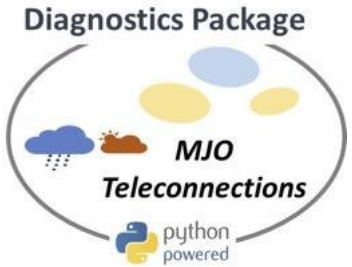
Diagnostics Package for MJO-Teleconnections

Cristiana Stan, Andrea Jenney, Daniela Domeisen, Hyemi Kim, Jiabao Wang, Zheng Wu, **Chaim Garfinkel**, Cheng Zheng



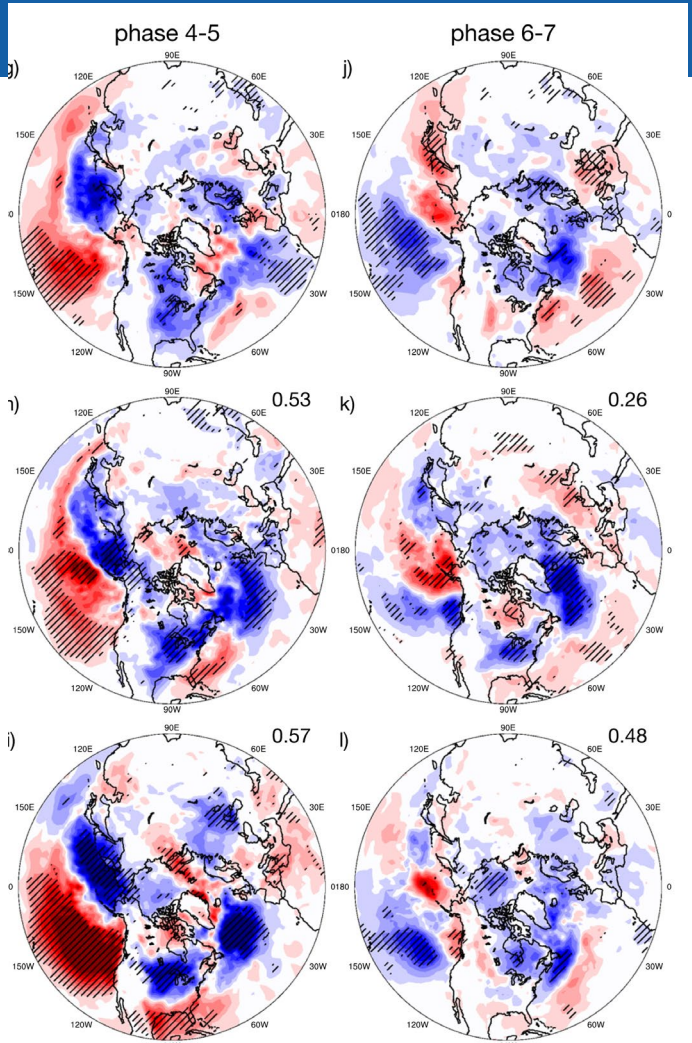
Importance of MJO teleconnections

EKE 850hPa
week 3-4

ERA-I

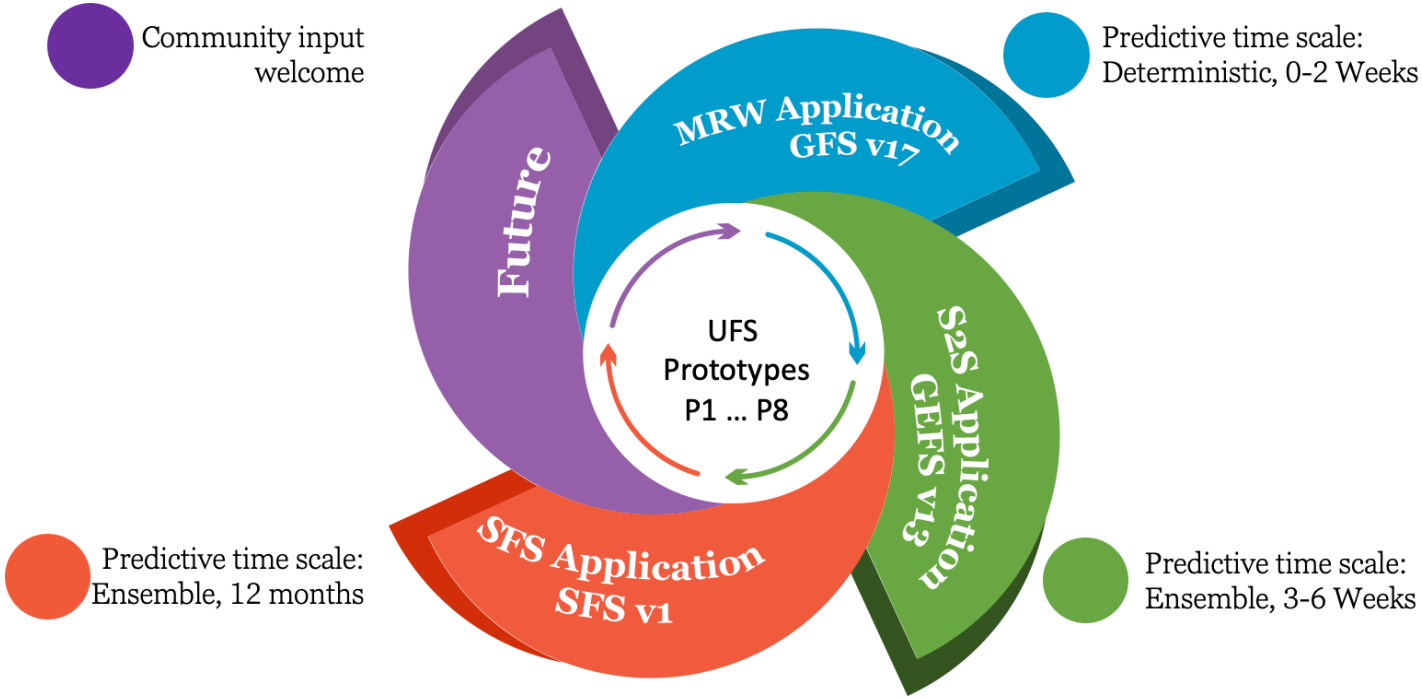
UFS5

UFS6



Zheng et al 2024

UFS Global Coupled Applications



Reforecast period	April, 2011 – March, 2018
Initial Conditions	1st and 15th of each month
Ensemble members	1
Reforecast length	35 days

UIFCW24
A UFS Collaboration Powered by EPIC

Importance of MJO teleconnections

EKE 850hPa
week 3-4

ERA-I

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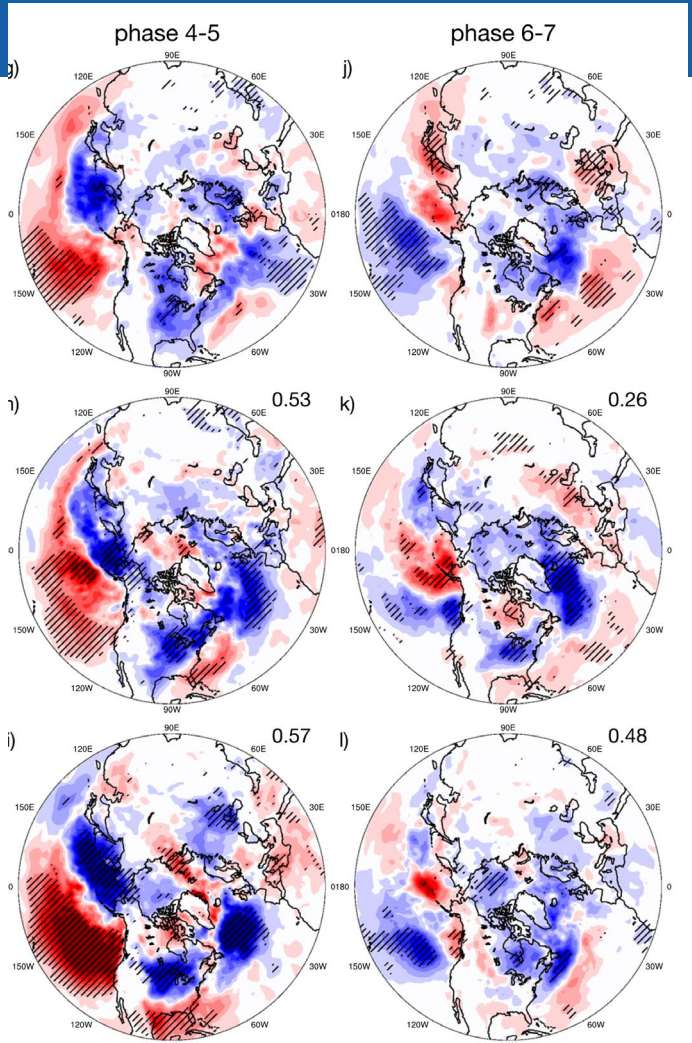
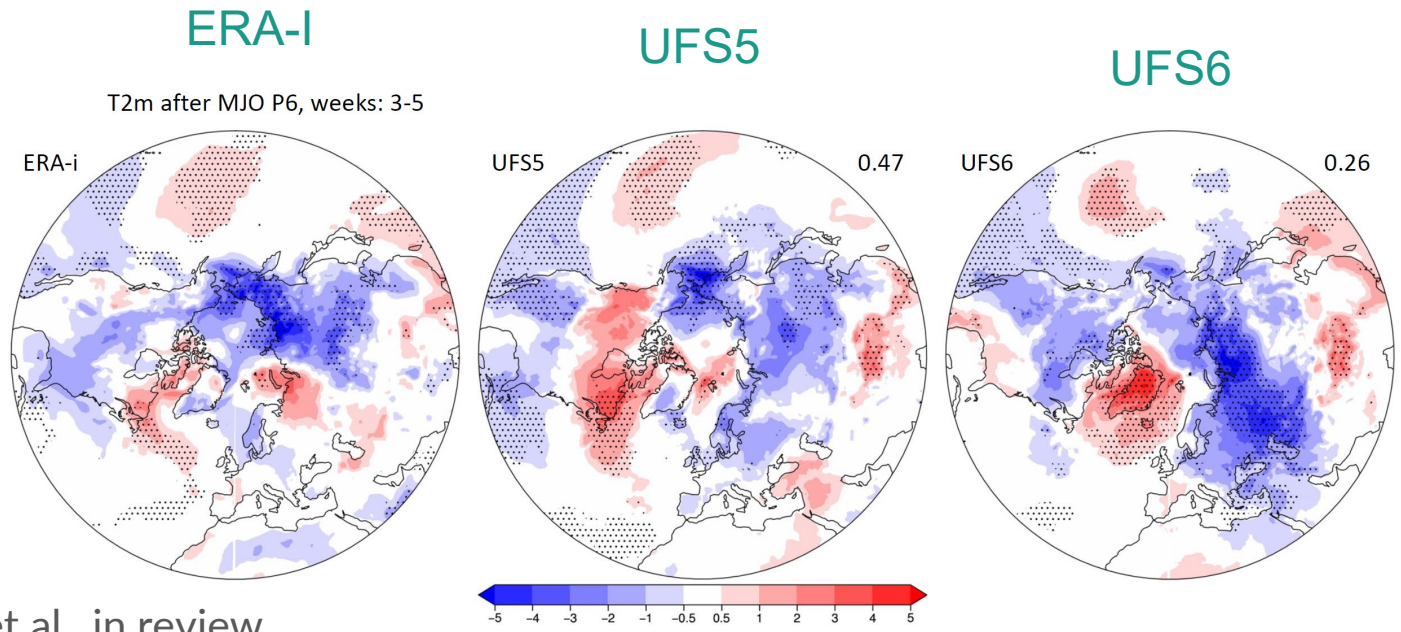


