Recent Changes in Persistence over Europe and the World in Reanalysis Dataset

Mehmet Sedat Gözlet[1,2]
Joakim Kjellsson[1,2]
Abhishek Savita[1]
Mojib Latif[1,2]

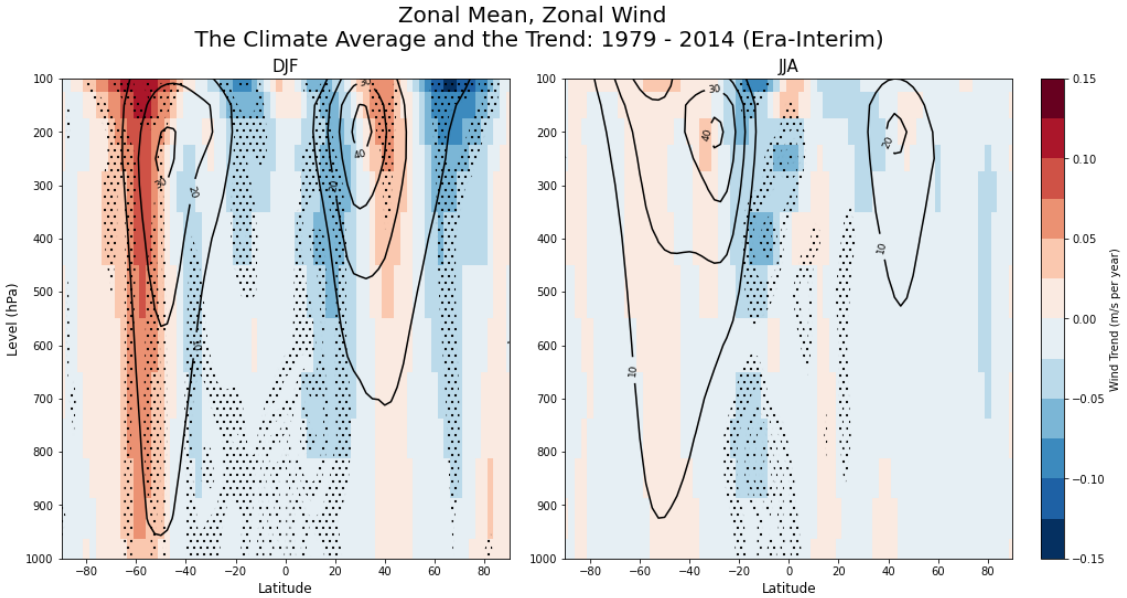
[1]GEOMAR Kiel, Germany, [2]Christian-Albrechts-Universität zu Kiel

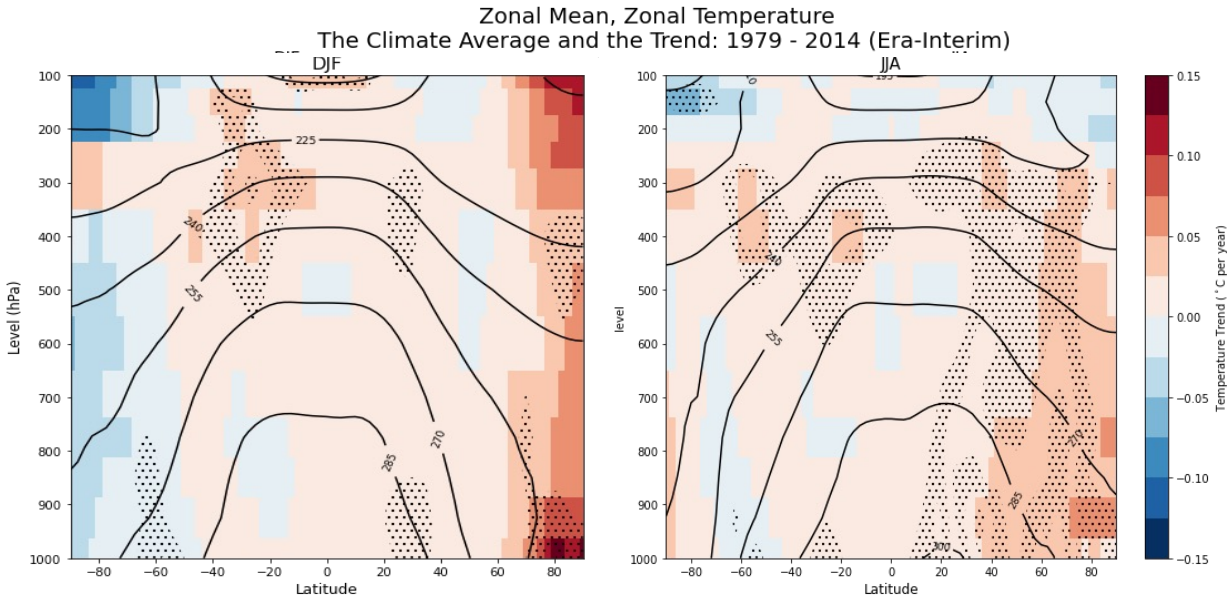
HELMHOLTZ
RESEARCH FOR GRAND CHALLENGES

GEOMAR

(mgozlet@geomar.de & gozletsedat@gmail.com)

