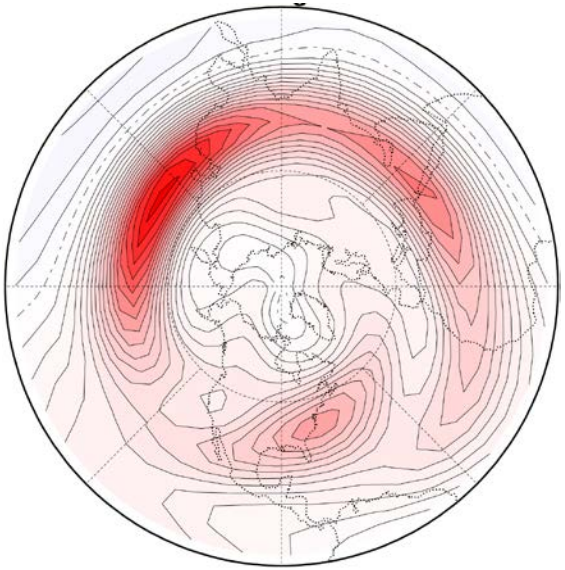
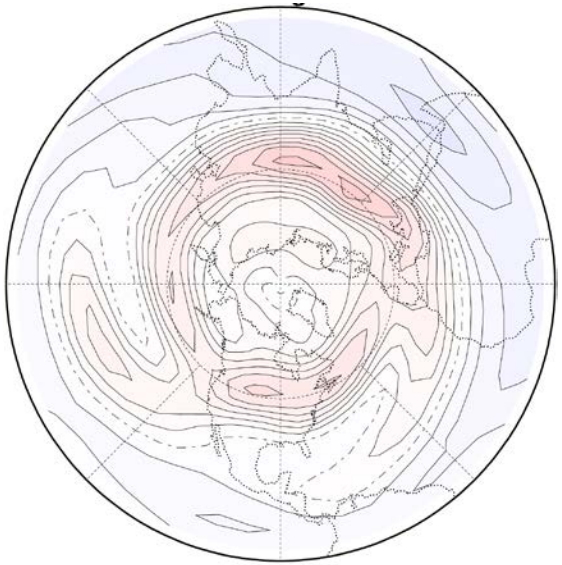
Seasonal contrasts in Northern Hemisphere tropospheric waveguide teleconnections

