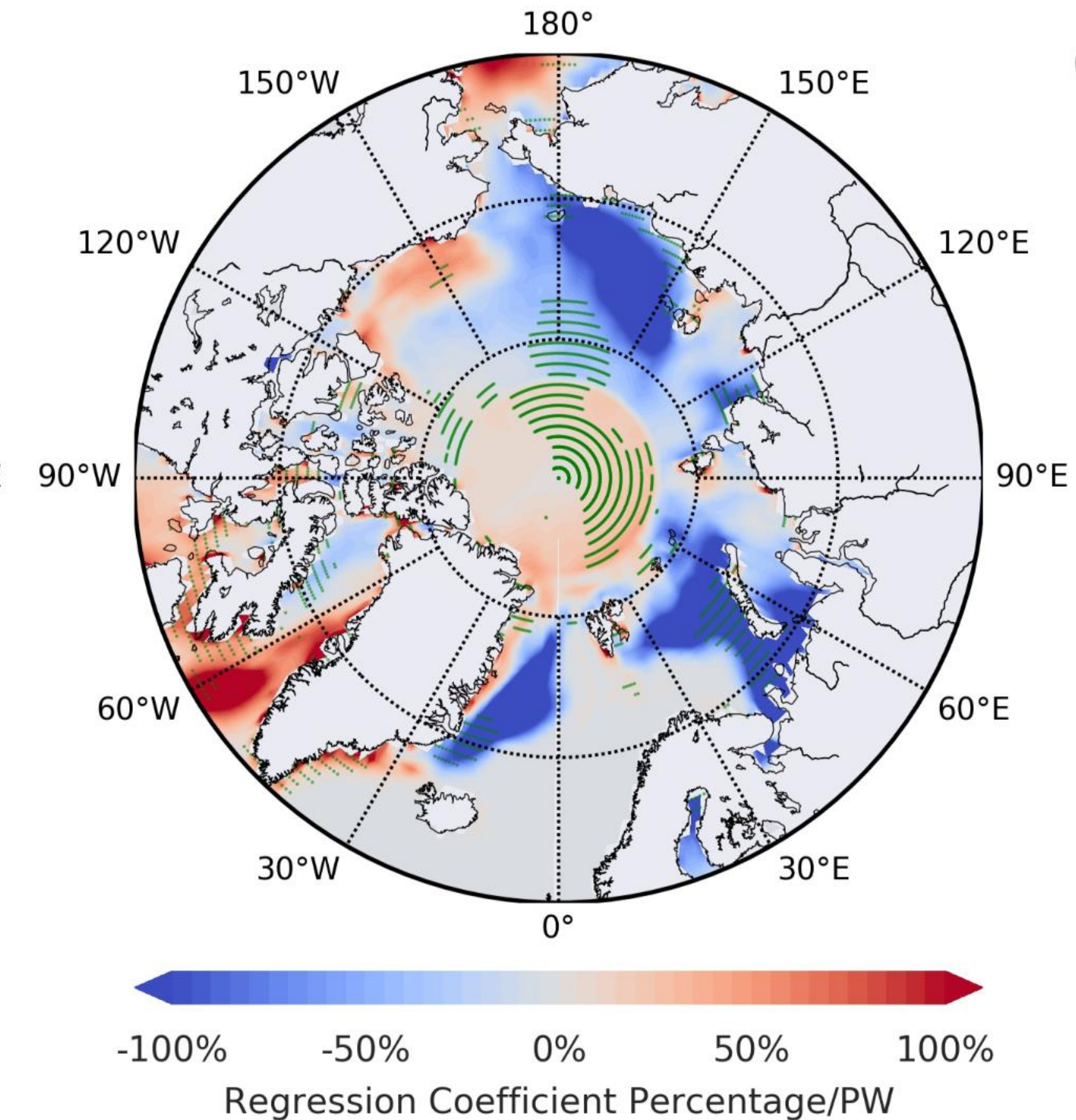


- Regression of SIC on AMET / OMET
 - Decadal
 - Detrend

ERA-Interim




ORAS4



- The mean energy transports in all the selected reanalysis agree well.
- However, the meridional energy transport from reanalysis are not well constrained in terms of the temporal variation. Be careful!
- Meridional energy transport has large impact on the Arctic sea ice.