Zheng et al 2024

Importance of MJO teleconnections

T2m, week 3-5 MJO phase 6



Garfinkel et al., in review

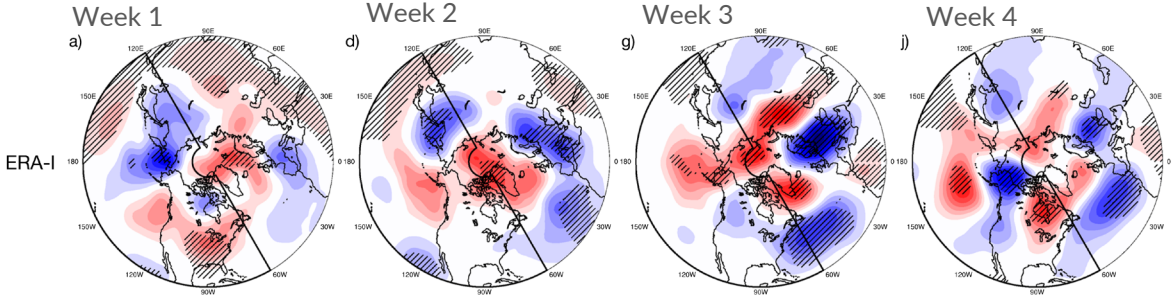
Importance of MJO teleconnections

Z500hPa, MJO phase 6-7

ERA-I

UFS5

UFS6



Zheng et al., 2024

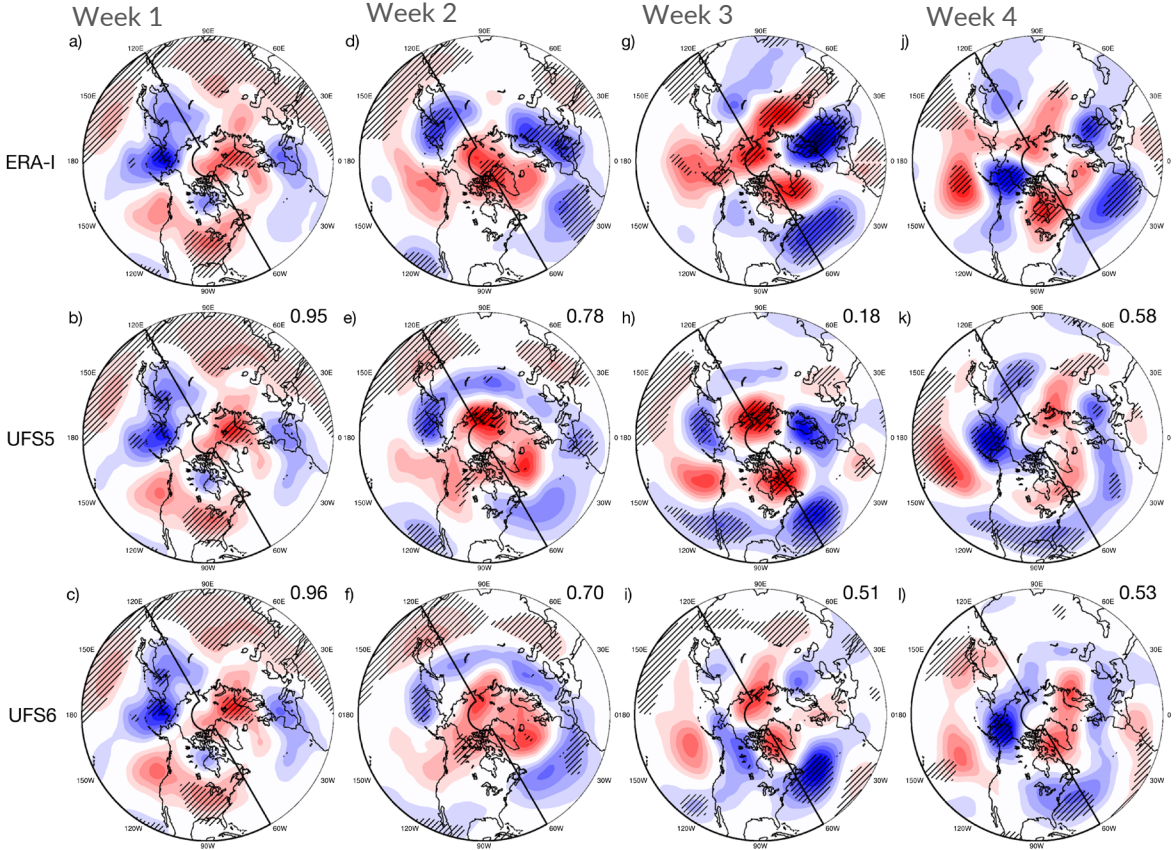
Importance of MJO teleconnections

Z500hPa, MJO phase 6-7

ERA-I

UFS5

UFS6



Zheng et al., 2024

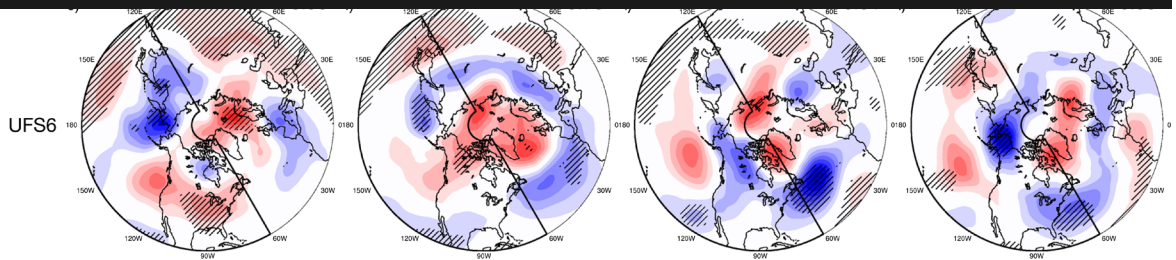
Importance of MJO teleconnections

Z50

Goal:

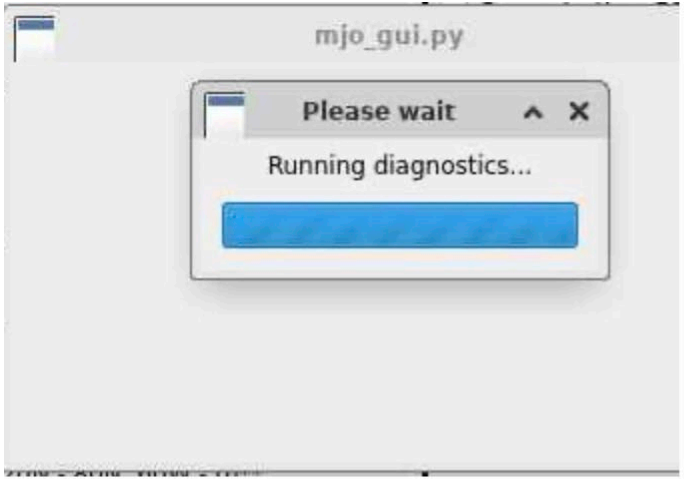
- A diagnostic package for evaluation of the MJO and MJO teleconnections.
- The package consists of a graphical user interface (GUI) and a collection of modular evaluation tools, all written in Python.
- The package can be applied to any forecast dataset prepared in the specified format.

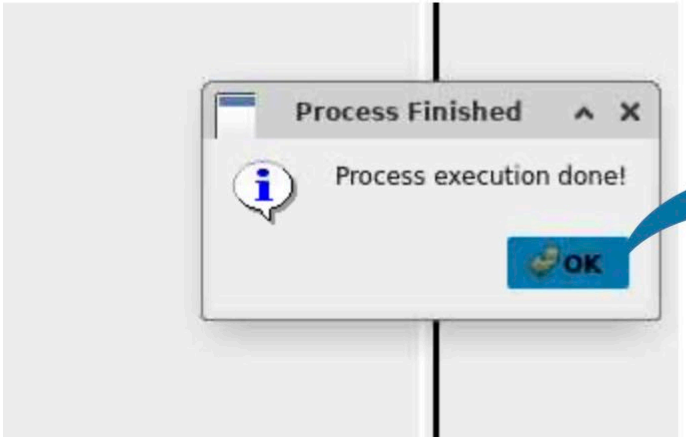
UFS6

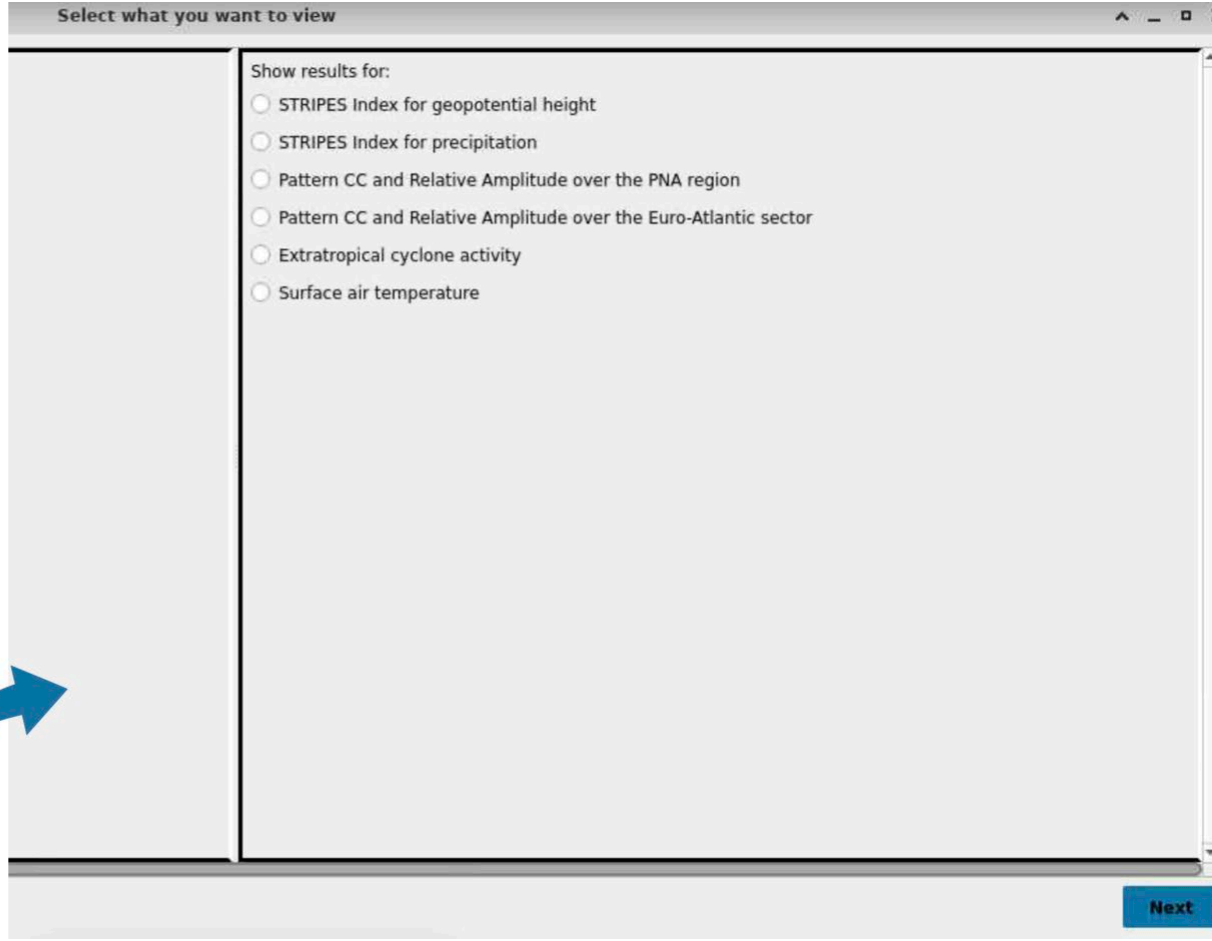


Zheng et al., 2024

GUI for the diagnostic package [Stan et al., in prep]