Grant Branstator & Haiyan Teng
NCAR



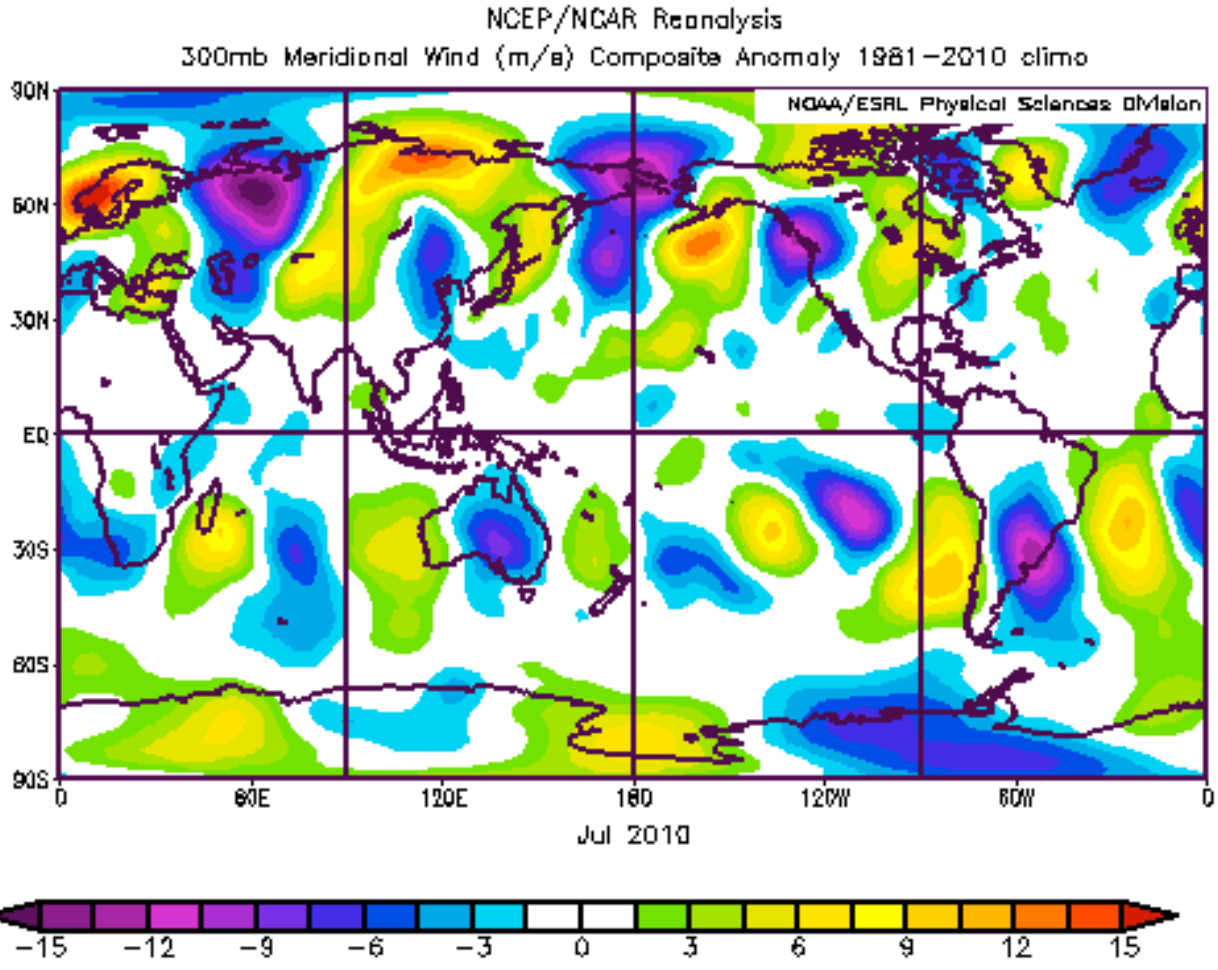
Jan Mean u200



Jul Mean u200

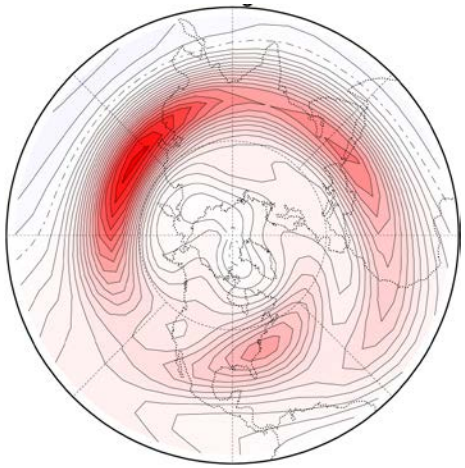
contour=5m/s

Jul 2010
300hPa v anomalies

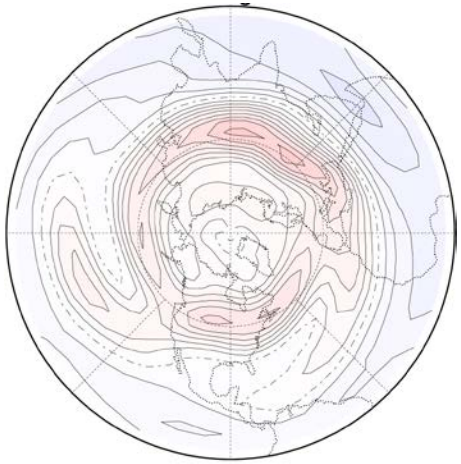


Nature's Mean u200

Jan



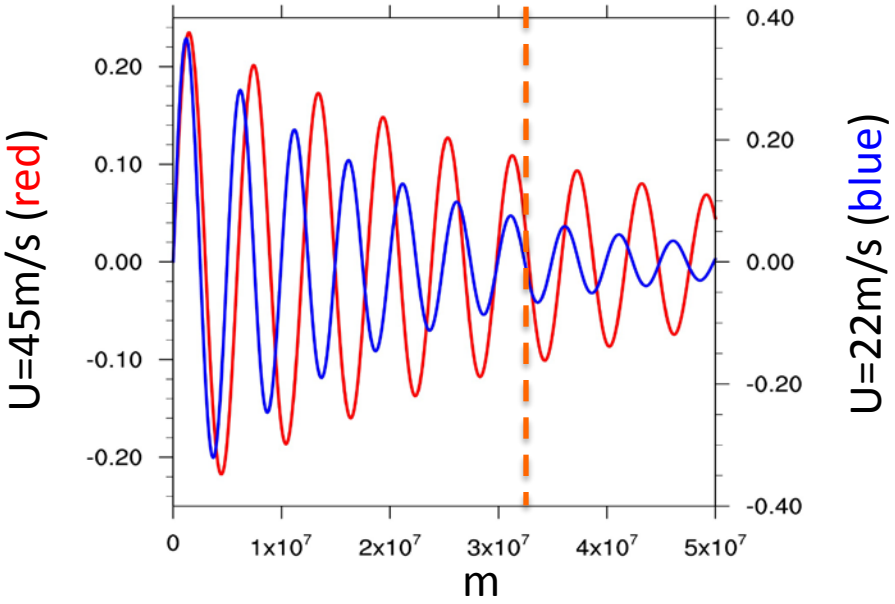
Jul



$$\frac{\partial \zeta}{\partial t} = -U\frac{\partial \zeta}{\partial x} - v\beta - \alpha\zeta$$

$$Uv_{xx} + v\beta + \alpha\zeta = \delta(x=0)$$

v response to δ(x=0)

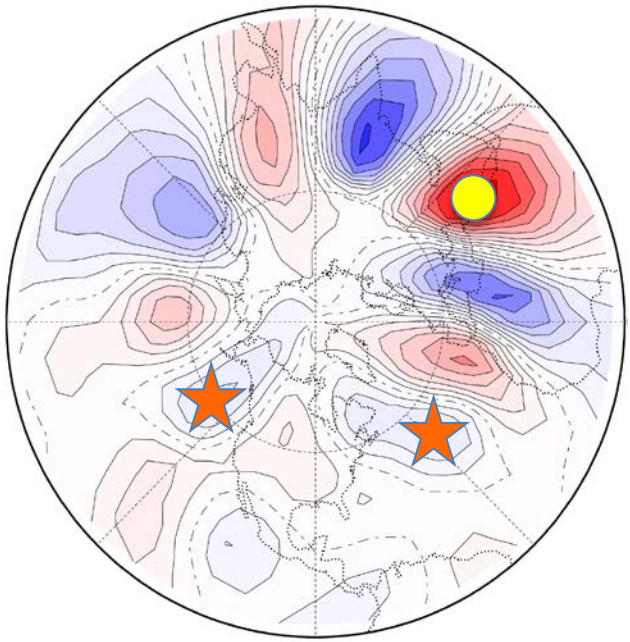


Nature

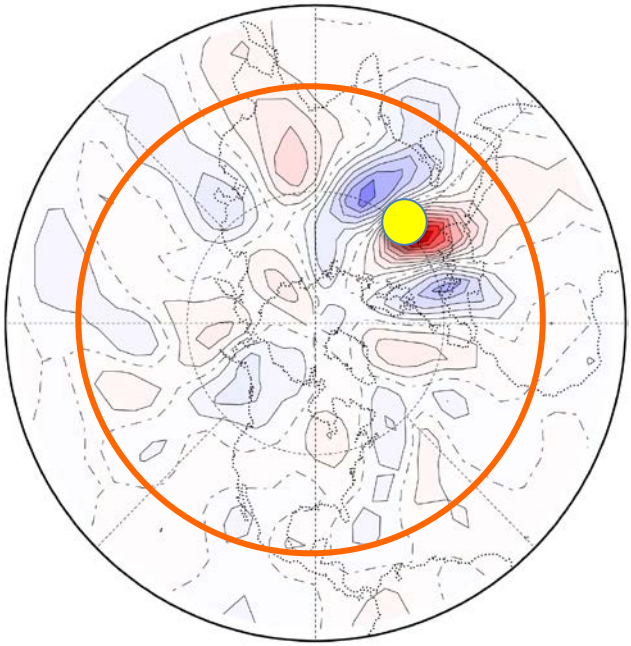
(subseasonal 30d mean v200)