Thanks and questions!

 +31 (0)20 460 4770

 info@esciencecenter.nl

 www.esciencecenter.nl

 blog.esciencecenter.nl

 [eScienceCenter](https://twitter.com/eScienceCenter)

 [eScienceCenter](https://www.youtube.com/eScienceCenter)

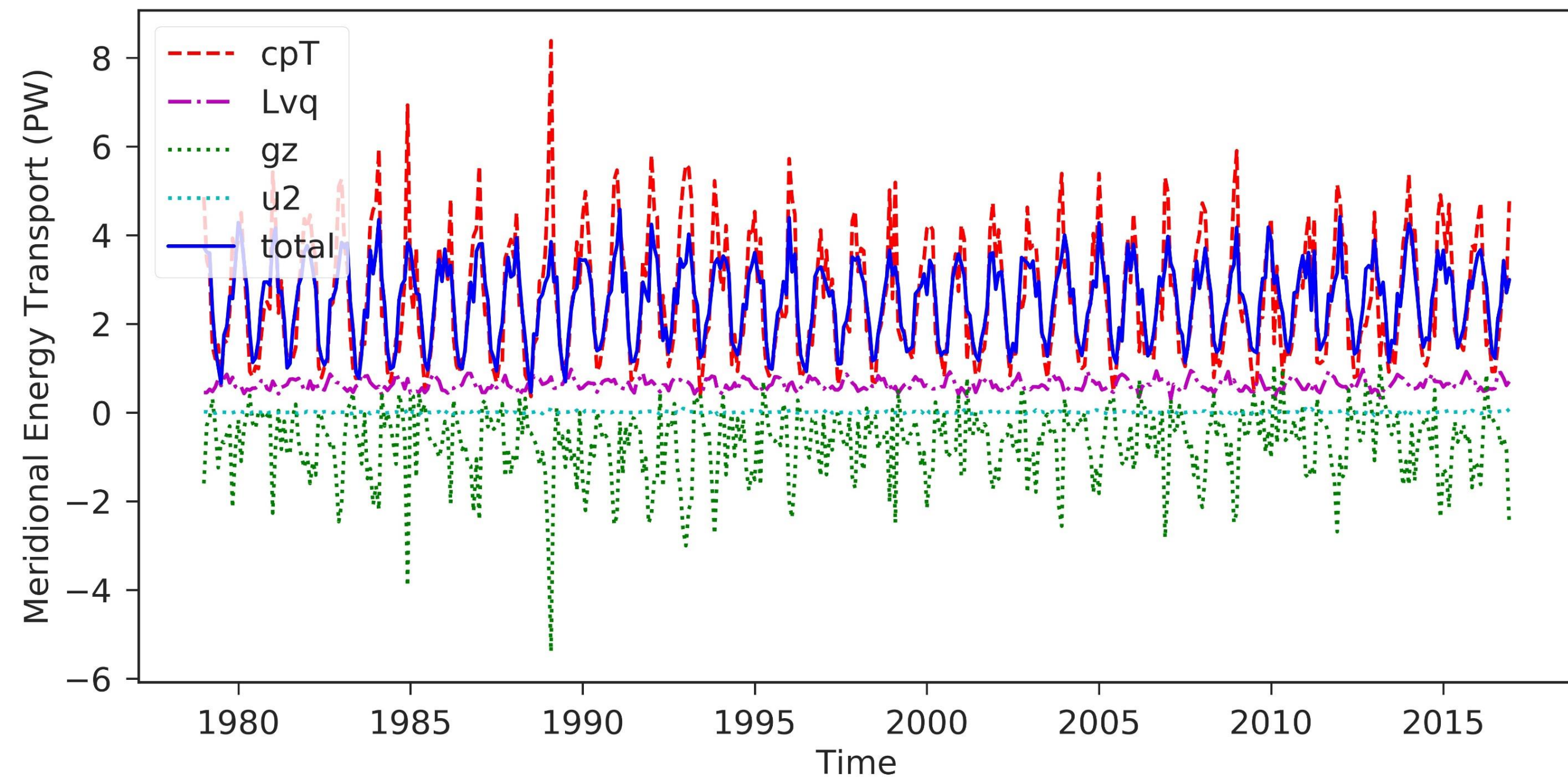
 [linkd.in/1j2uS8S](https://www.linkedin.com/company/eScienceCenter)