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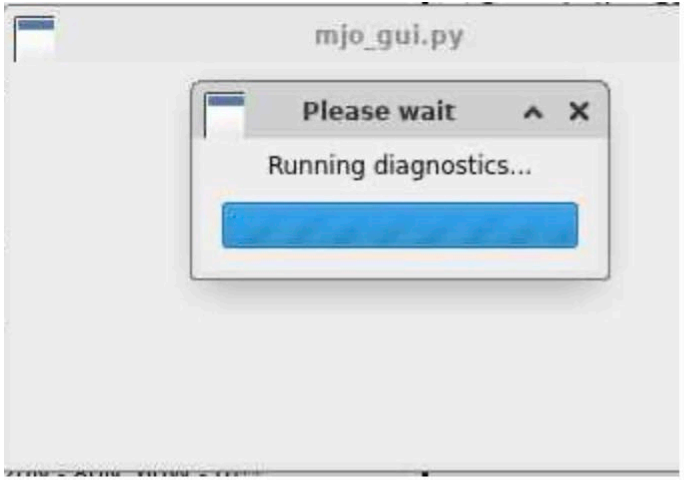
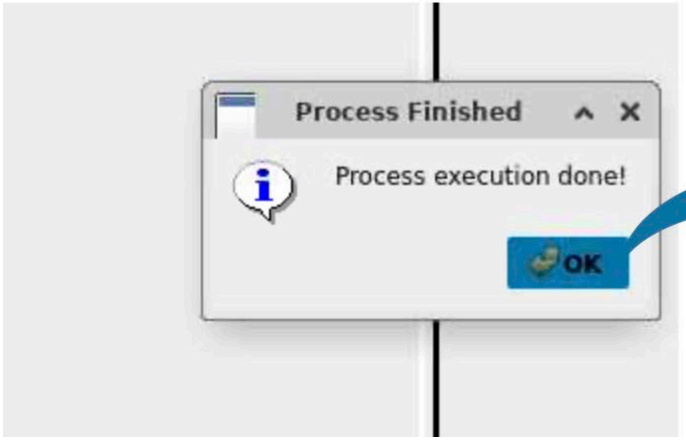
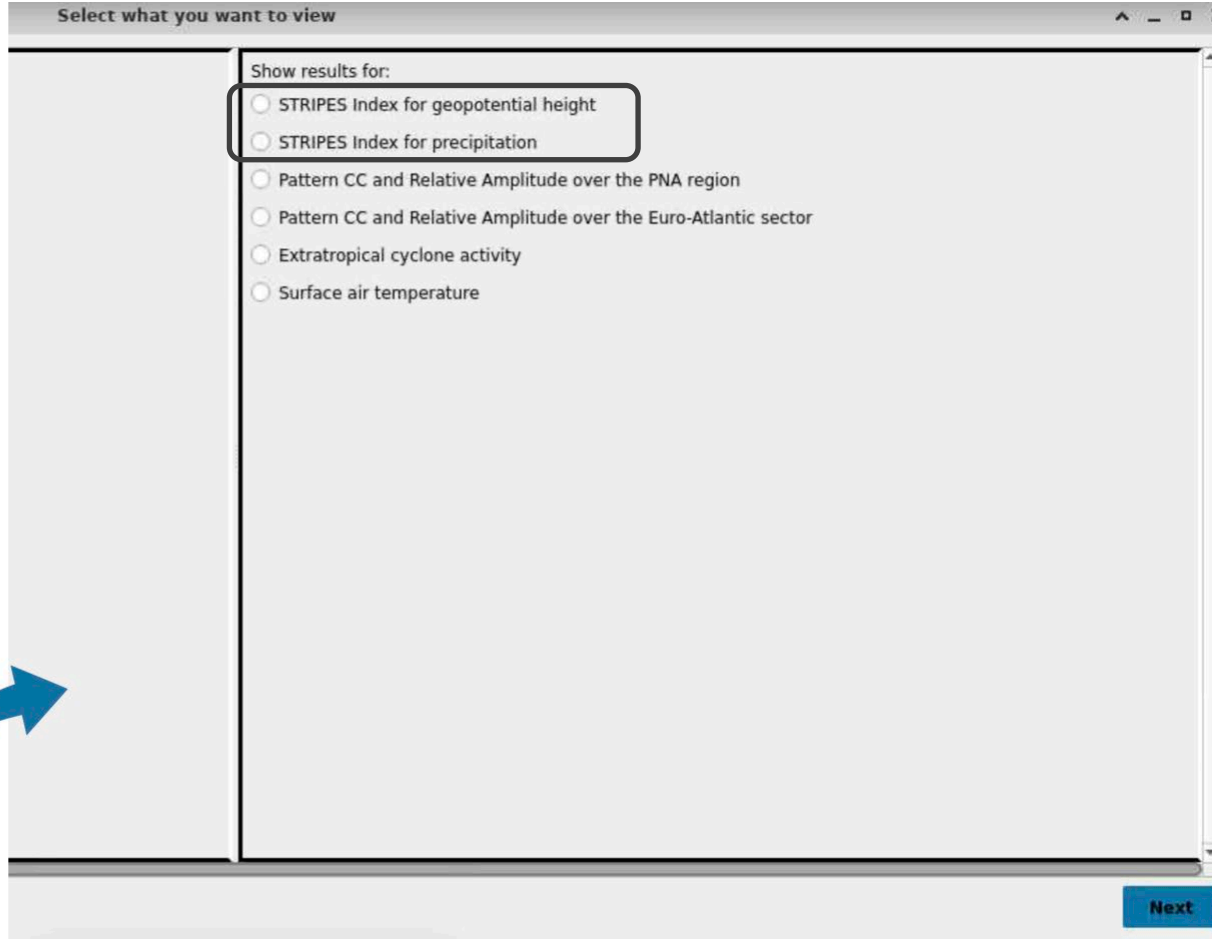
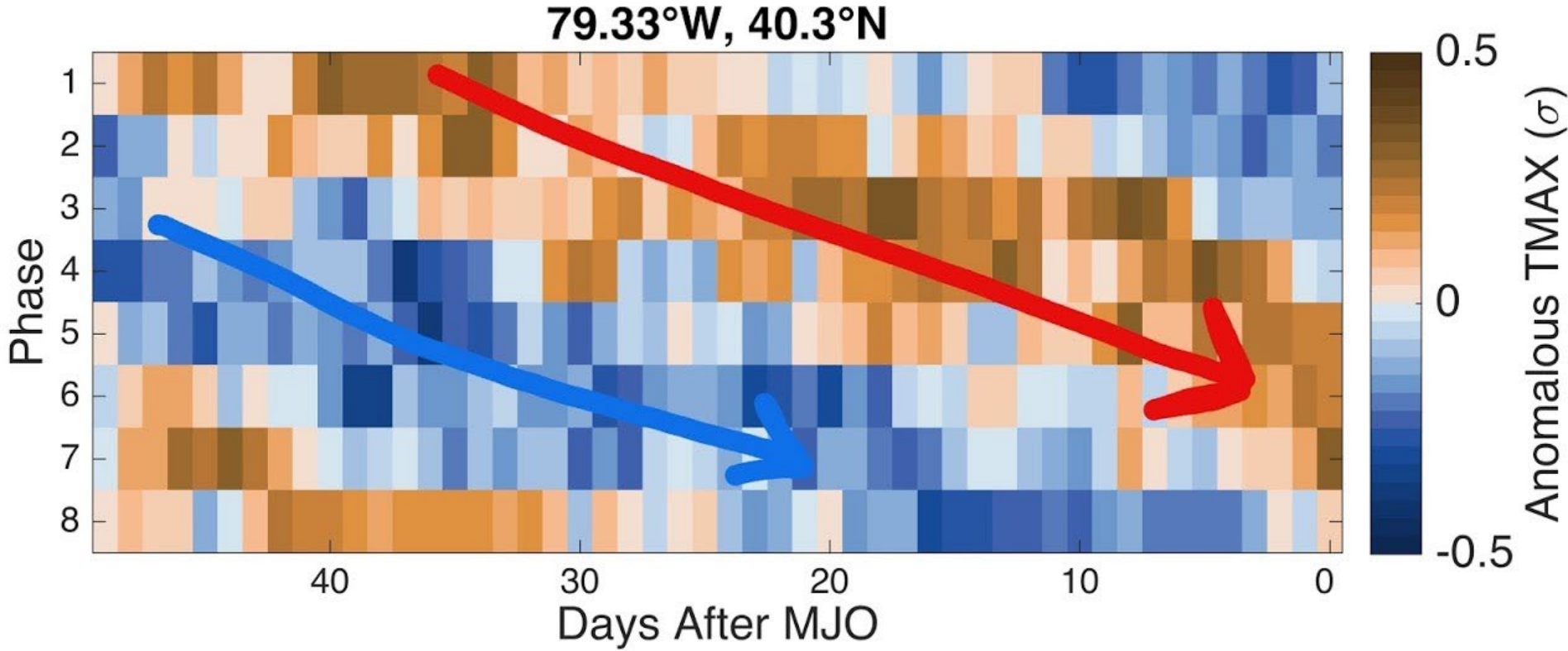




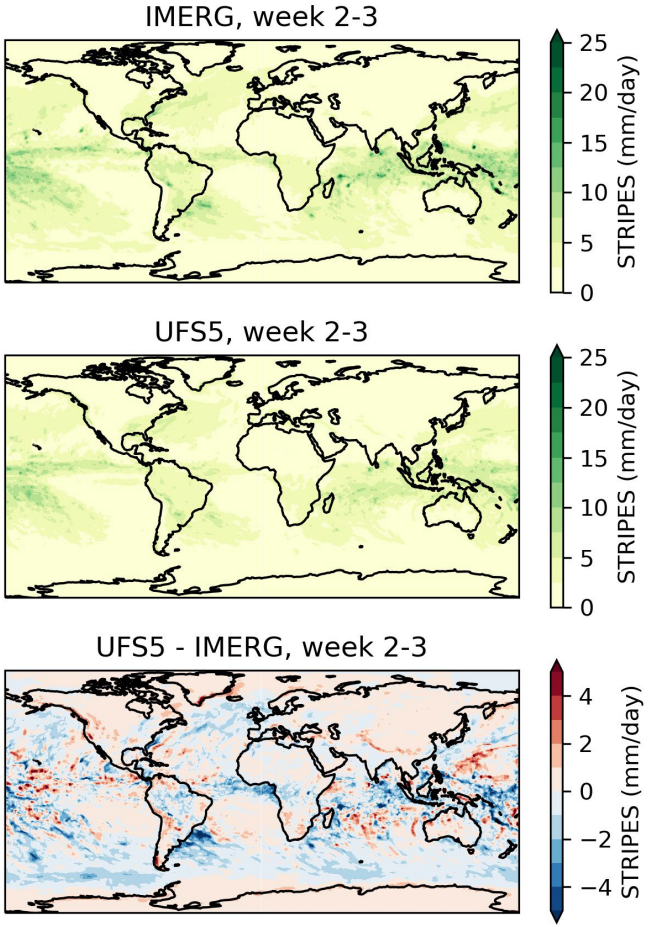


STRIPES index (Sensitivity to the Remote Influence of Periodic EventS)