1pt cor plots

DJF



JJA

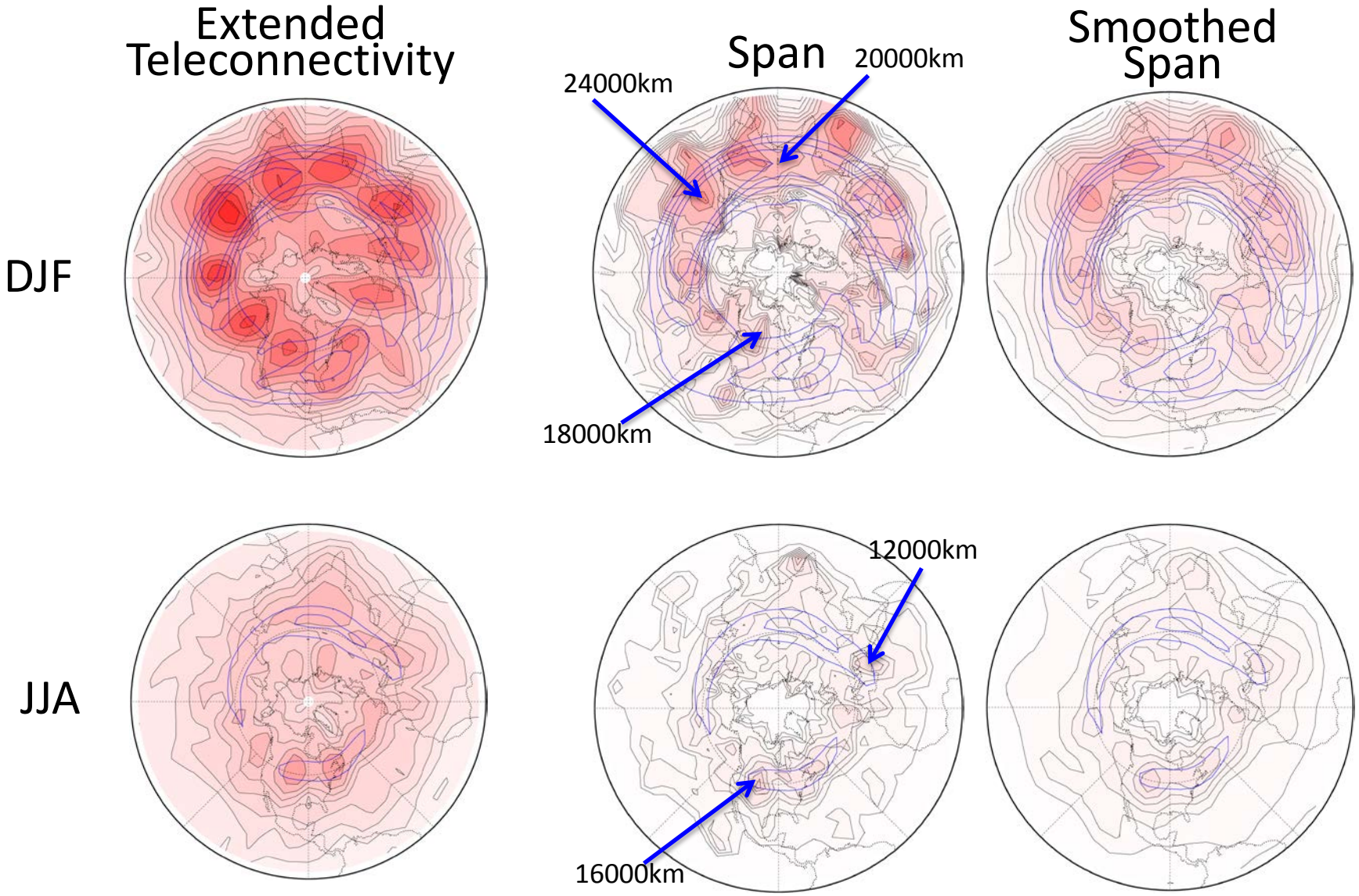


- Extended Teleconnectivity
- Span
- “Circumglobal”

contour=0.1

Nature

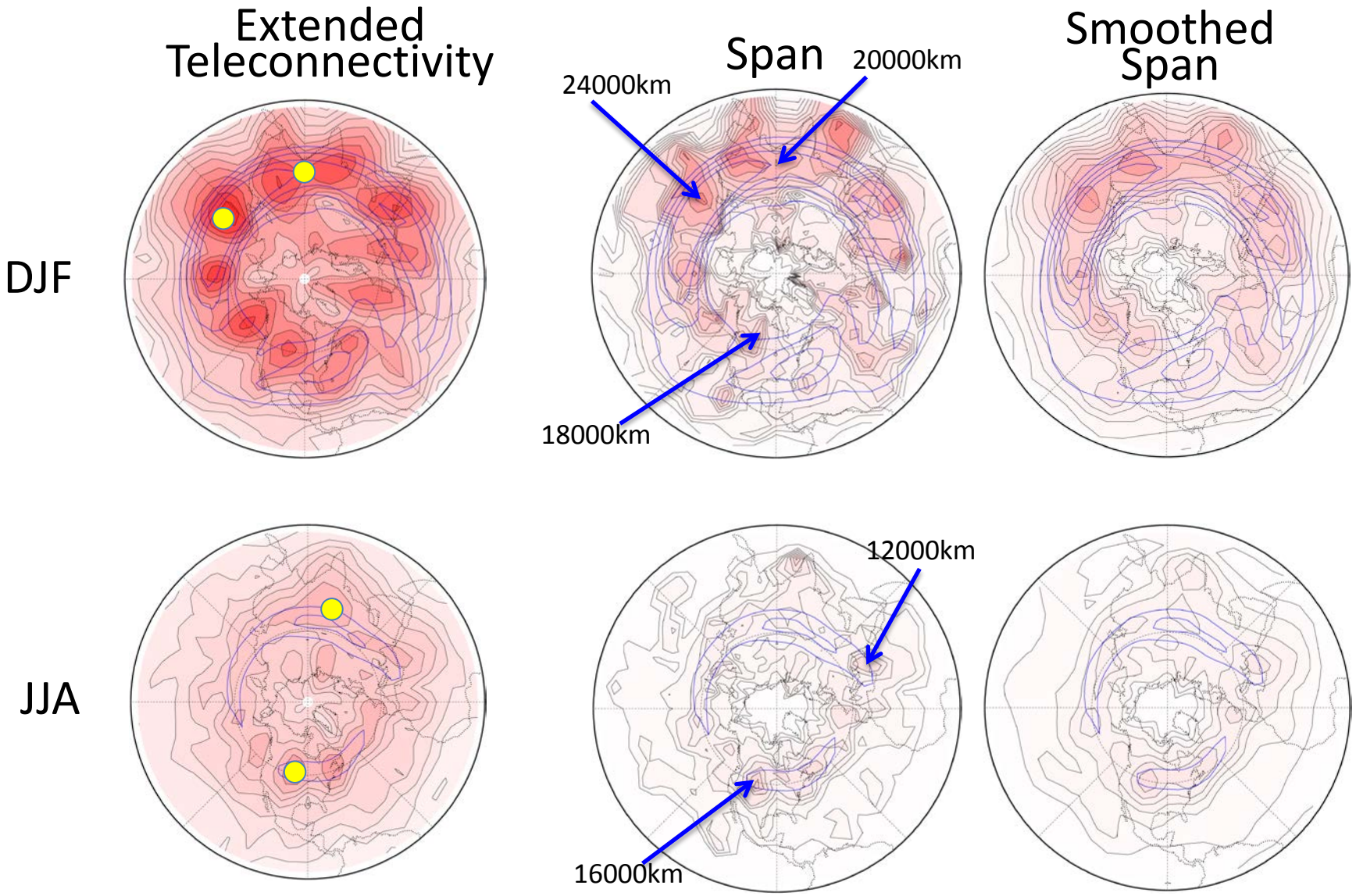
(subseasonal 30d mean v200)