- Questions

Backup Slides

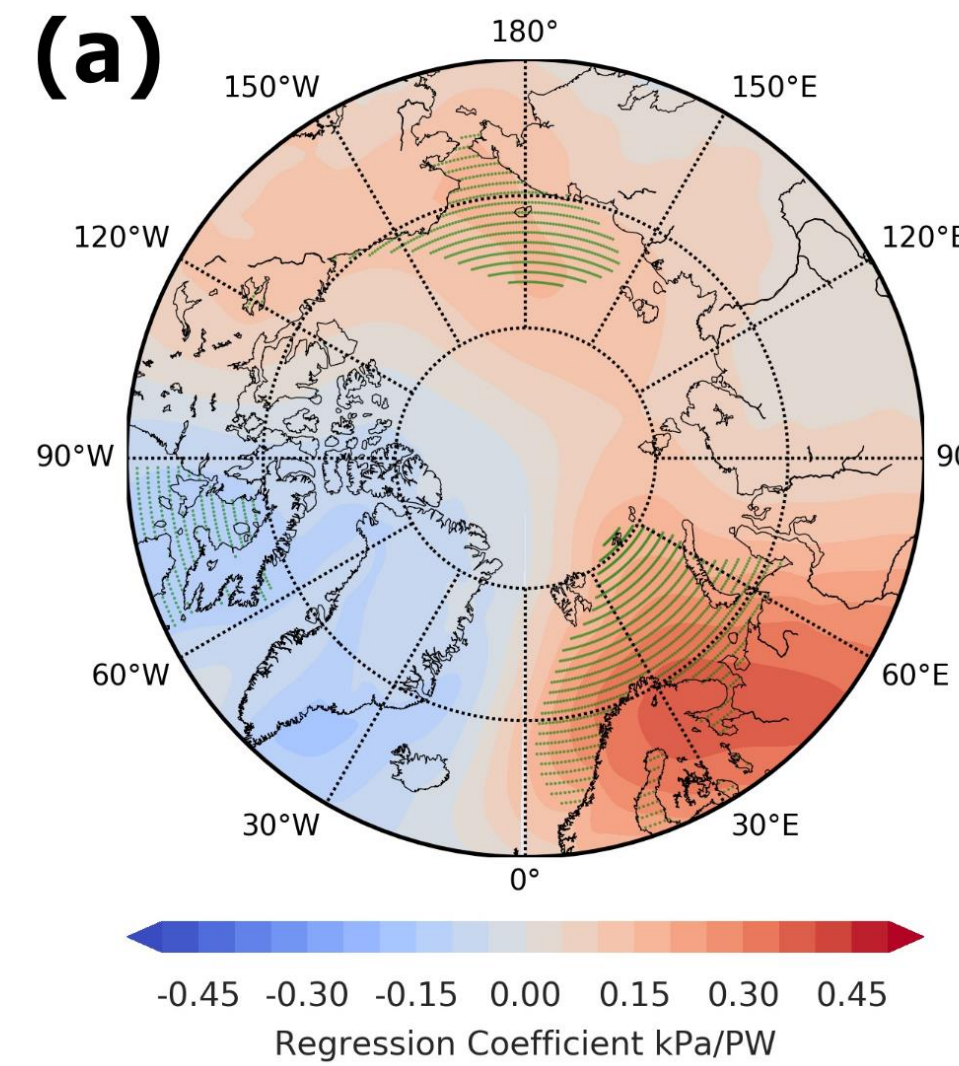


- Meridional Energy Transport