Zonal Wind and Temperature Trend





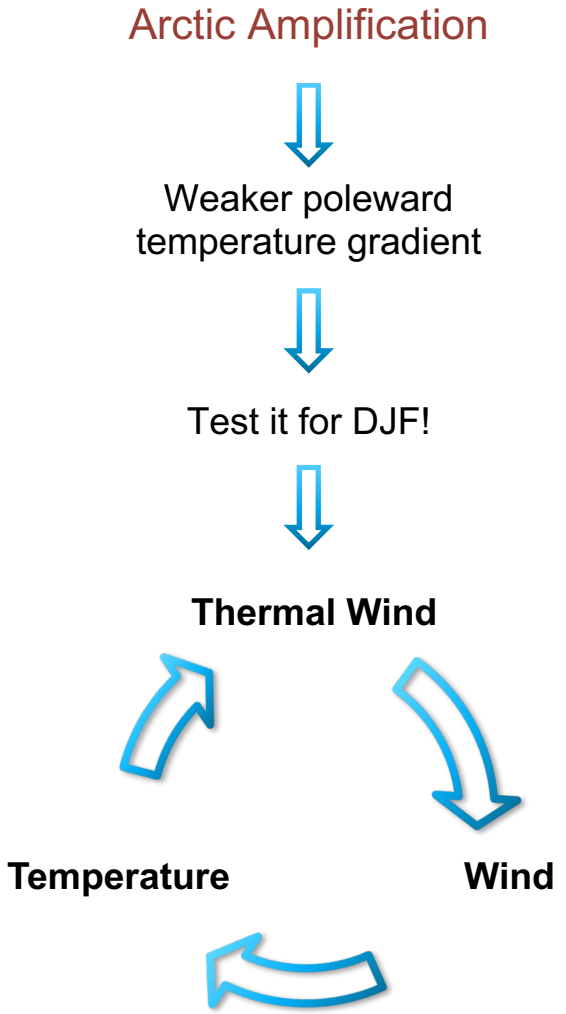
Data & Methodology

The Research Origin

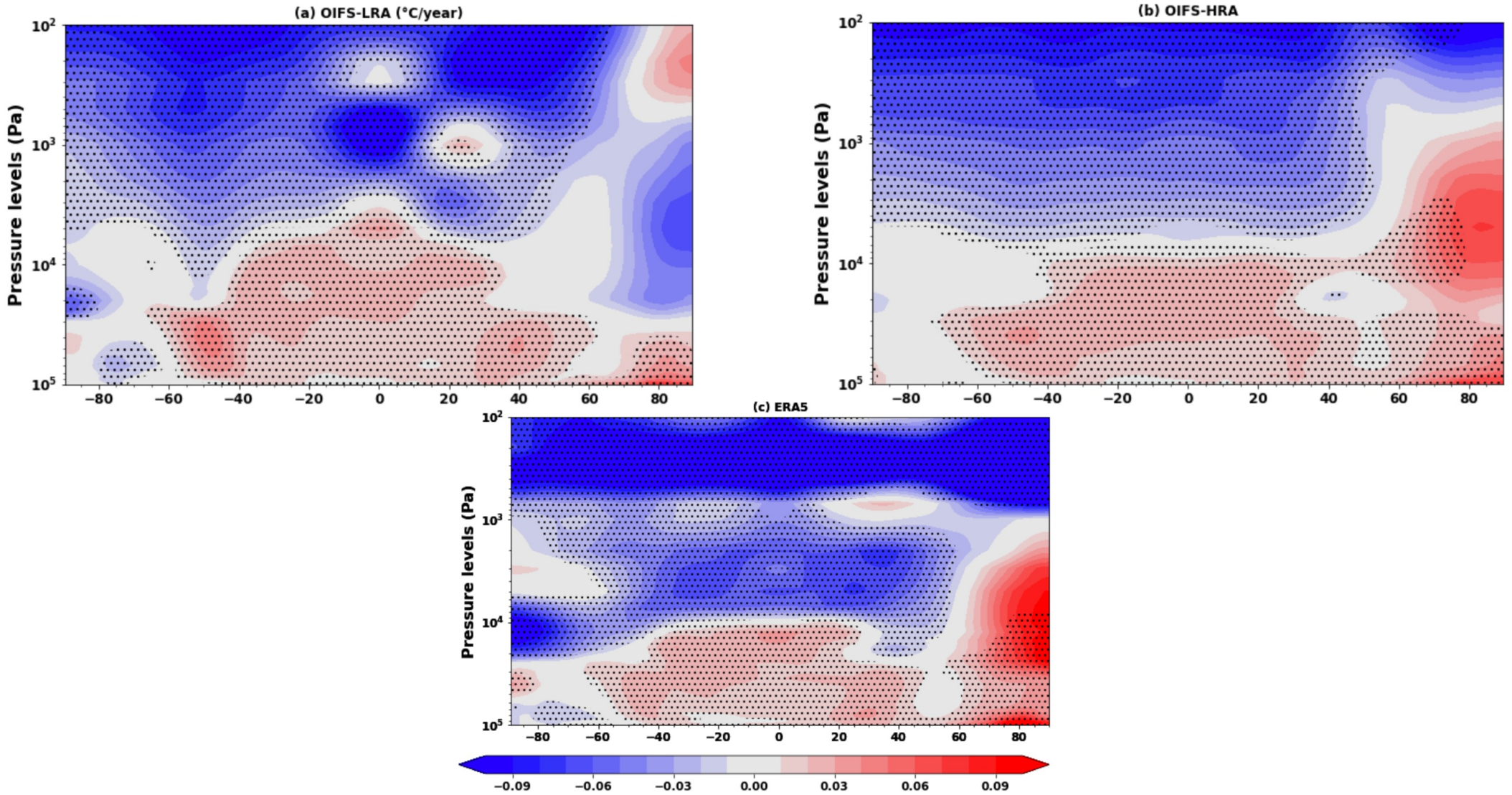
- Arctic Amplification
- The ‘weaker poleward temperature gradient’

DATA

- Observation: ERA5
- Models(AMIP):
  - OIFS-LR: 100 km
  - OIFS-HR: 25 km
- Period: 1979 - 2018