contour=0.02

Nature

(subseasonal 30d mean v200)

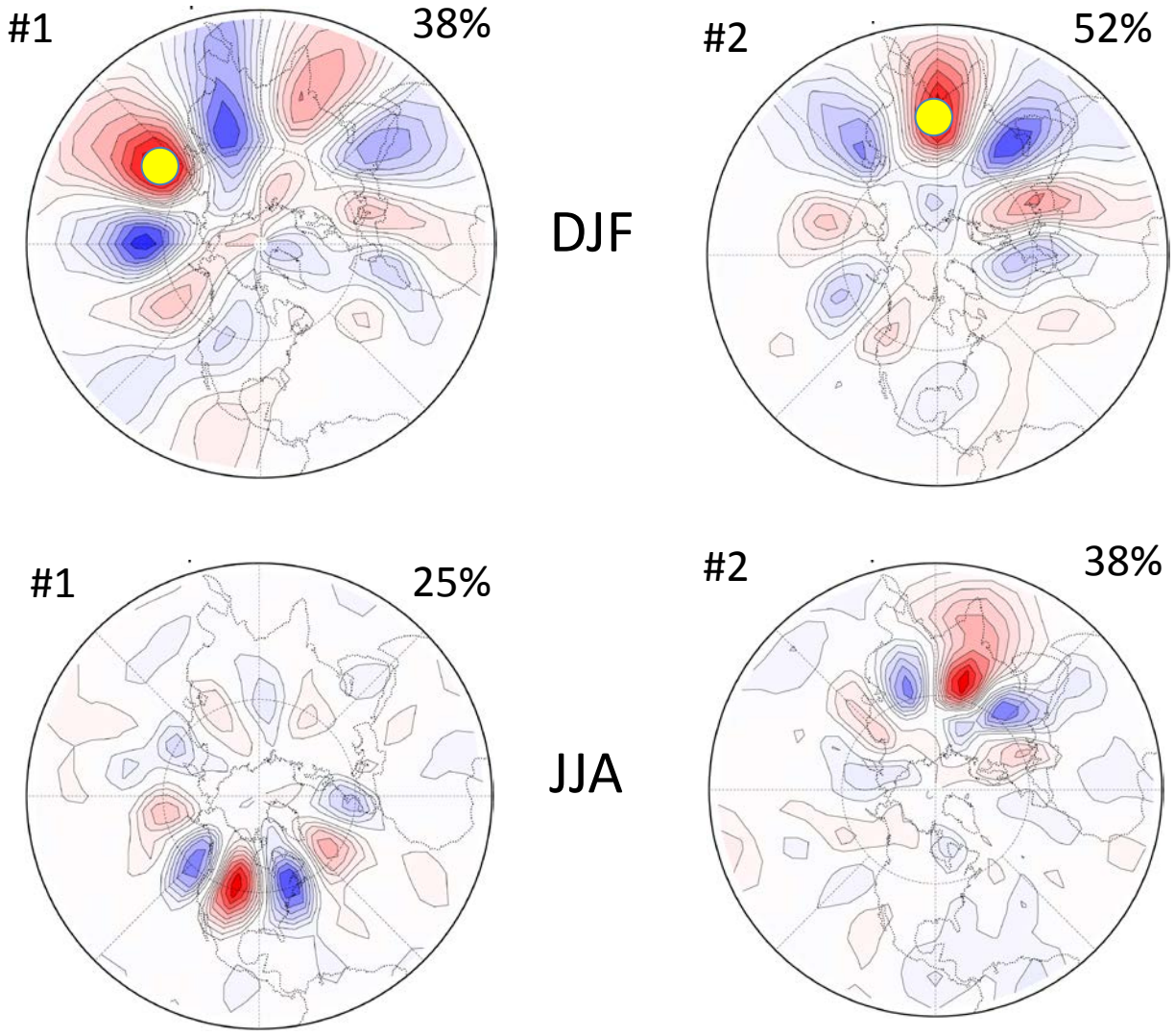


contour=0.02

Nature

Leading 1pt cor maps

(subseasonal 30d mean v200)



contour=0.1

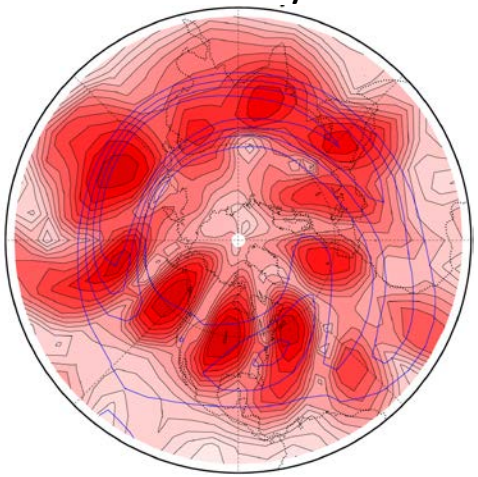
CAM5 with climatological SSTs

(subseasonal 30d mean v200)