 - Atmosphere (ERA-Interim)
 - Time series at 60N

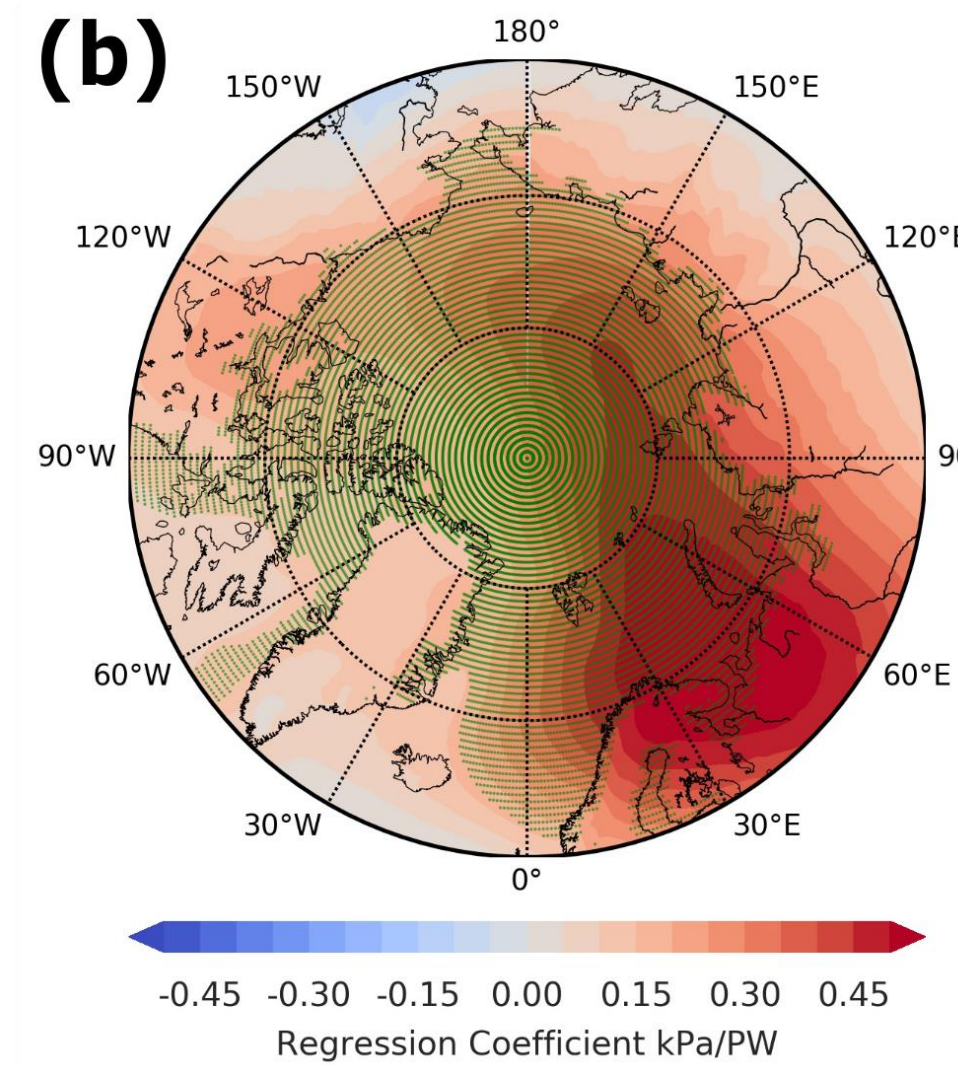