Preliminary result : temperature trend



Preliminary results : thermal wind bias for DJF

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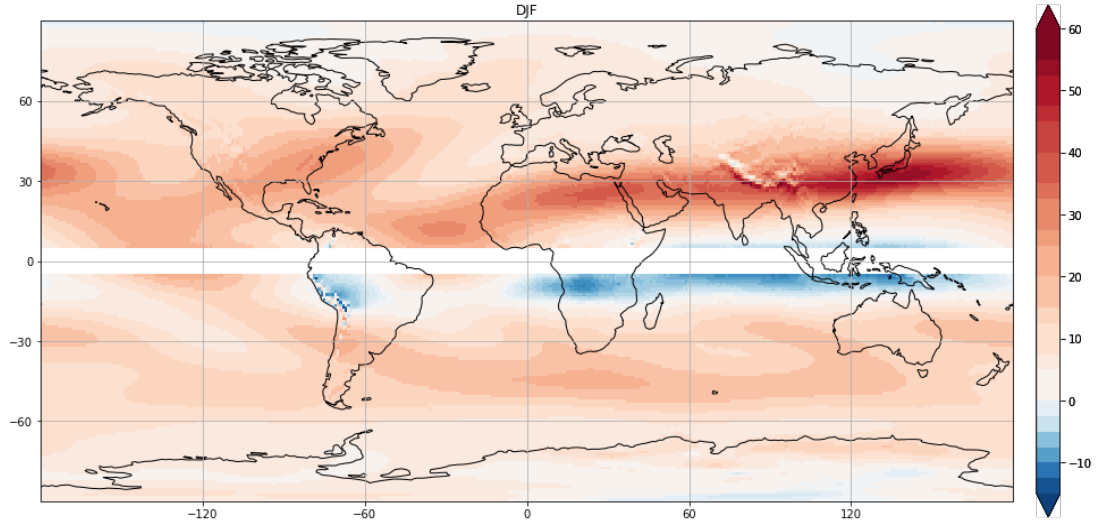
ERA5, Annual Mean

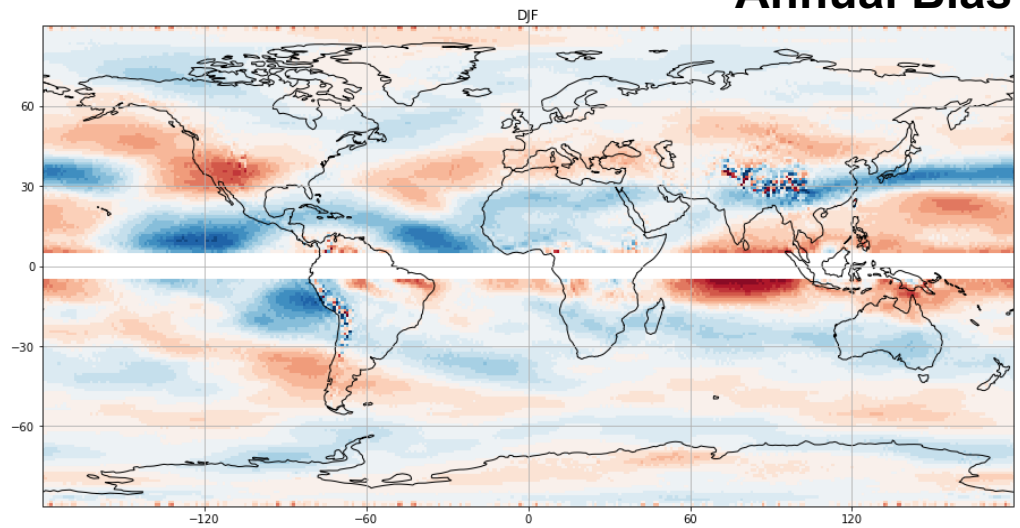


- Both of the models **underestimate** the hotspot, **overestimates** cold spot.
- Low resolution model has wavy structure/noise

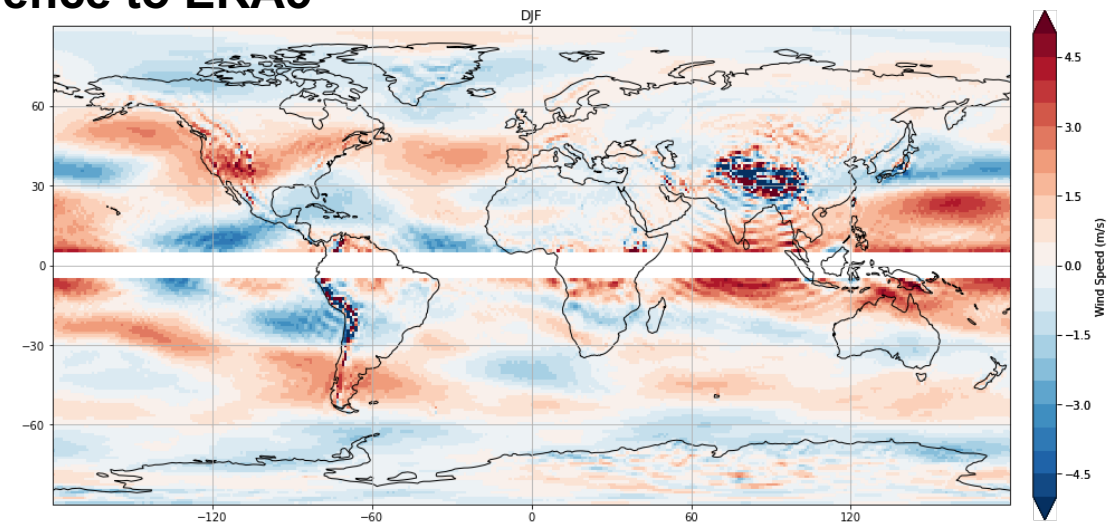
$$\mathbf{V}_T \equiv \mathbf{V}_g(p_1) - \mathbf{V}_g(p_0) = -\frac{R}{f}\int_{p_0}^{p_1} \left(\mathbf{k} \times \boldsymbol{\nabla}_p T\right) d\ln p$$