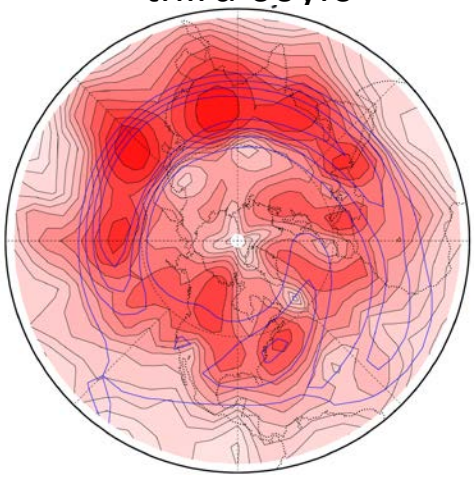
Extended Teleconnectivity 60yr Subsamples from 1000yrs

Jan

first 60yrs

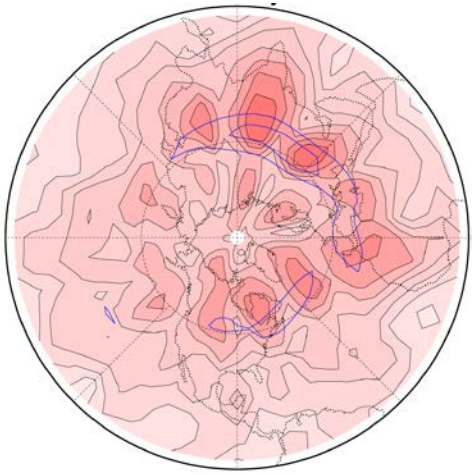


third 60yrs

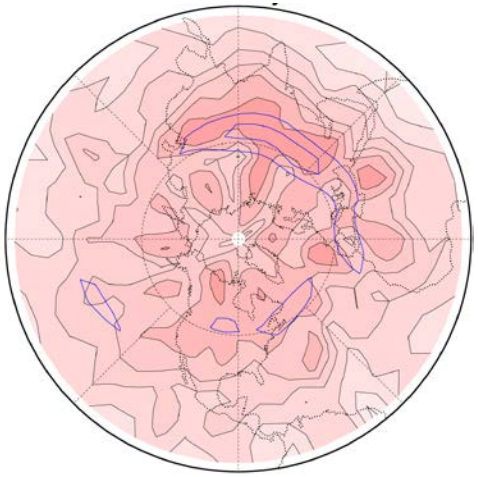


Jul

sixth 60yrs



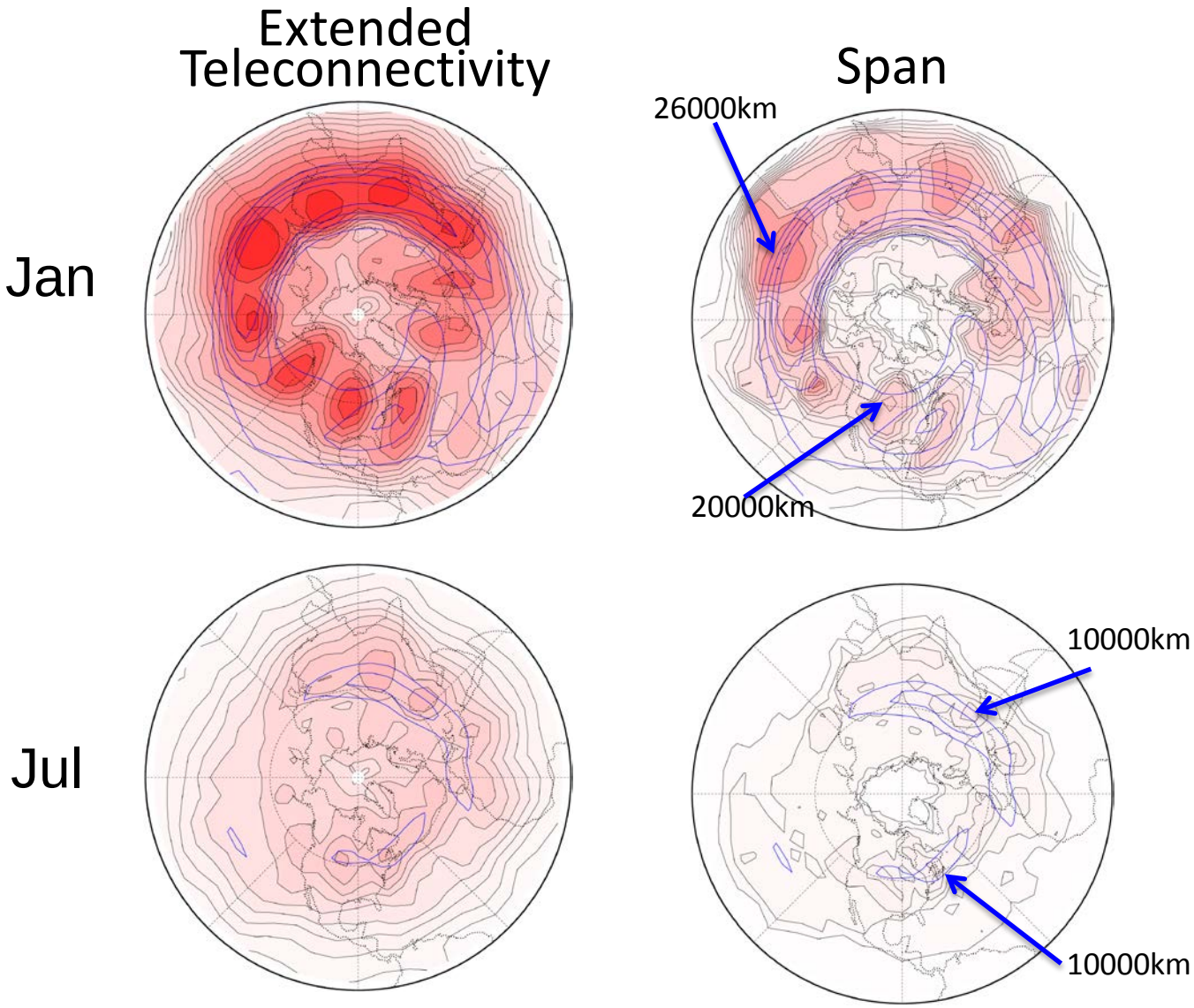
seventh 60yrs



contour=0.02

CAM5

(subseasonal 30d mean v200)