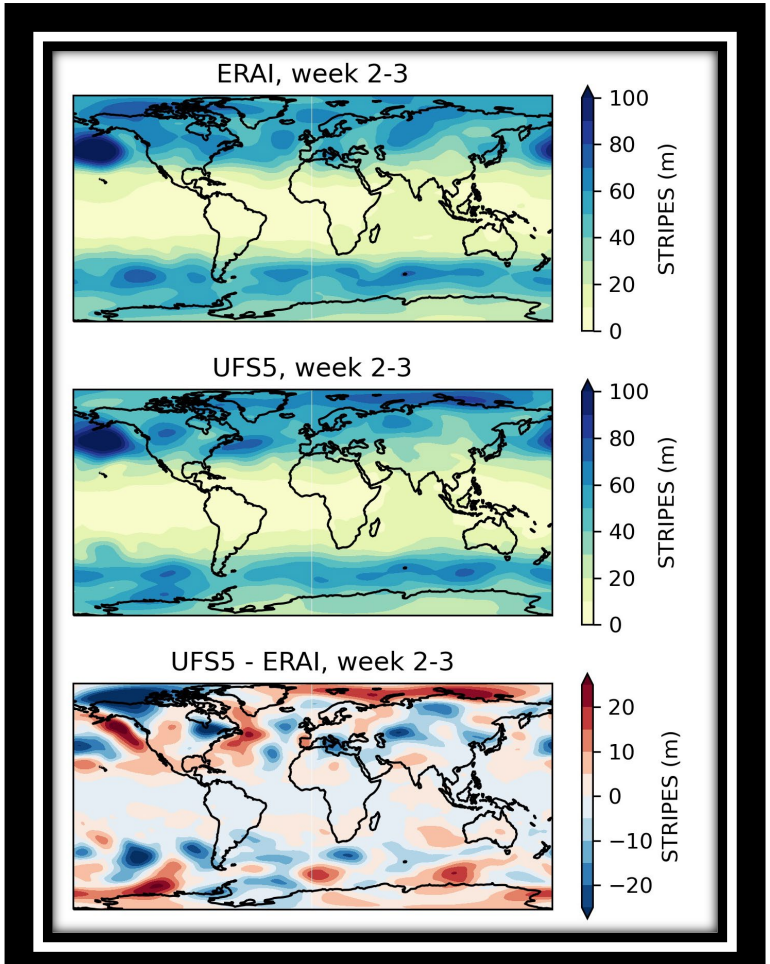
Jenney et al., 2019

STRIPES index, precipitation



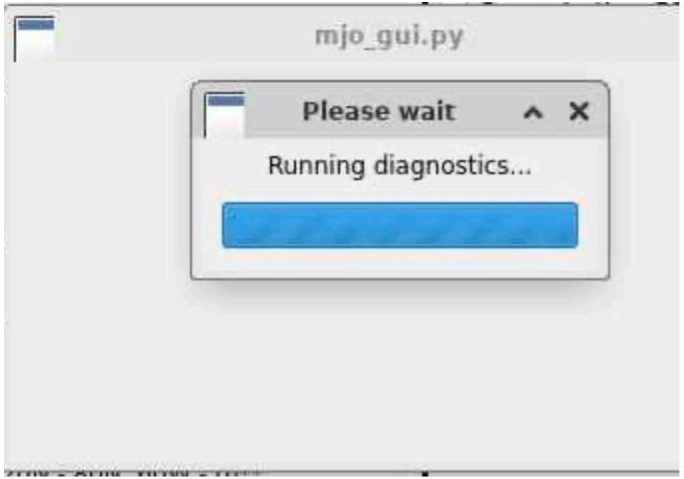
Stan et al., in prep

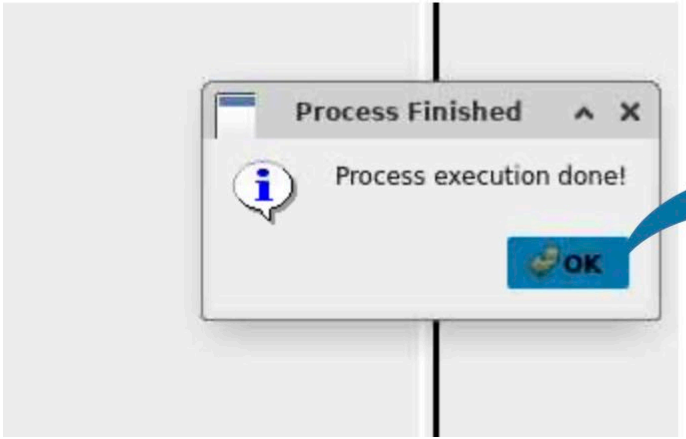
STRIPES index, Z500hPa

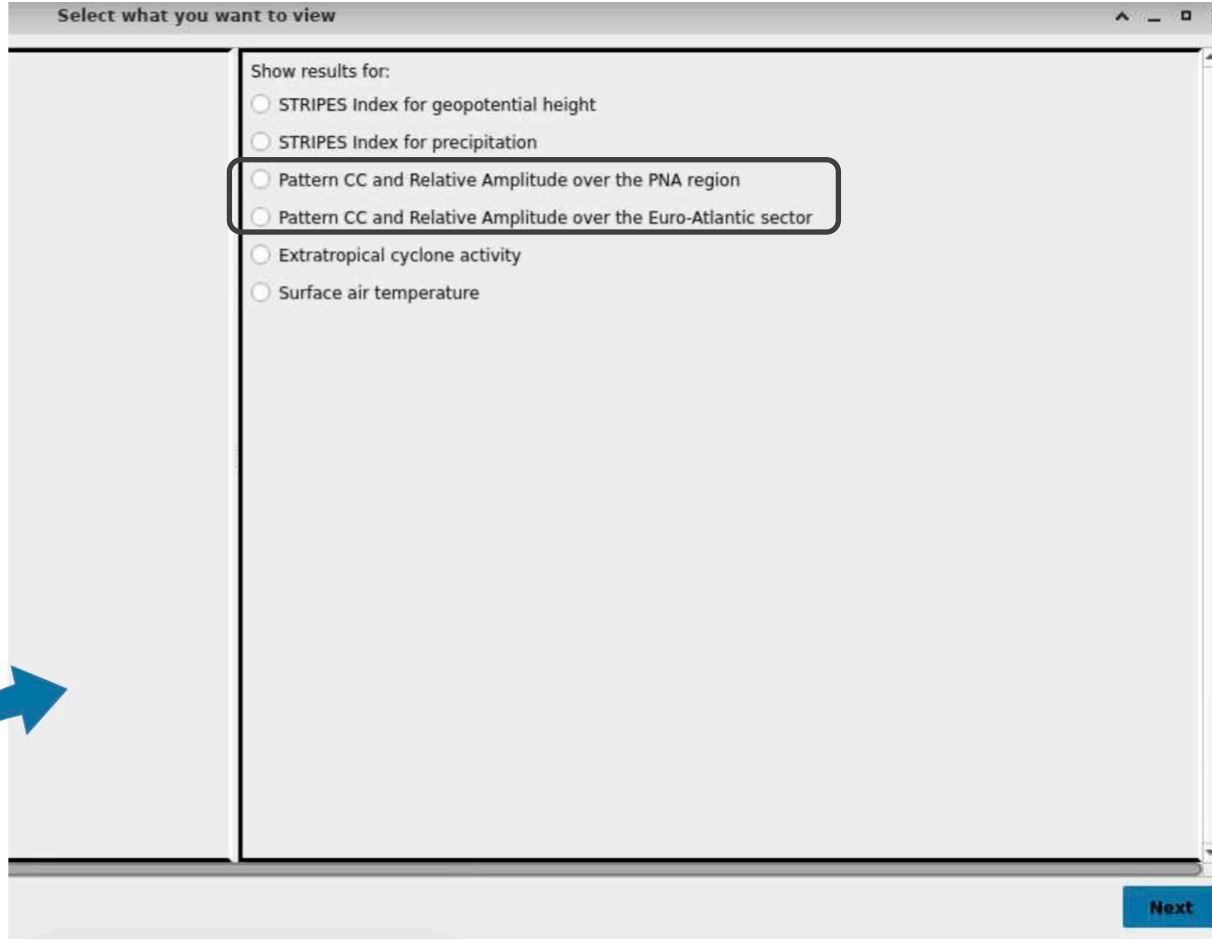


Stan et al., in prep

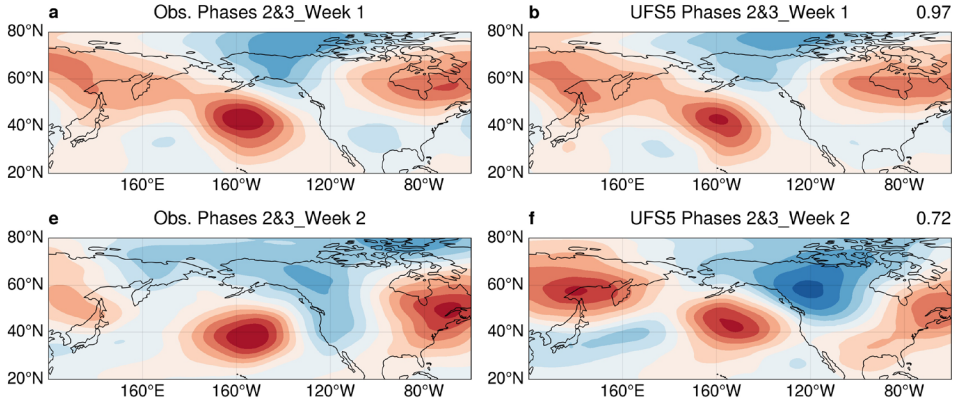
GUI for the diagnostic package [Stan et al., in prep]







Relative amplitude and pattern correlation, Z500hPa



Stan et al., in prep

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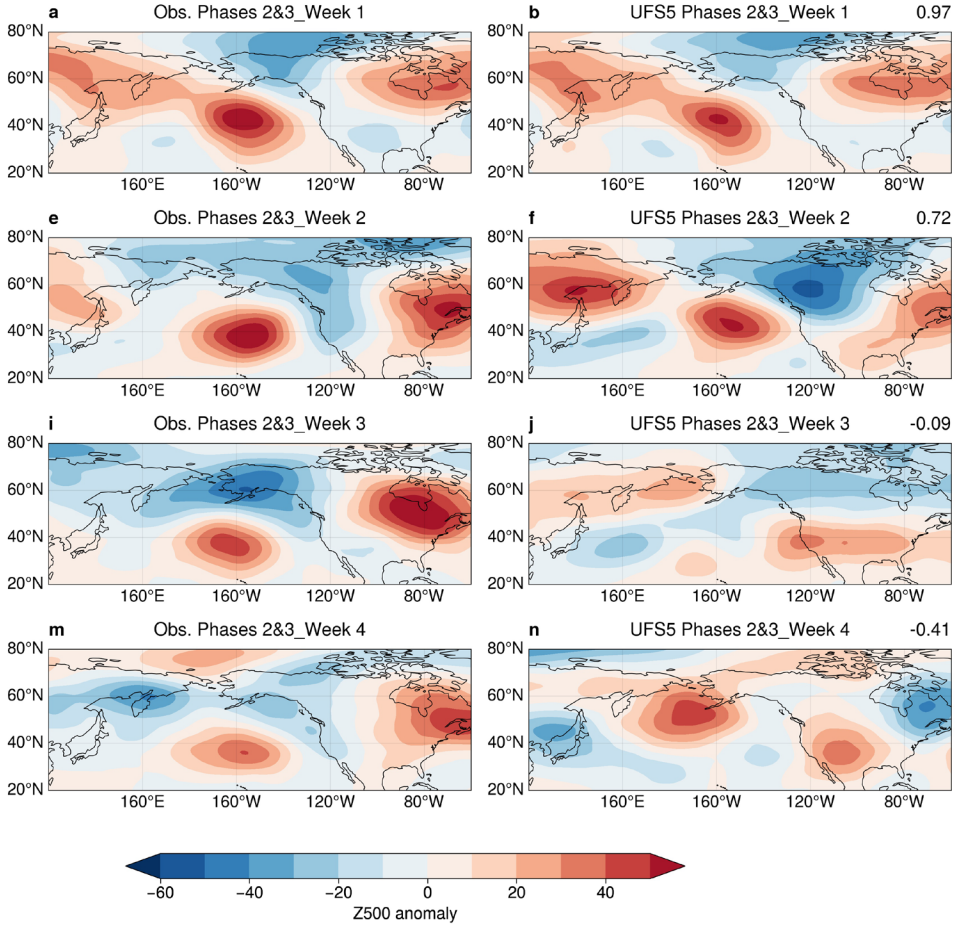
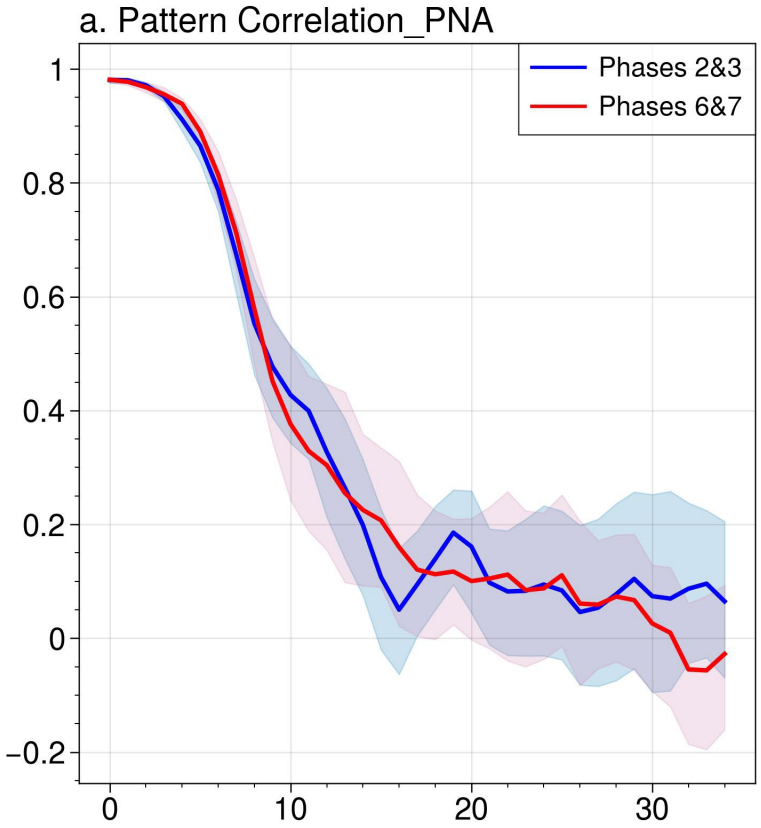
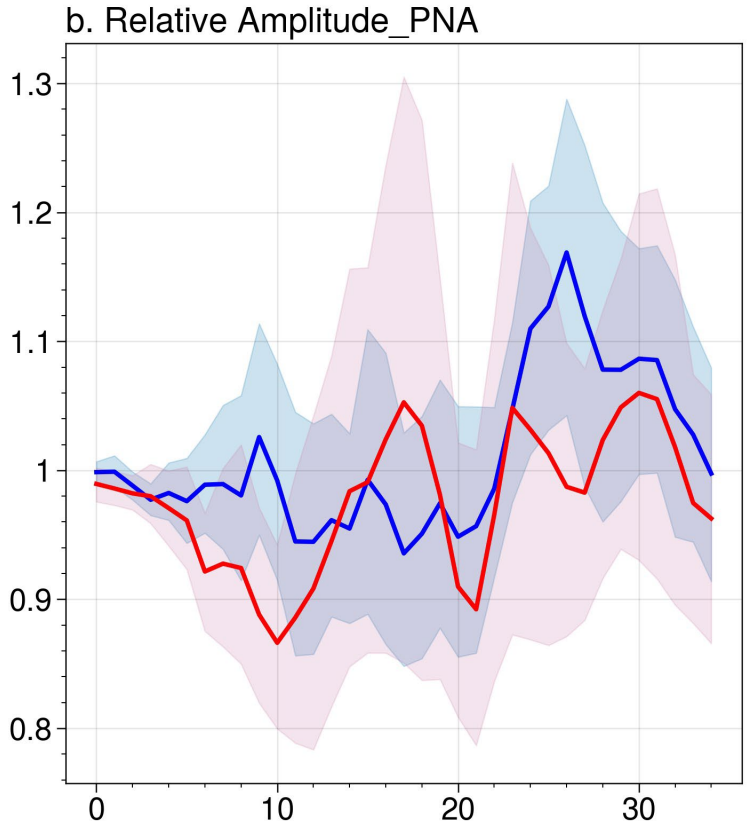