Annual Bias reference to ERA5

OIFS-LR

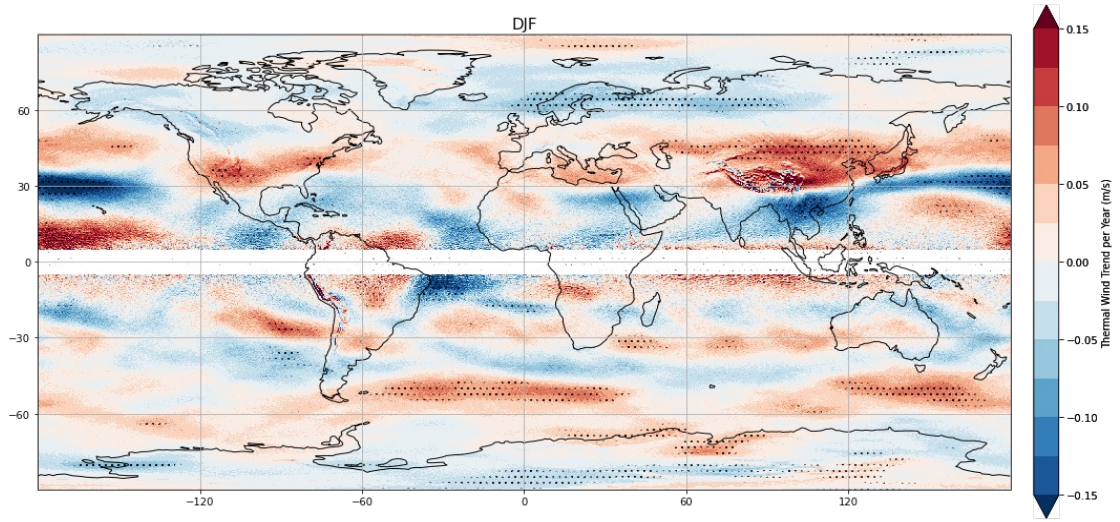


OIFS-HR



Preliminary results : thermal wind trend for DJF

ERA5, Trend

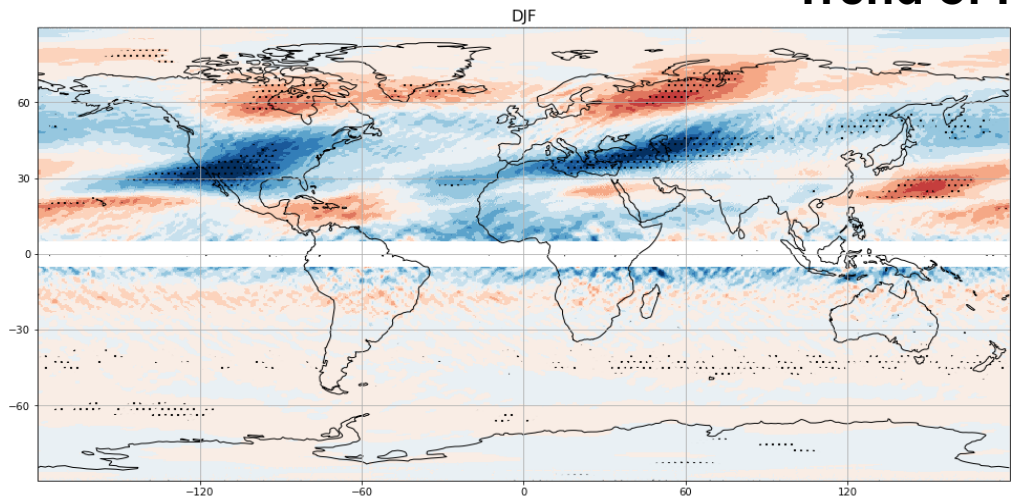


- The models miss the trends and yield different results

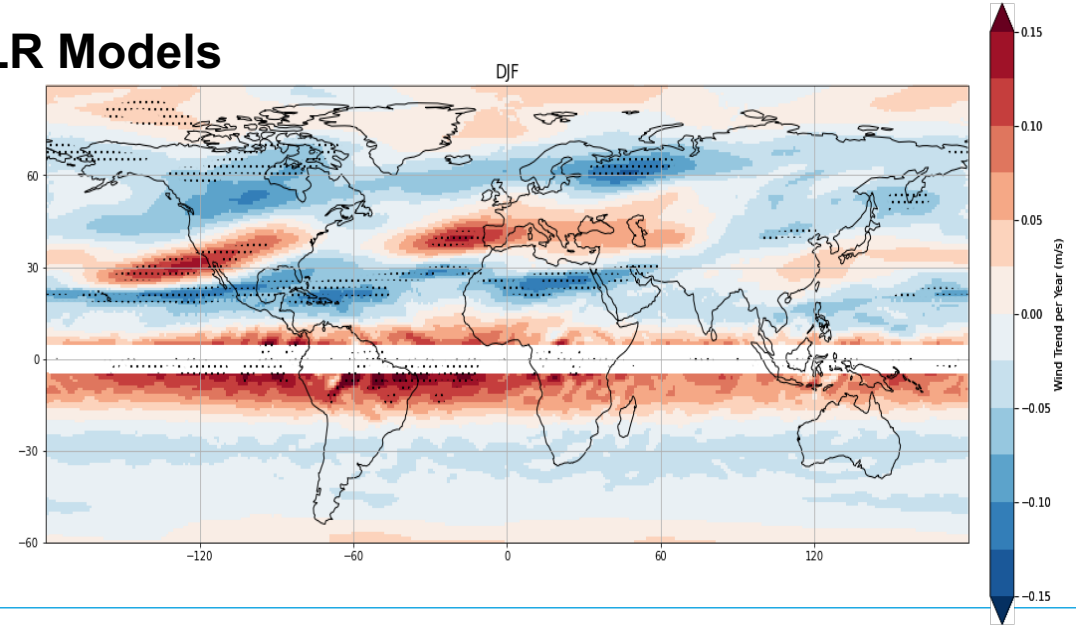
$$\mathbf{V}_T \equiv \mathbf{V}_g(p_1) - \mathbf{V}_g(p_0) = -\frac{R}{f}\int_{p_0}^{p_1} \left(\mathbf{k} \times \boldsymbol{\nabla}_p T\right) d\ln p$$