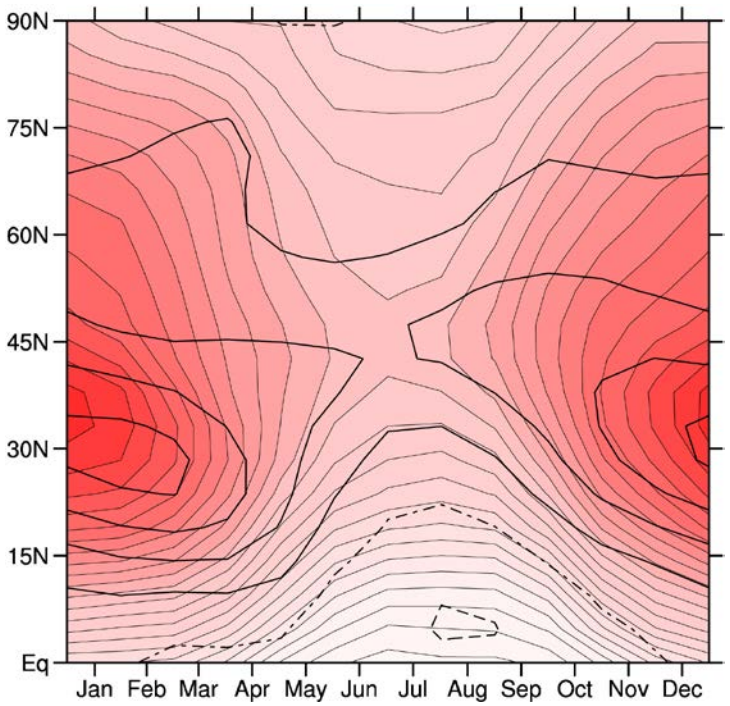


CAM5

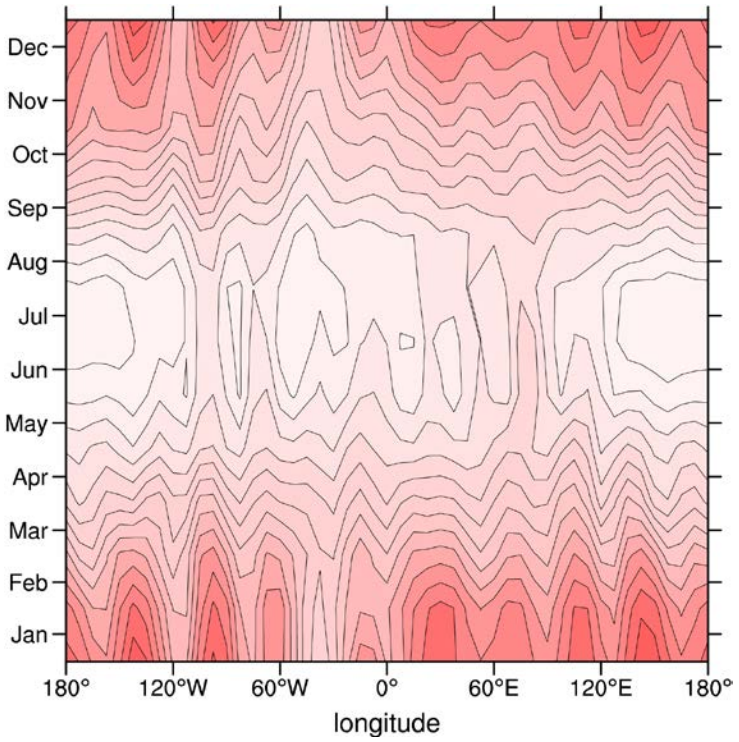
(subseasonal 30d mean v200)

Seasonality of Extended Teleconnectivity

Zonal average



20N-60N



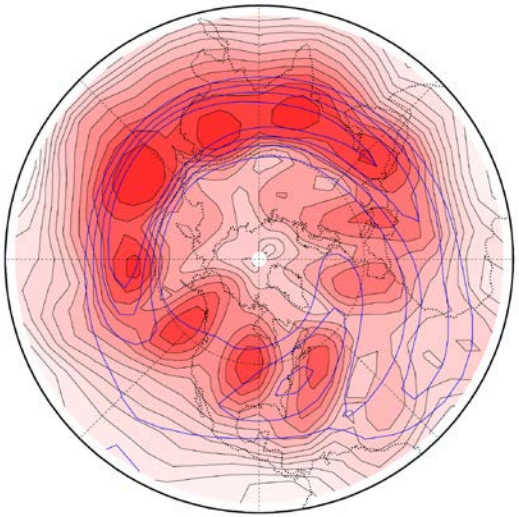
contour=0.01

CAM5

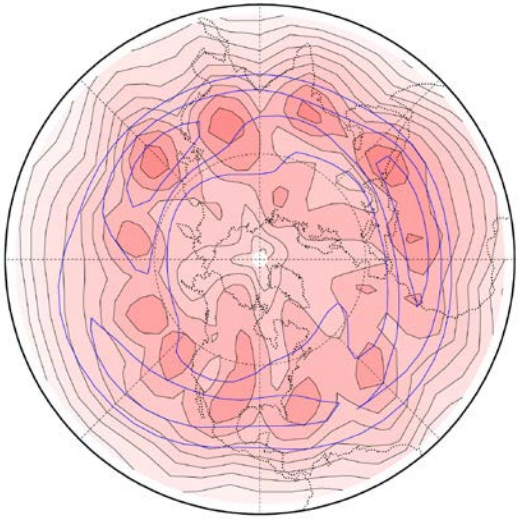
(subseasonal 30d mean v200)