• Regression of SIC & SLP on AMET

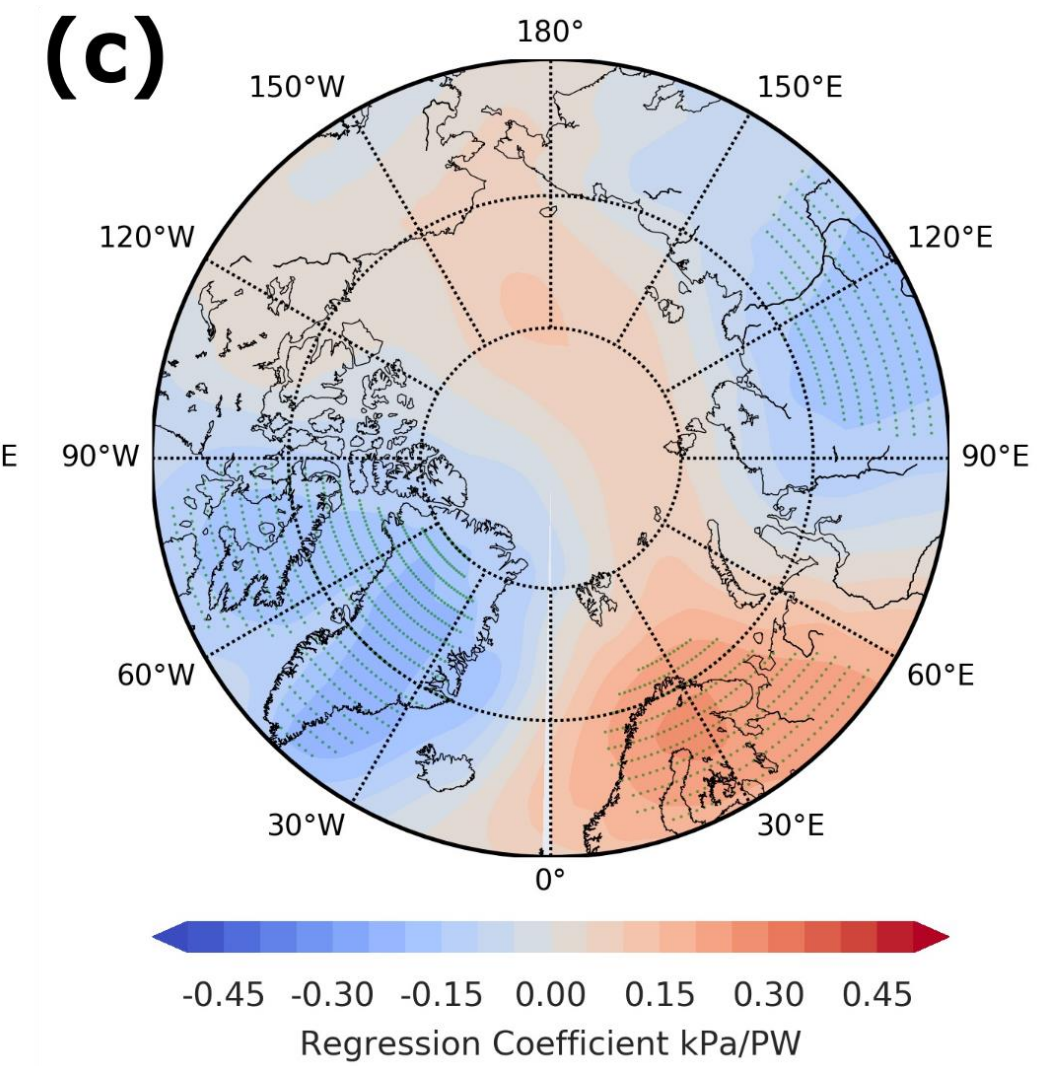