Trend of HR & LR Models

OIFS-LR

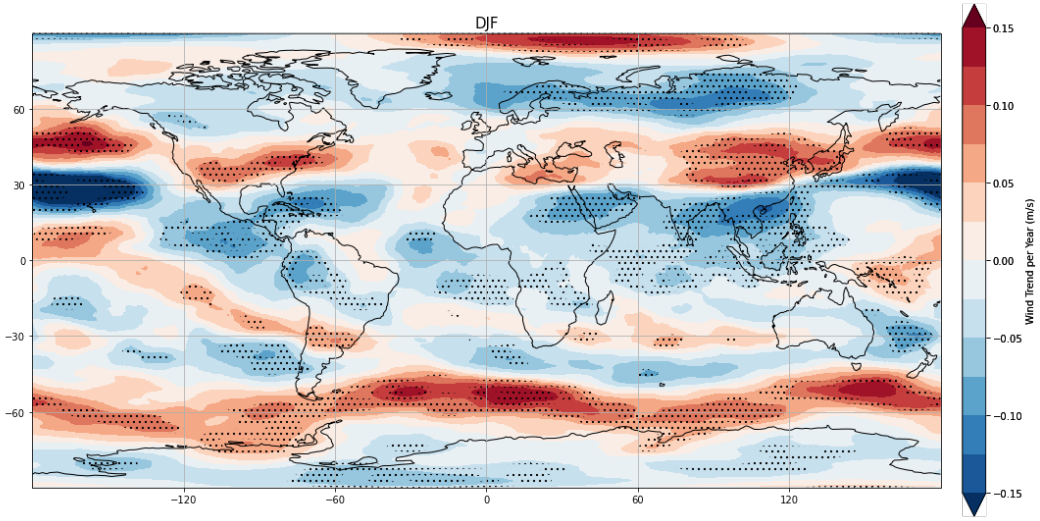


OIFS-HR



Preliminary results : wind trend for DJF

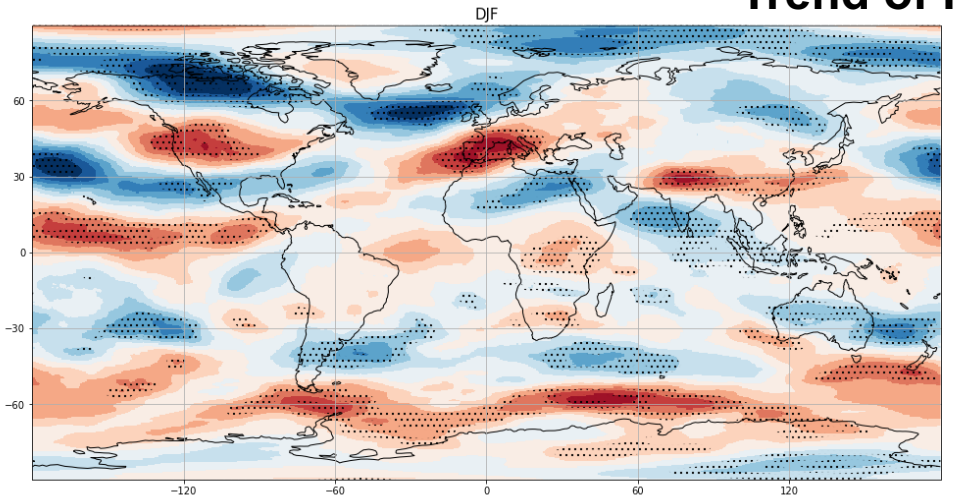
ERA5, Trend



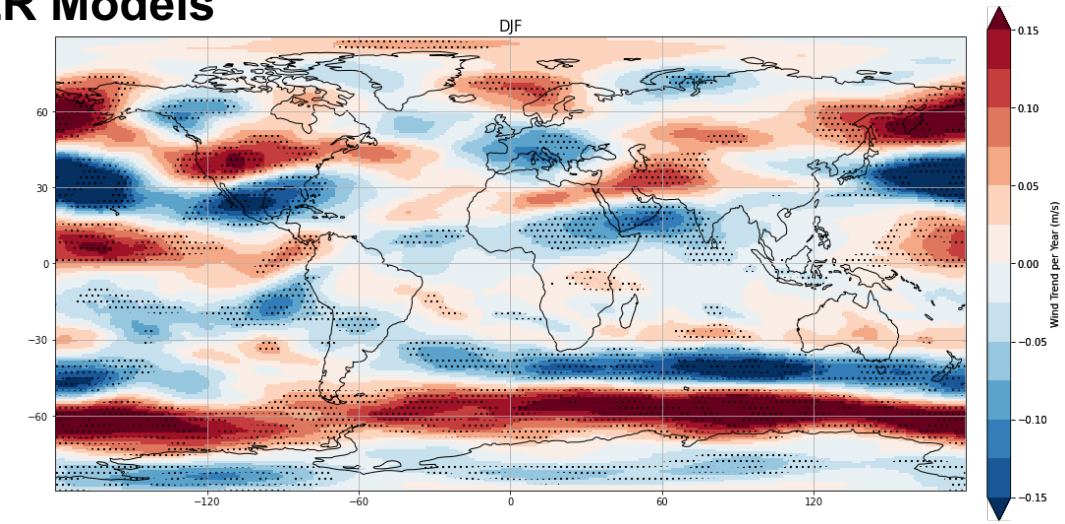
- HR model results are **compatible** with ERA5
- HR and LR models yields different results for the Arctic