Extended Teleconnectivity

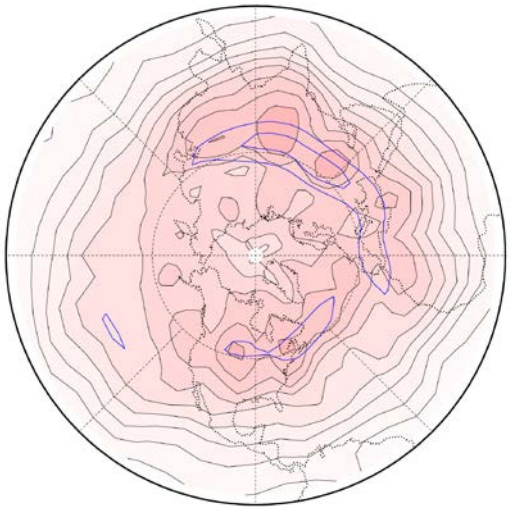
Jan



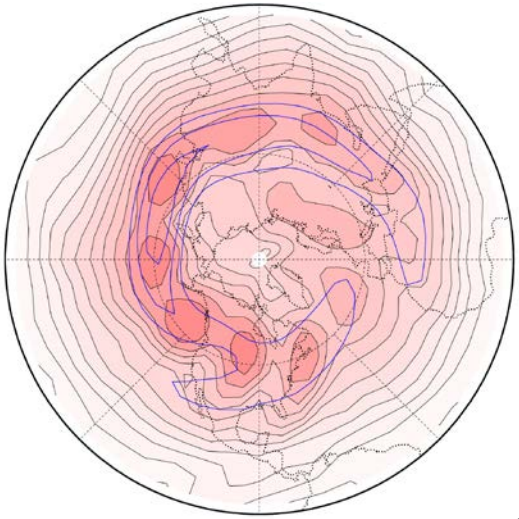
Apr



Jul



Oct



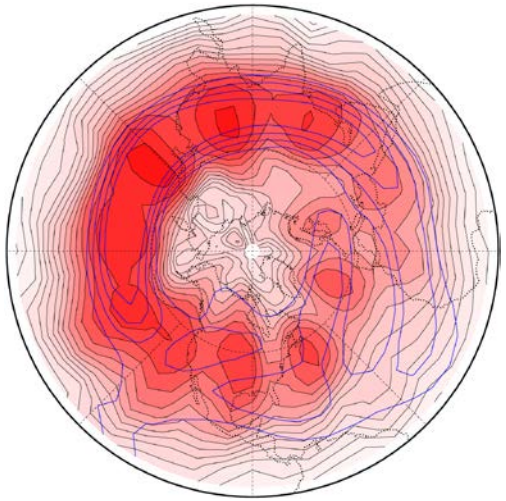
contour=0.02

Linear Planetary Wave Model

(1000 randomly force steady v200 solutions)

Extended Teleconnectivity

Jan



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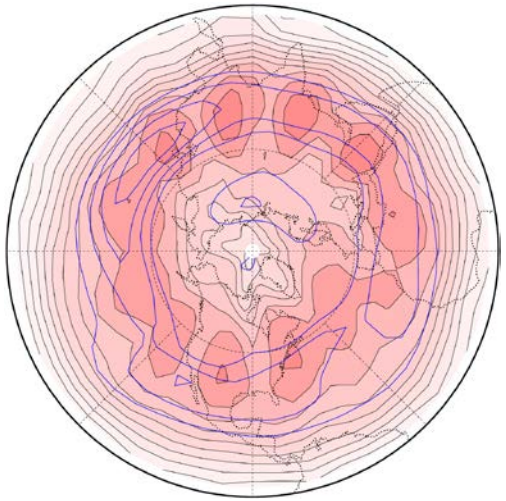

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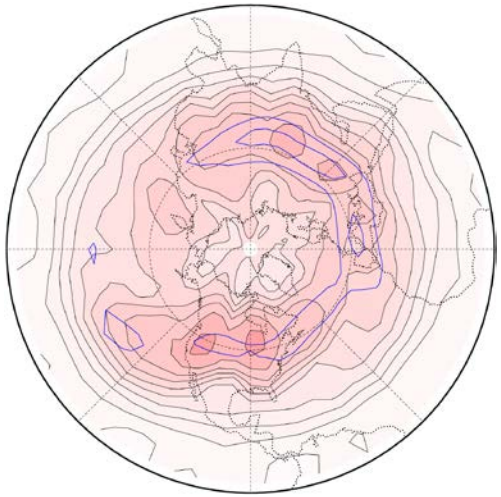

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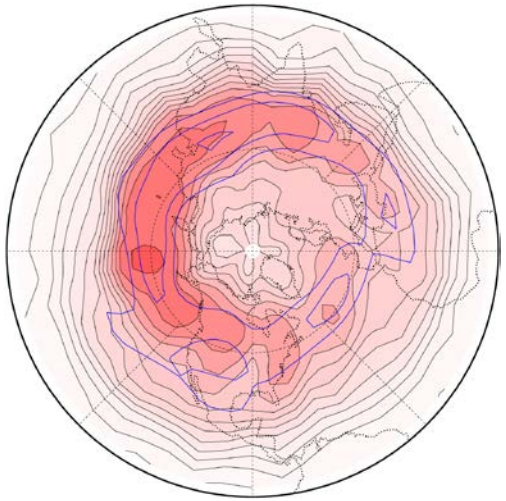


contour=0.02

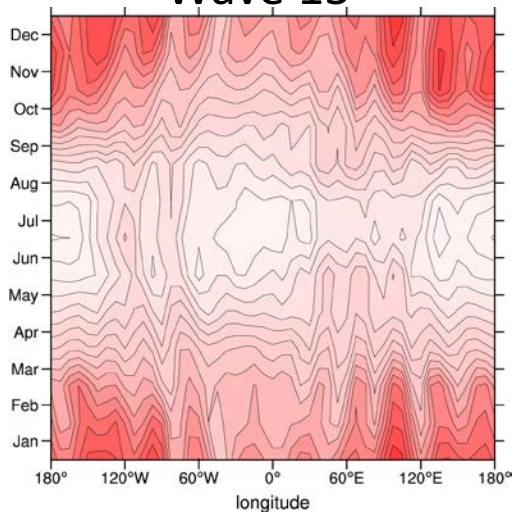
Linear Planetary Wave Model

Truncated CAM5 Basic States

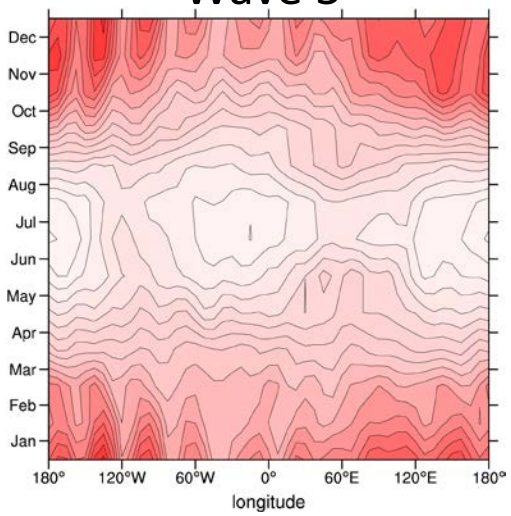
(1000 steady solns per month)