- Decadal
- Detrend
- Winter only



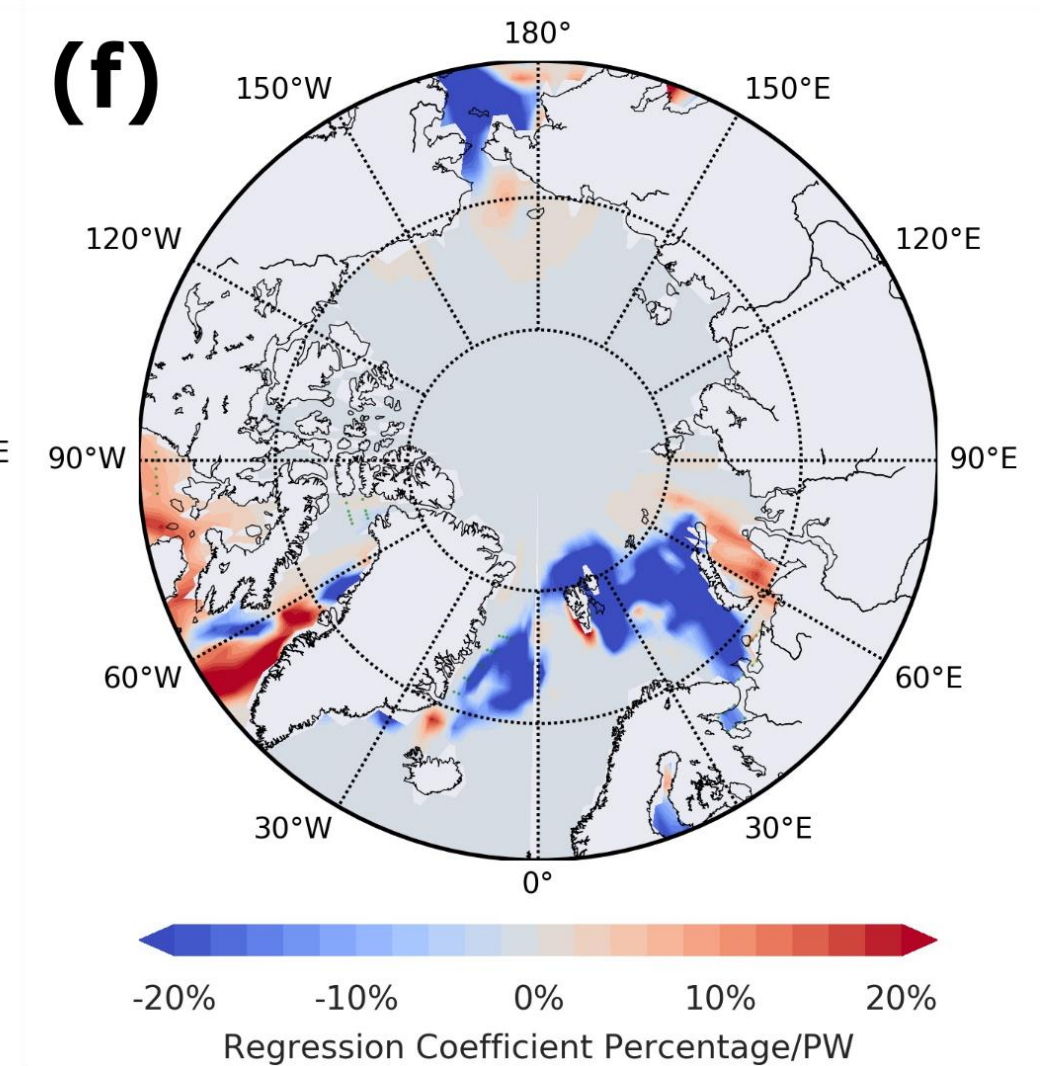