Trend of HR & LR Models

OIFS-LR

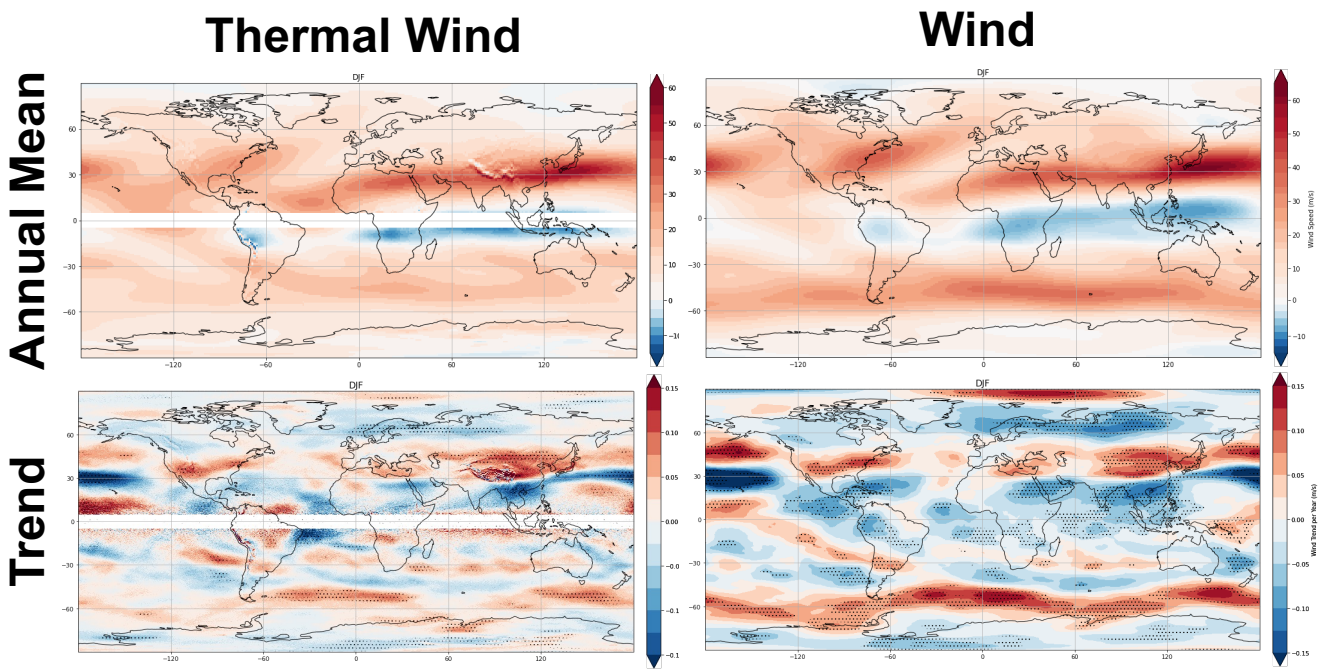


OIFS-HR

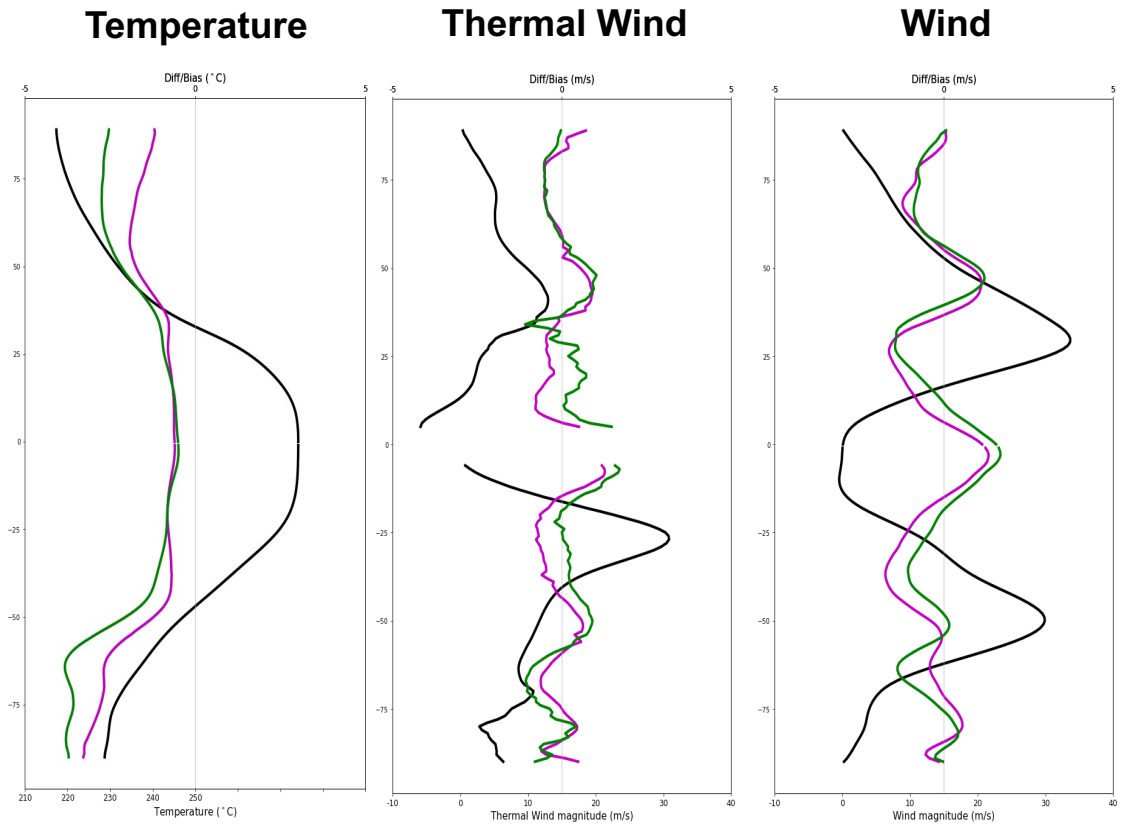


Conclusion

- The compliance of thermal wind and wind speeds at 300hPa is **satisfactory**!