Stan et al., in prep

Relative amplitude and pattern correlation, Z500hPa

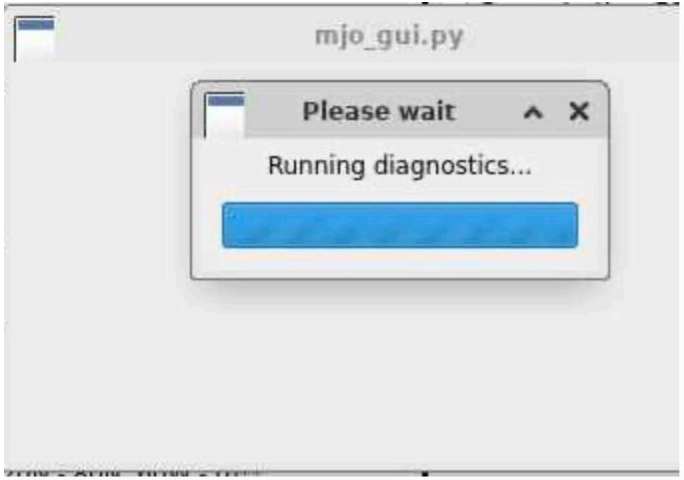


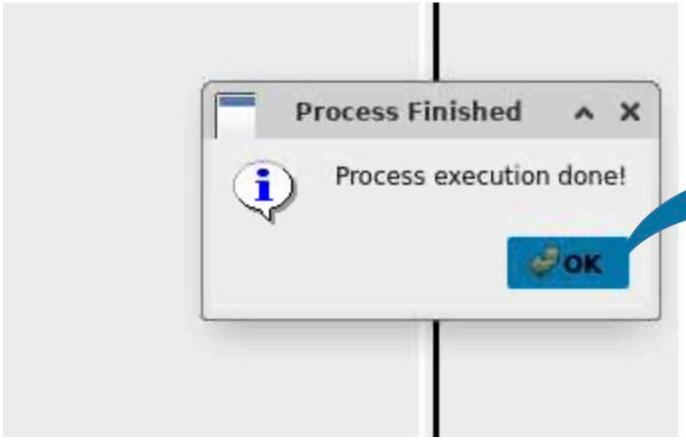


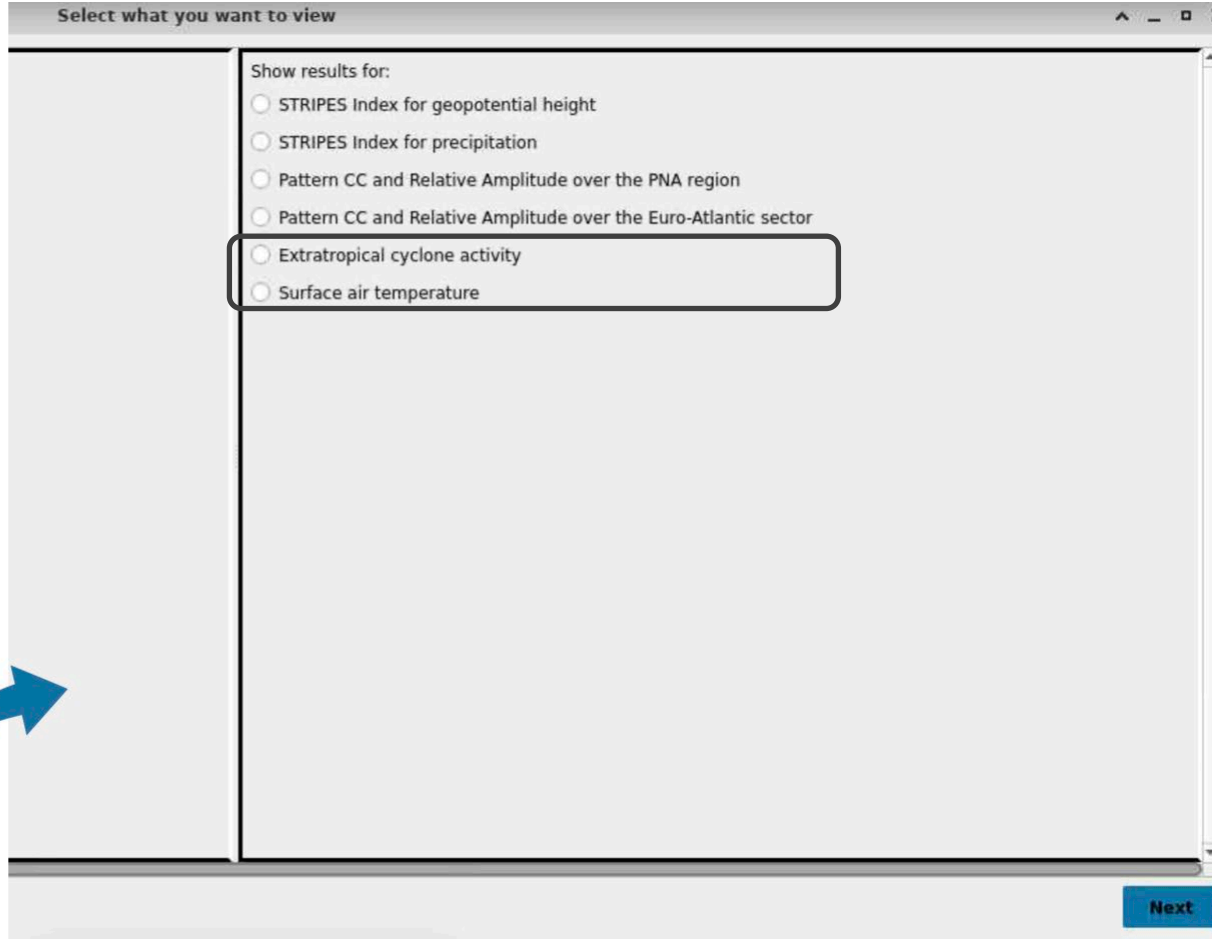
Stan et al., in prep

Days after initializations

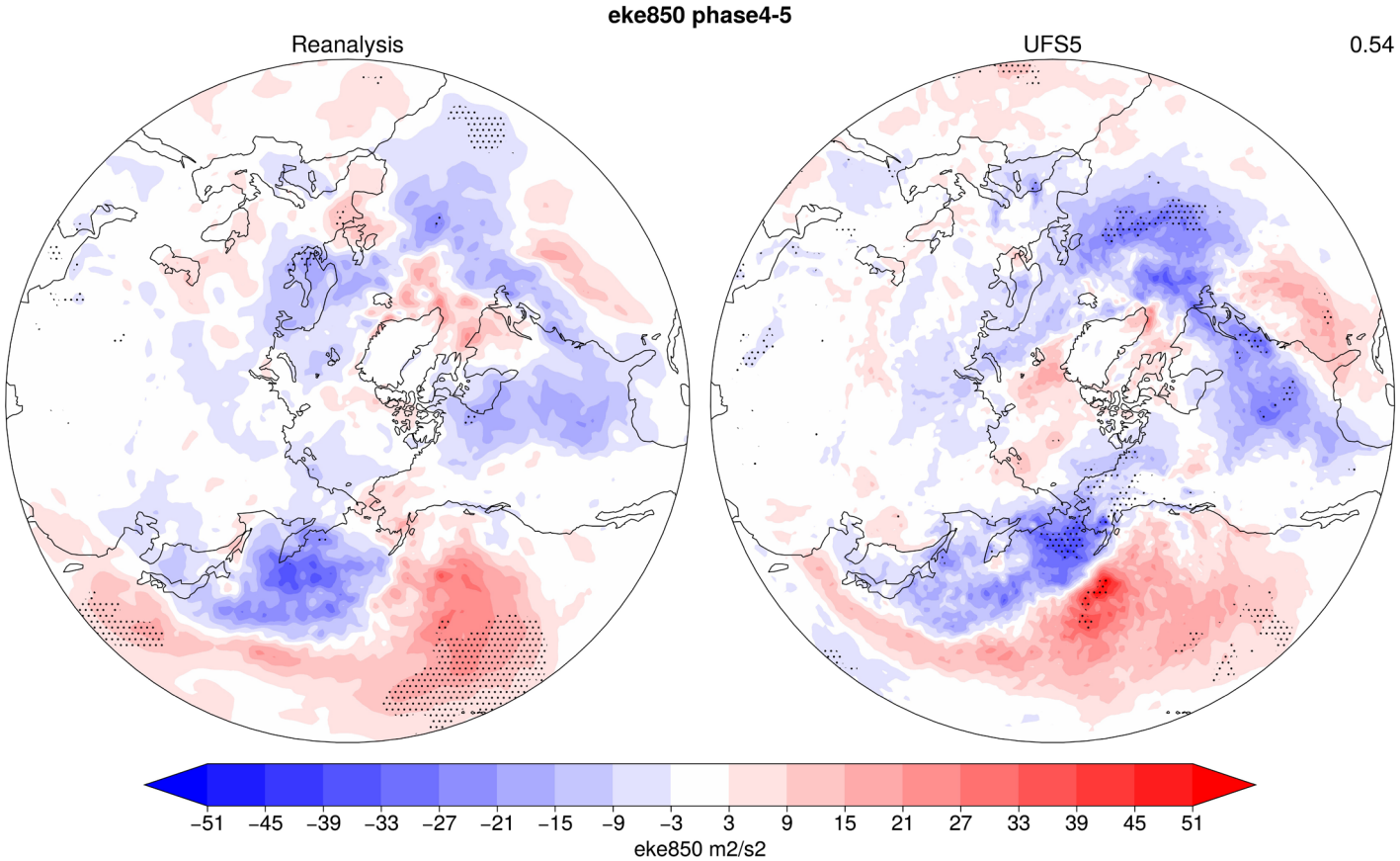
GUI for the diagnostic package [Stan et al., in prep]