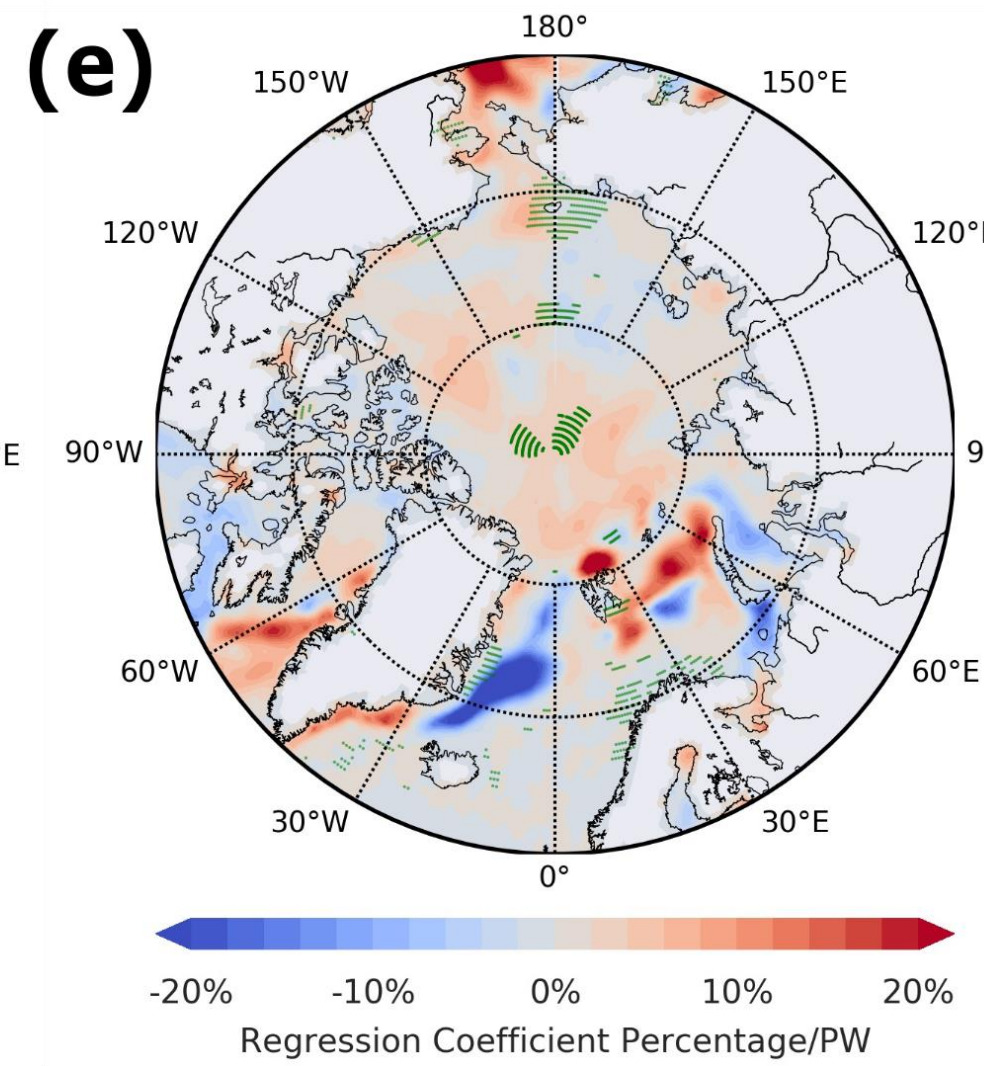
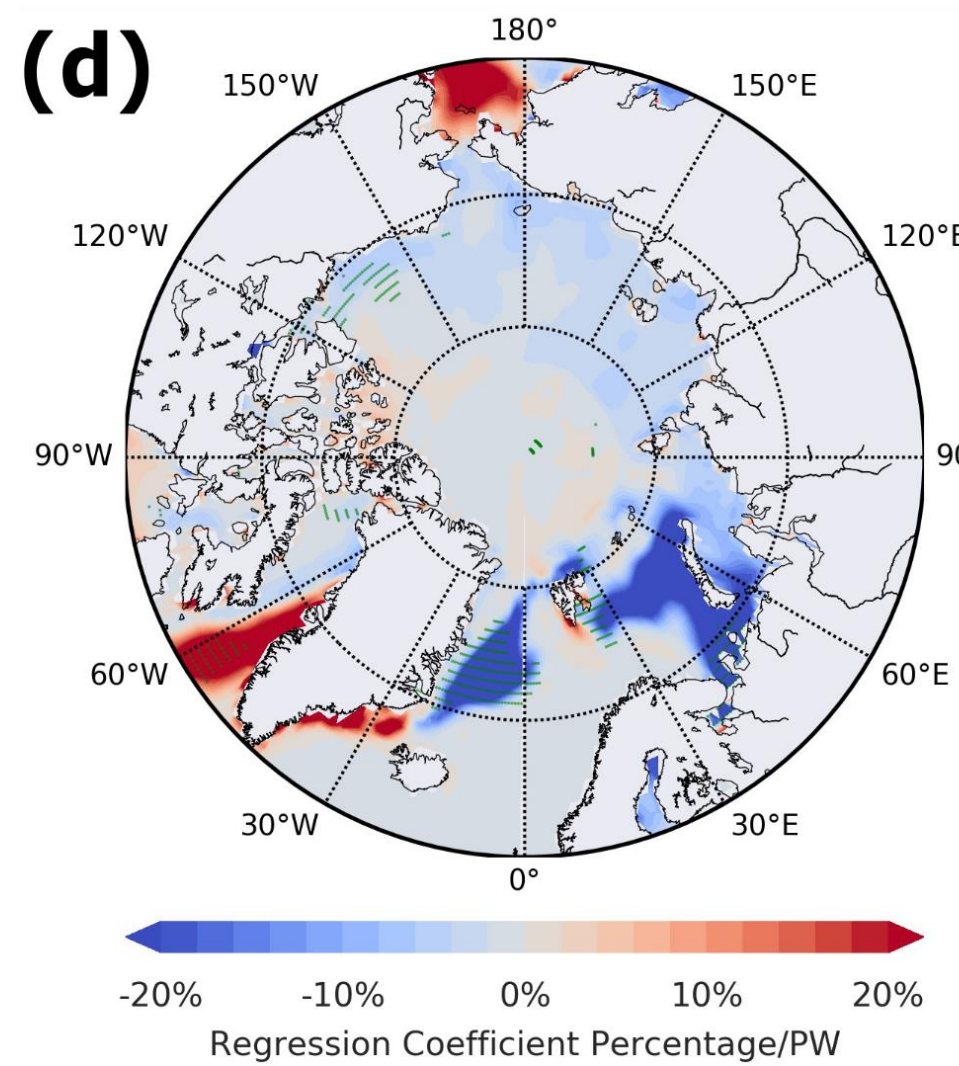
ERA-Interim