- The response of the jet stream to changing temperature gradient is **in favor of shifting**.



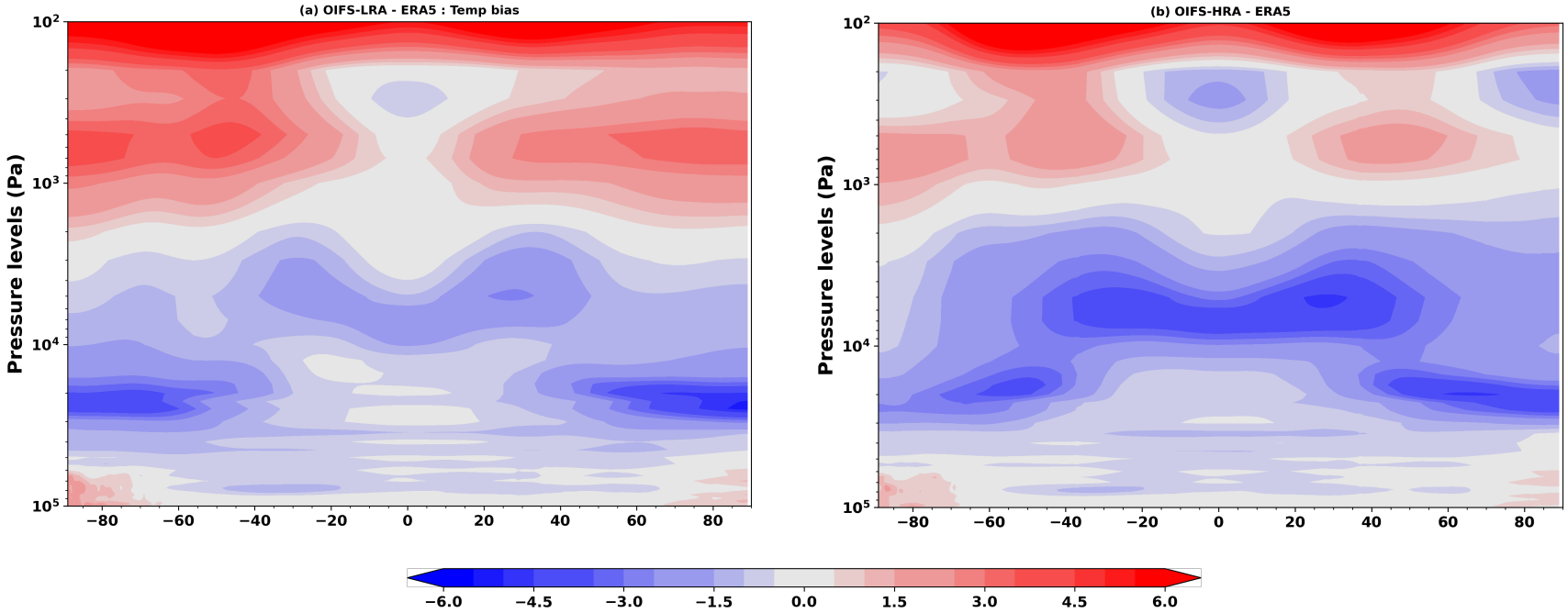
- There is **no significant** performance difference between models.