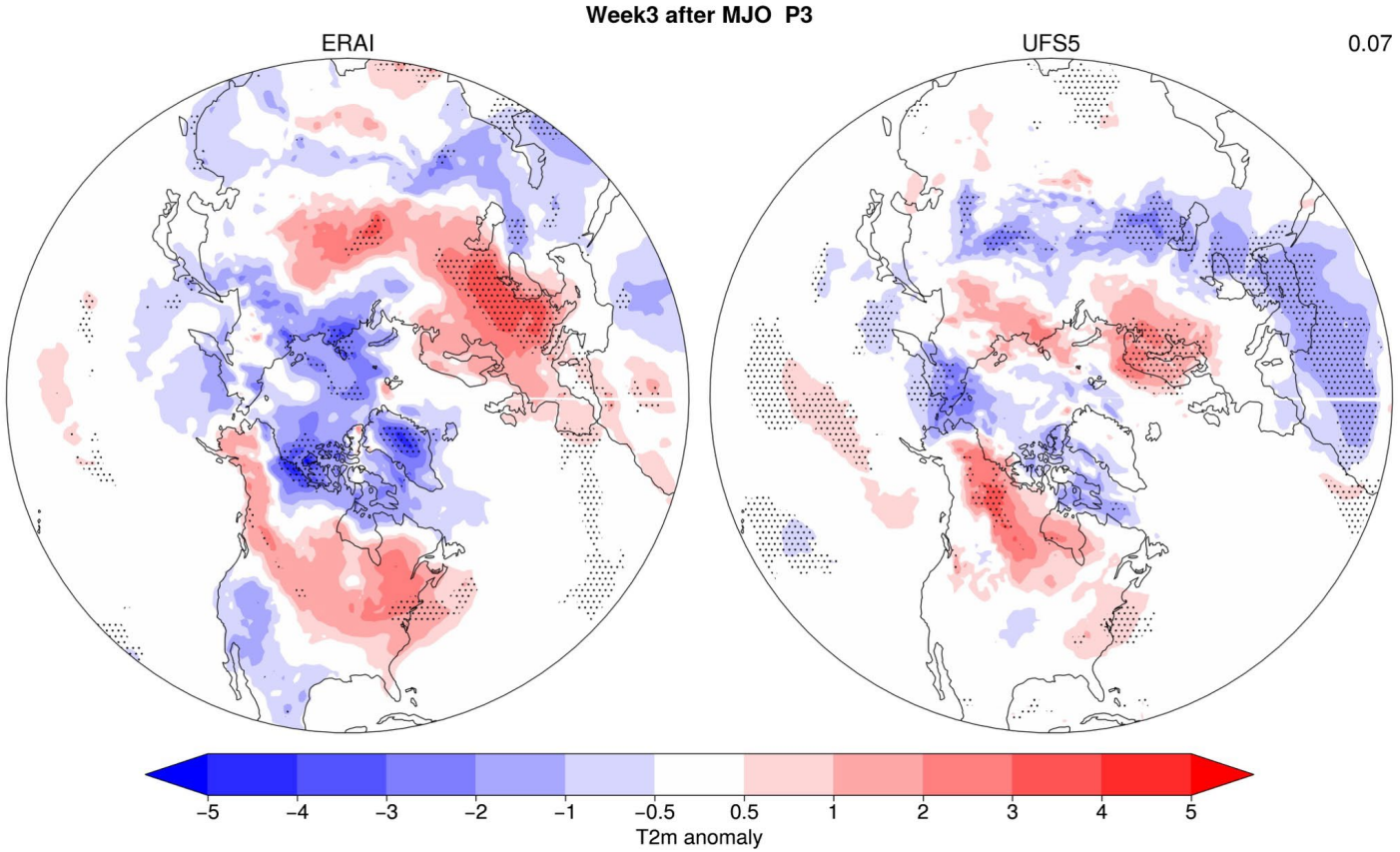


Cyclone Activity



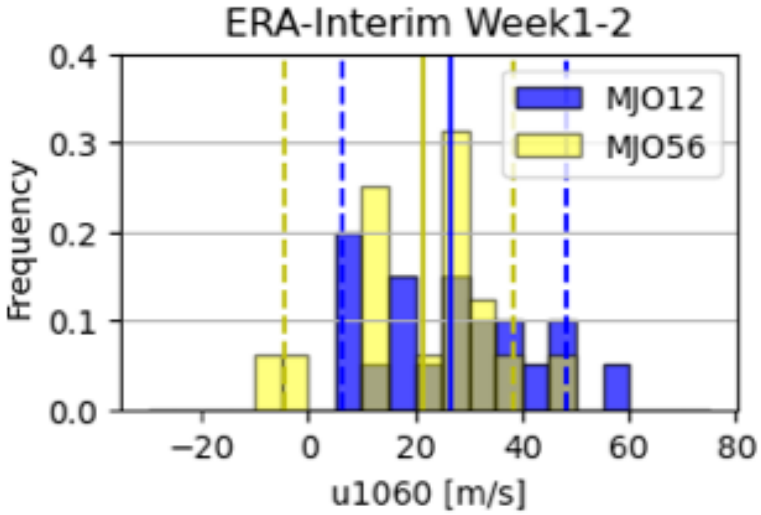
Stan et al., in prep

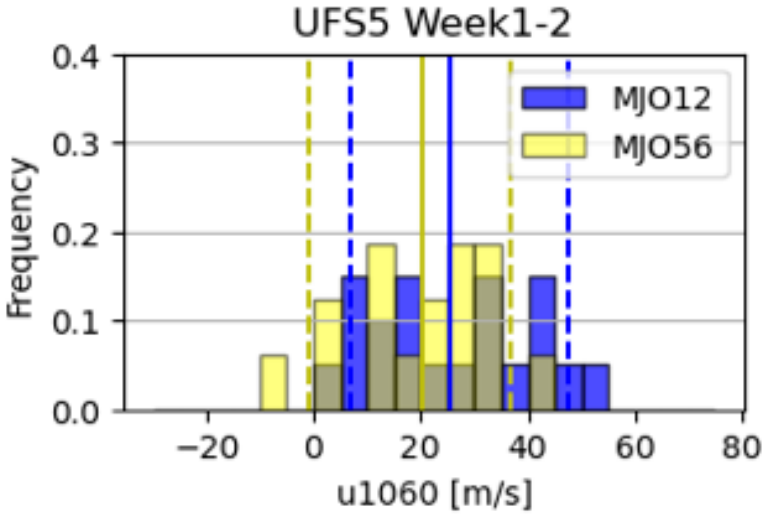
Surface temperature



Stan et al., in prep

Stratospheric Pathway





Stan et al., in prep

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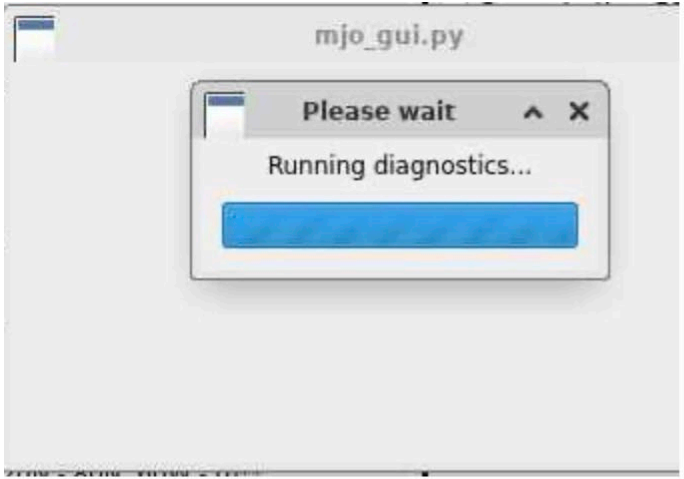

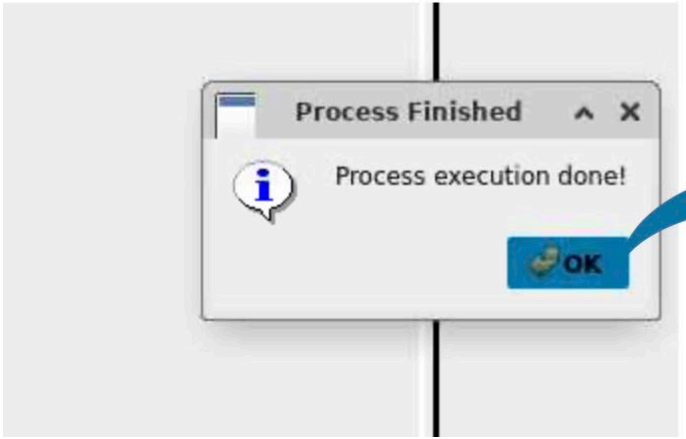

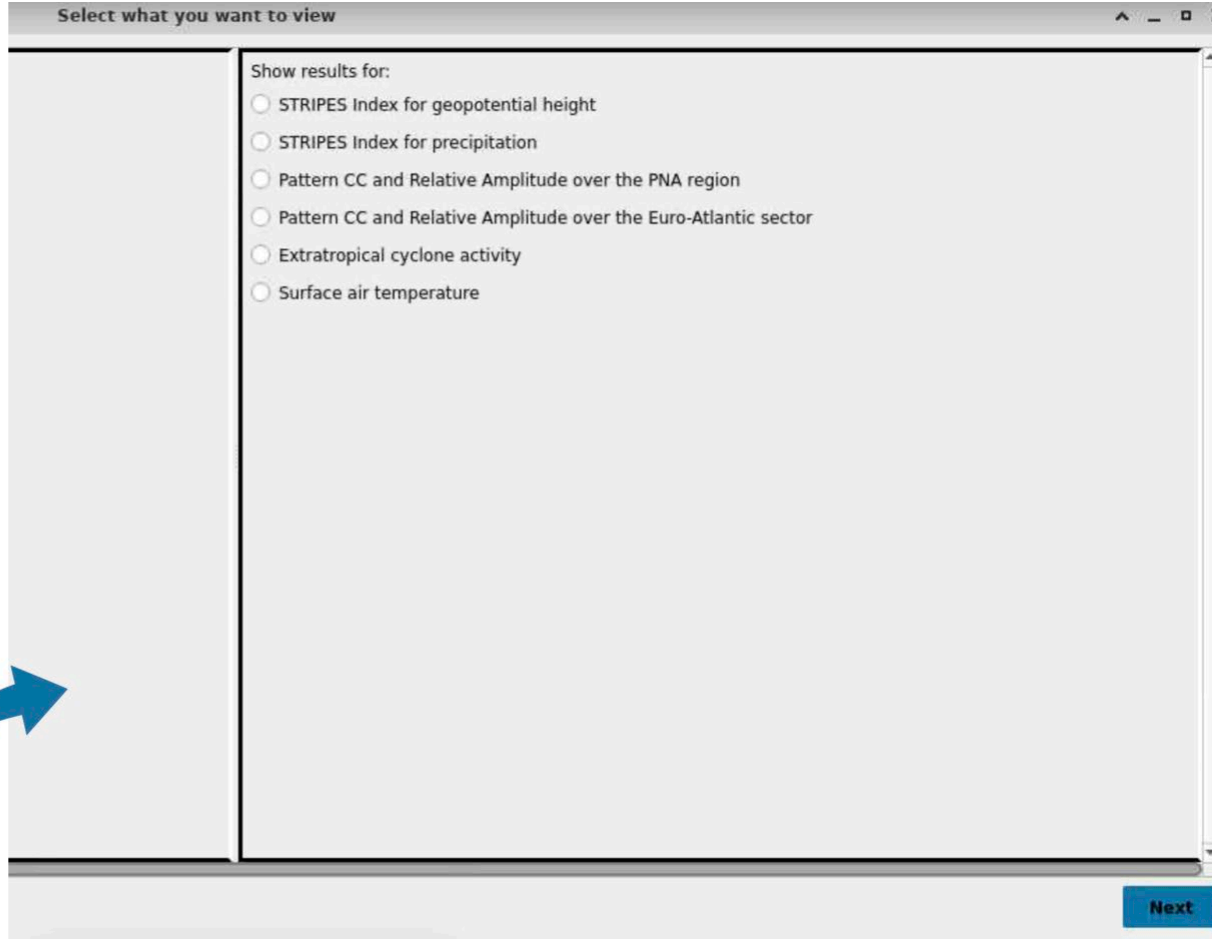

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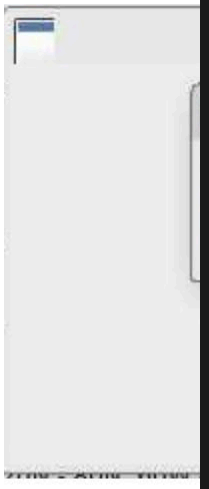


Summary:

- A diagnostic package for evaluation of the MJO and MJO teleconnections.
- The package consists of a graphical user interface (GUI; optional) and a collection of modular evaluation tools, all written in Python.
- More tools can be added easily, can either using included dataset as input or user specified datasets
- The package can be applied to any forecast dataset.
- We want this this to be useful – please send feedback!