MERRA2

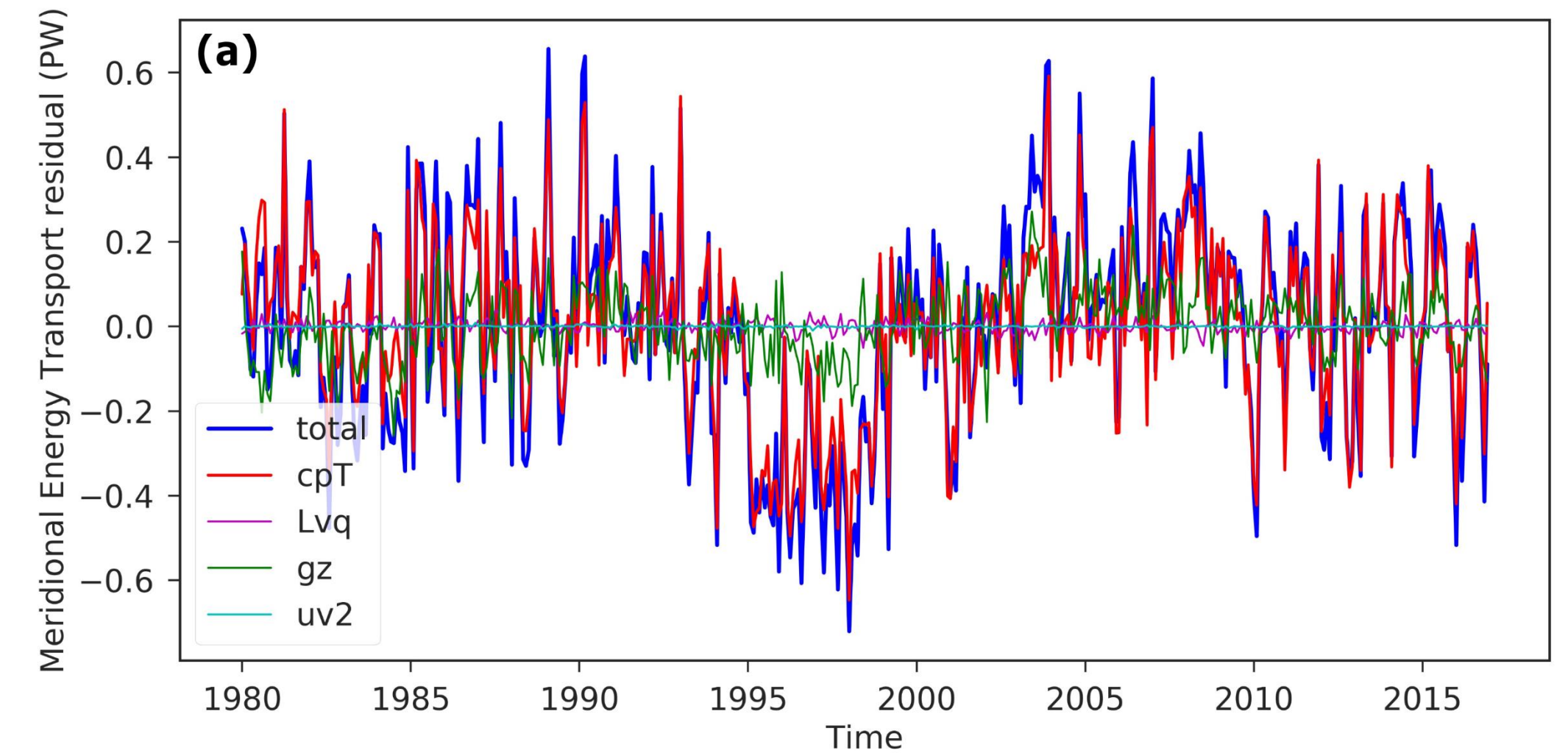


JRA55



- Meridional Energy Transport
- Difference from each
component

ERA-Interim - MERRA2



ERA-Interim - JRA55