ERA5 **OIFS-HighResolution** **OIFS-LowResolution**

Backup Slides

Temperature Bias

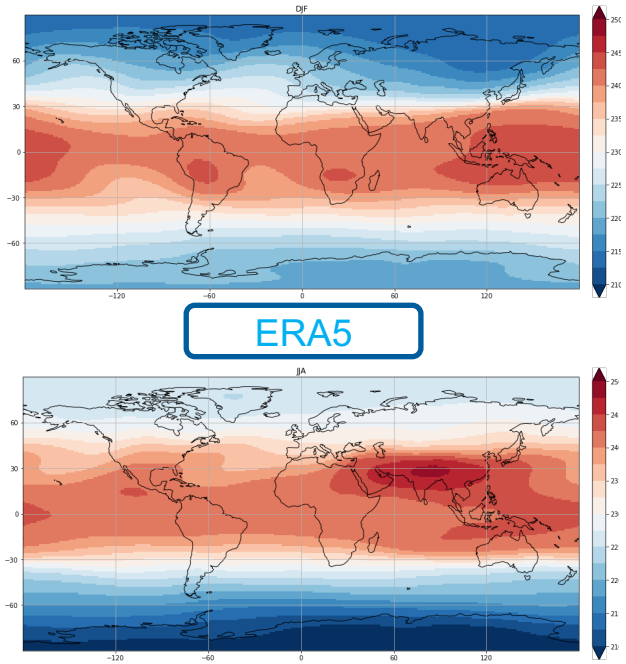


Backup Slides

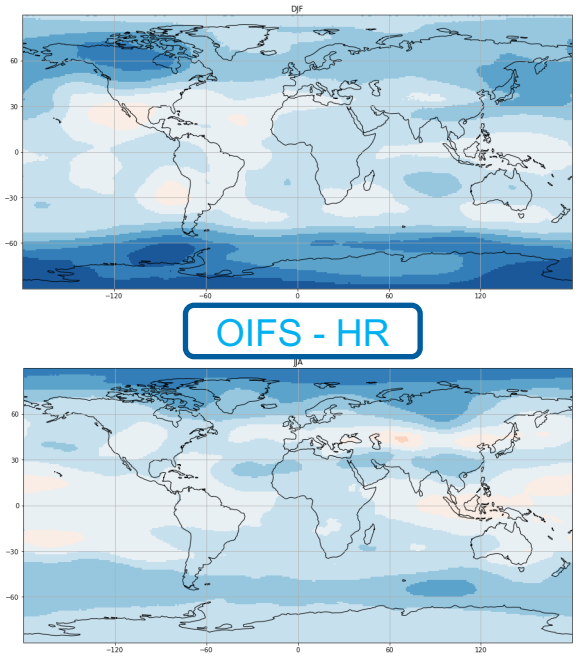
Temperature, Annual Mean

DJF

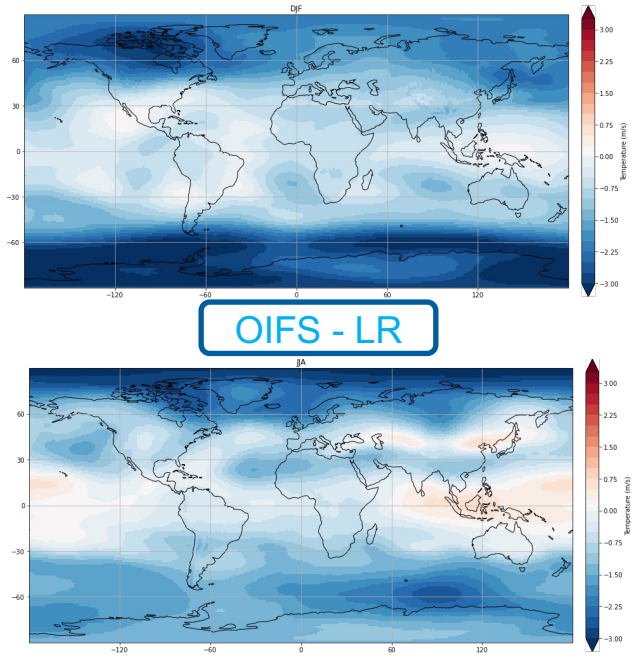
JJA



ERA5



OIFS - HR



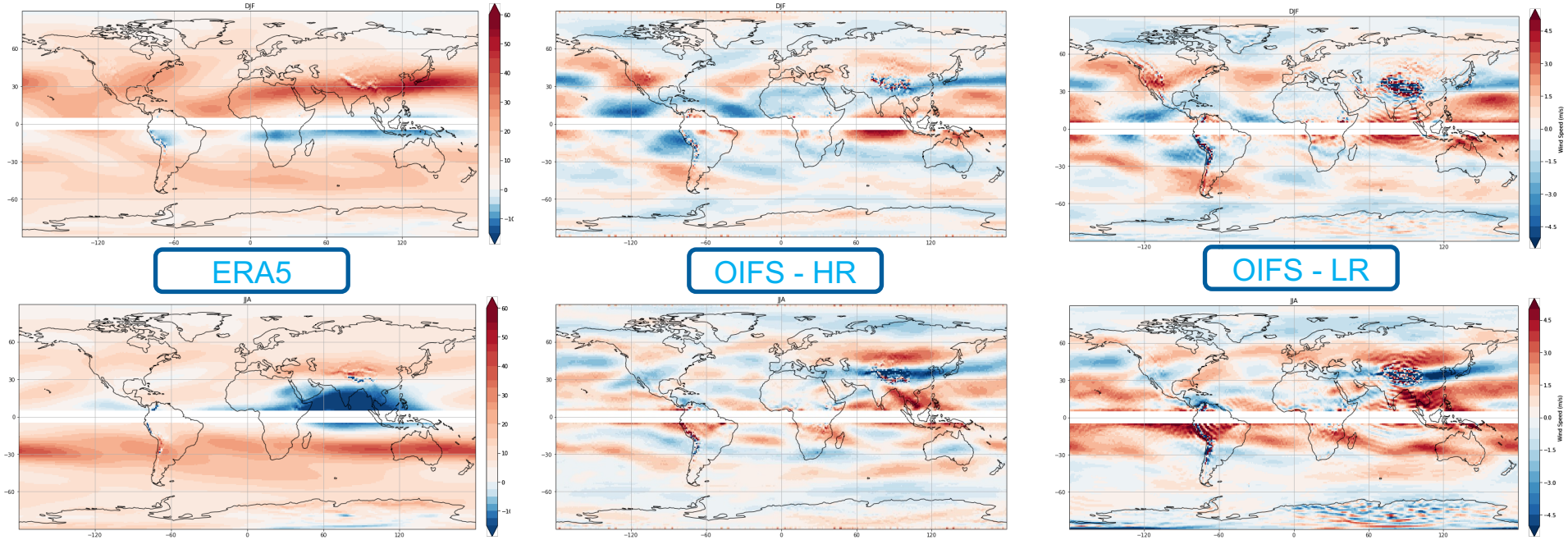
OIFS - LR

Backup Slides

Thermal Wind, Annual Mean

DJF

JJA



Backup Slides

Wind, Annual Mean

DJF

JJA