•Zheng C., D.I.V. Domeisen, C. I. Garfinkel, A. M. Jenney, H. Kim, J. Wang, Z. Wu, and C. Stan. The impact of vertical model levels on the prediction of MJO teleconnections. Part I: The tropospheric pathways in the UFS global coupled model. (2024) Climate Dynamics

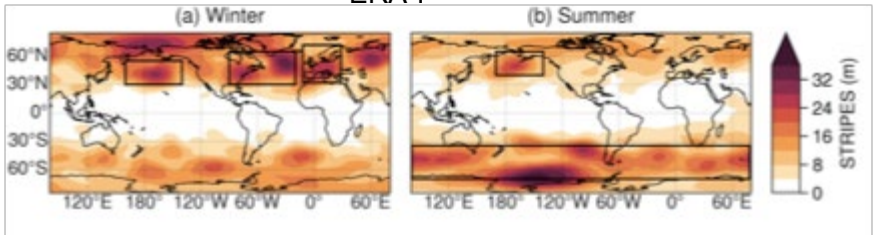
•Garfinkel C.I., Z. Wu, P. Yadav, Z. Lawrence, D.I.V. Domeisen, C. Zheng, J. Wang, A. M. Jenney, H. Kim, C. Schwartz, and C. Stan. The impact of vertical model levels on the prediction of MJO teleconnections. Part 2: The stratospheric pathway in the UFS global coupled model. (in review) Climate Dynamics

•Wang J., D.I.V. Domeisen, C.I. Garfinkel, A. M. Jenney, H. Kim, Z. Wu, Z. Cheng, and C. Stan. Prediction of MJO teleconnections in the UFS global fully coupled model. (in review) Climate Dynamics

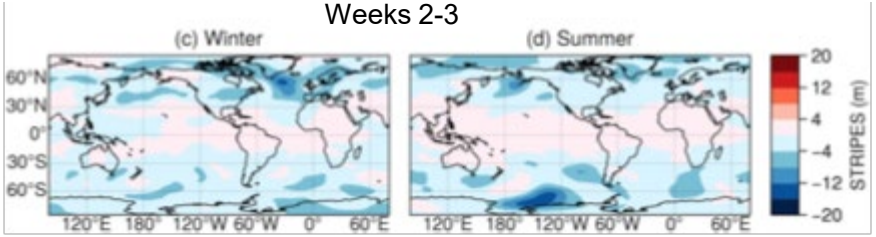
•Stan, C., et al., A Python diagnostics package for evaluation of MJO-Teleconnections in S2S forecast systems, to be submitted

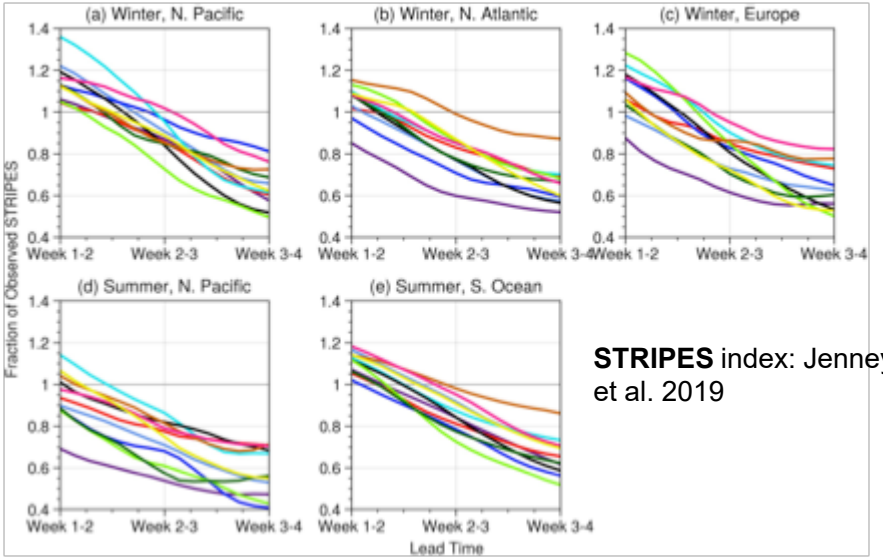
MJO-Teleconnections to the NH Z500 Distribution

ERA-I



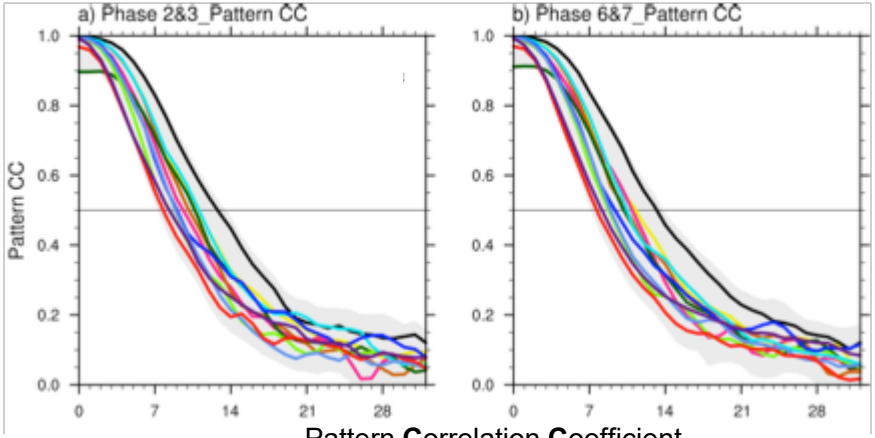
Weeks 2-3





STRIPES index: Jenney et al. 2019

PNA

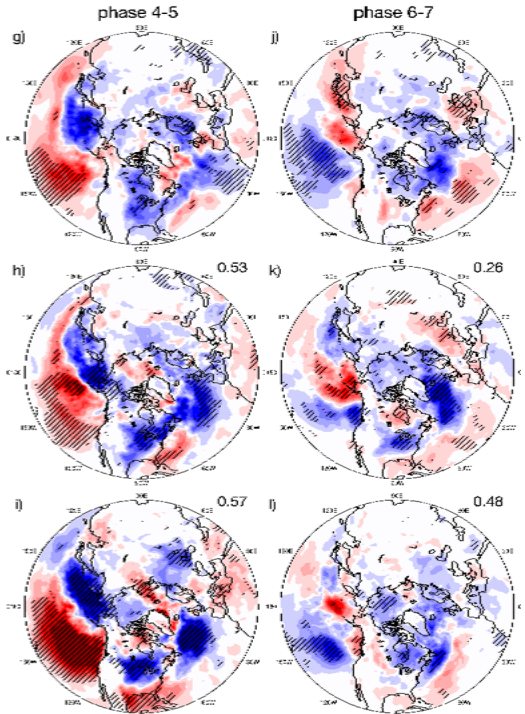


Pattern **C**orrelation **C**oefficient, Wang et al. 2020

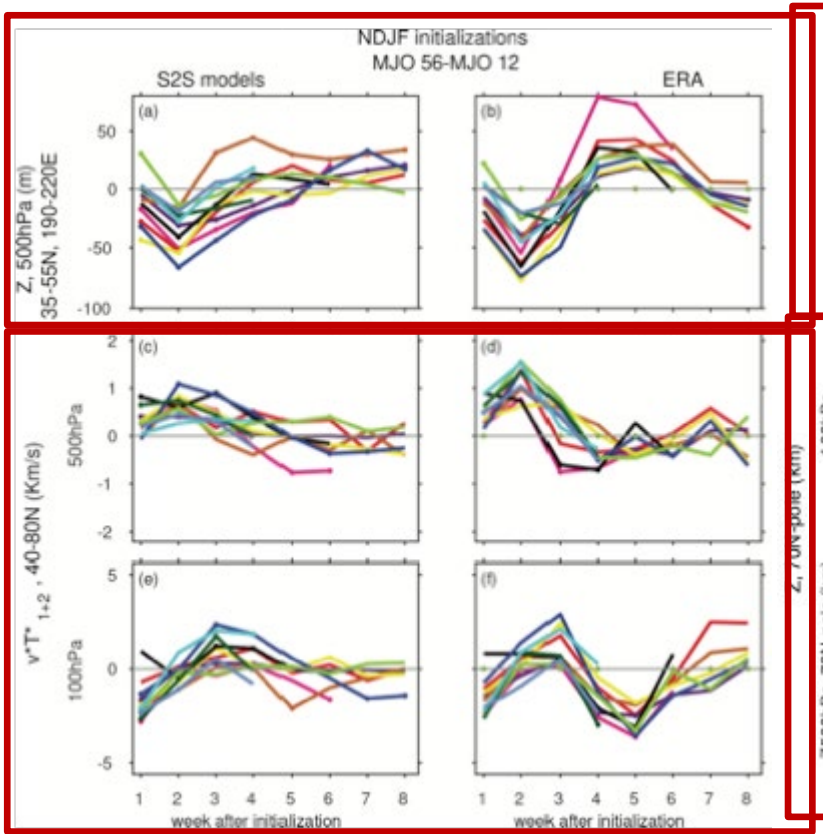
MJO-Teleconnections to the NH Z500 Distribution

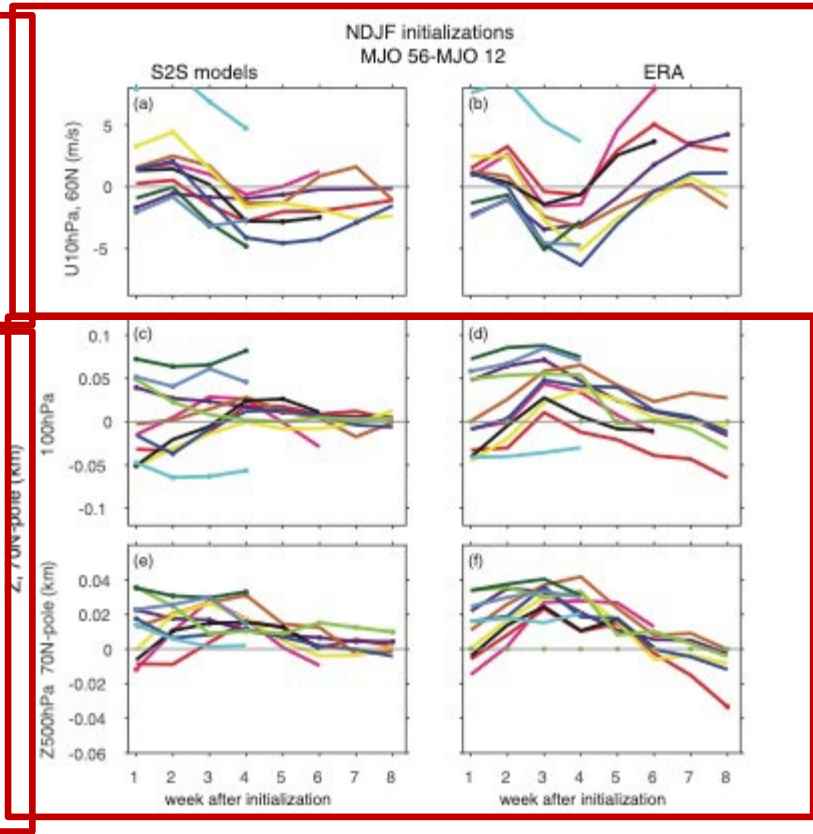
EKE85

0

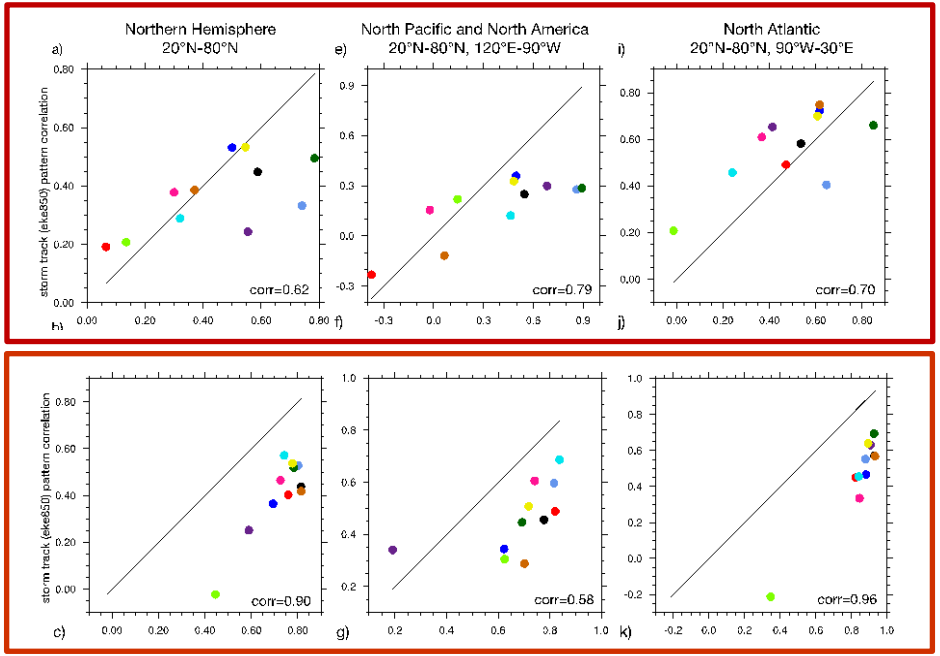


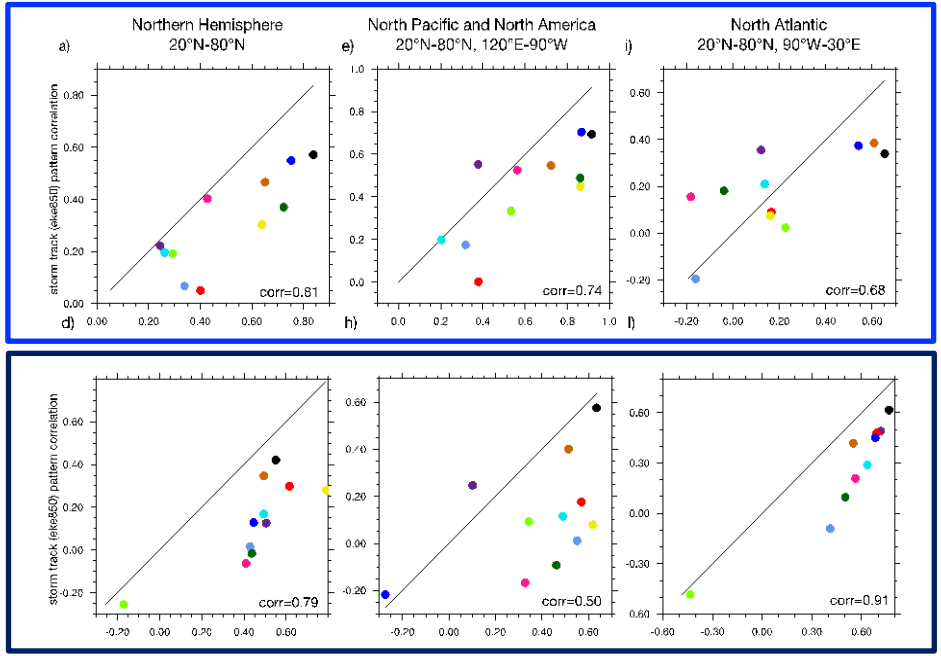
MJO-Teleconnections to the NH Z500 – Stratospheric Path





MJO-Teleconnections to the NH Storm Tracks





Phase 8-1

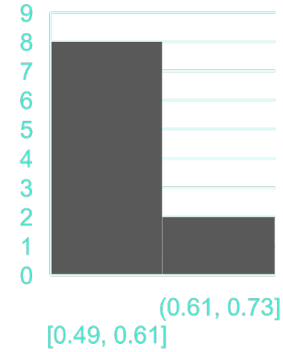
Phase 2-3

Phase 4-5

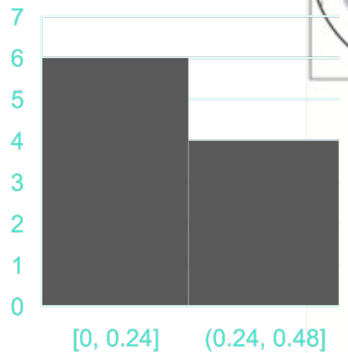
Phase 6-7

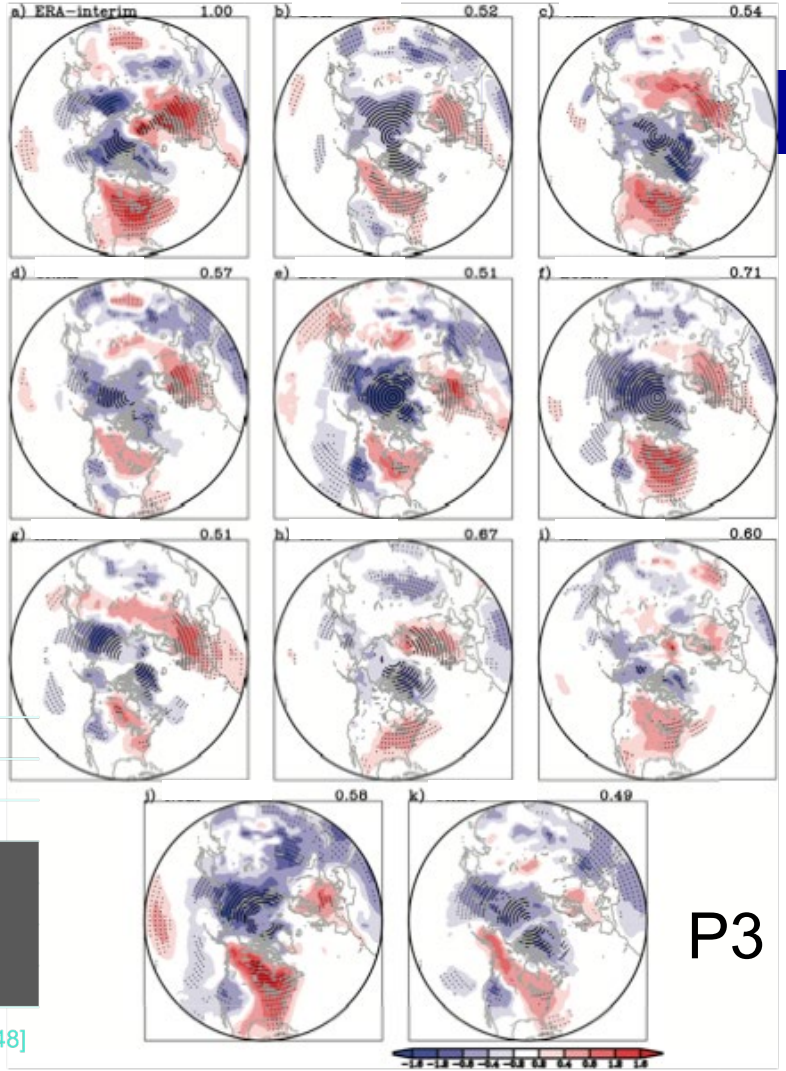
T2m

Phase 3

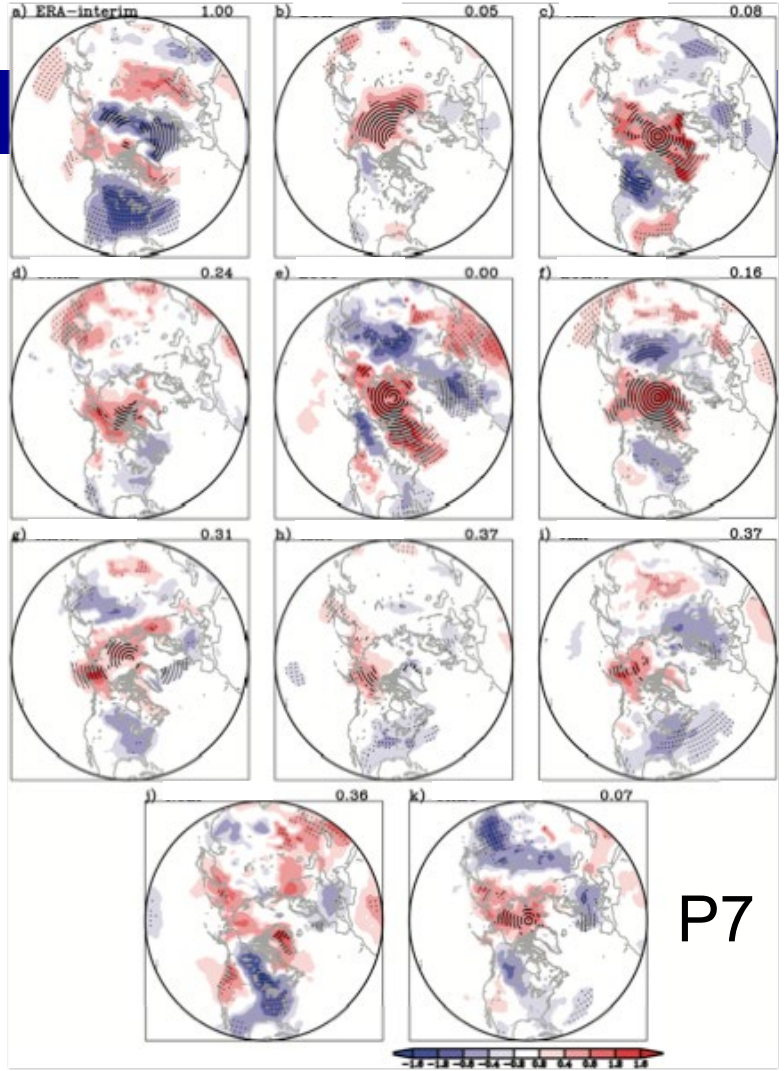


Phase 7





P3



P7

P1-P8 Prototypes: Experimental Setup

Reforecast period	April, 2011 – March, 2018
Initial Conditions	1st and 15th of each month
Ensemble members	1
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P1-P8 Prototypes: Experimental Setup

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UIFCW24
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Coupled UFS Prototypes

Prototype	Atmospheric Model C384 (~0.25 degree) horizontal resolution			Ocean Model Tripolar ~0.25 degree horizontal resolution	Wave Model Regular lat/lon 0.5 degree grid	Ice Model Tripolar ~0.25 degree horizontal resolution	Mediator
	Dynamical Model	Physics Settings & Driver	Land Model				
P1	FV3 64 layers, Non-Fractional grid (model top at 54km)	GFSv15.2, IPD driver	Noah LSM	MOM6	N/A	CICE5	NEMS
P2							
P3.1							
P4		GFSv15.2, CCPP driver			WW3		
P5						CICE6 (Mushy TD not turned on)	CMEPS
P6	FV3 127 layers, Fractional grid (model top at 80km)	GFSv16					
P7		Modified GFSv16	Noah-MP LSM			CICE6 (Mushy TD turned on)	
P8		Further Modified GFSv16	Modified Noah-MP LSM				

(P8+ includes one-way coupled aerosols)

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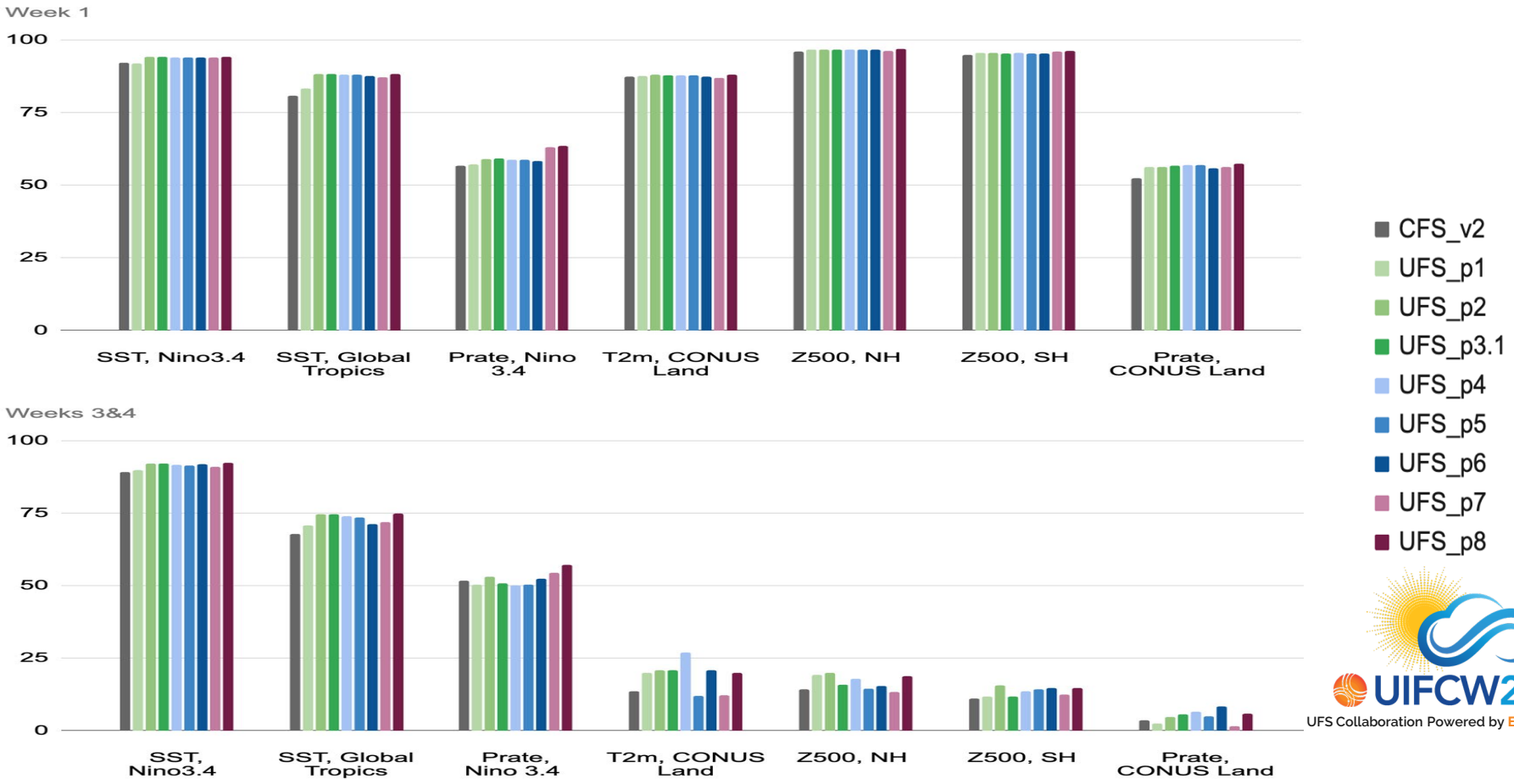
Anomaly correlations in P1-P8 Prototypes



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