20N-60N

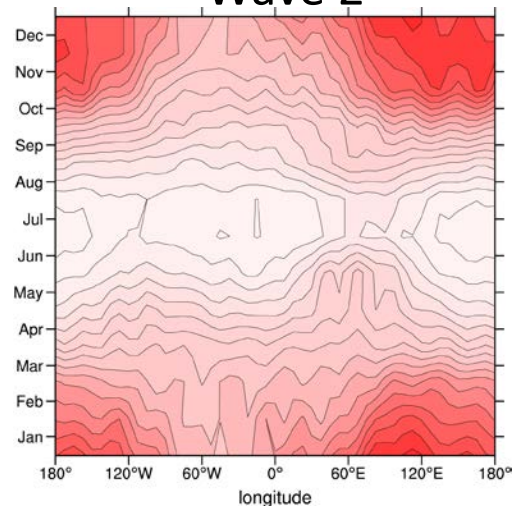
Wave 15



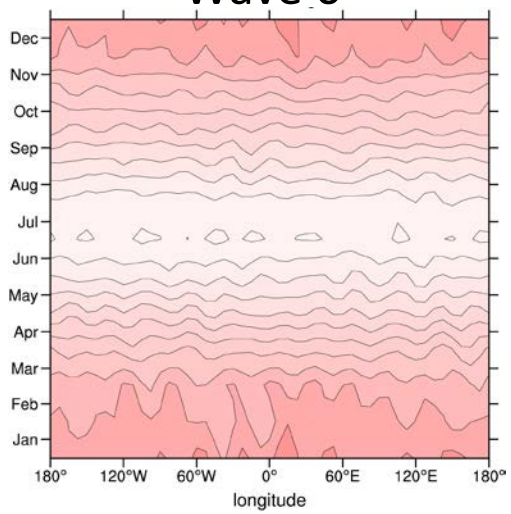
Wave 5



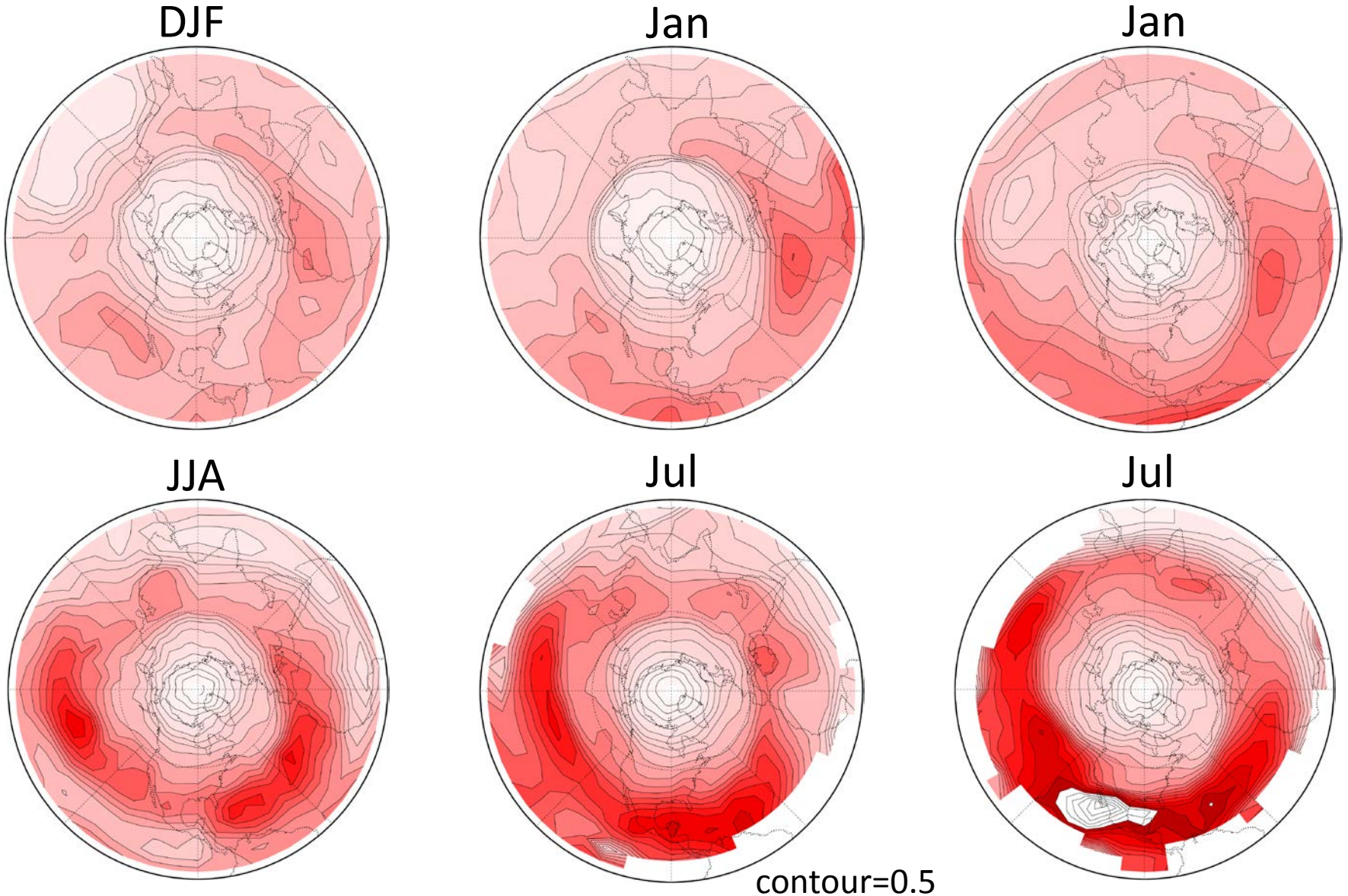
Wave 2



Wave 0



Zonal Wavenumber of 1 pt cor Maps



Conclusions

- the teleconnection signatures of the waveguide are clear in *all seasons*
- waveguide teleconnection properties fall into *two main seasons with rapid transitions between them*
- waveguide teleconnections are much *stronger, larger scale and less confined to specific longitudinal sectors in winter than in summer*
- *circumglobal teleconnections* are much less distinct in summer than winter
- most features of the seasonality are controlled by the mean state (*specific forcing is not important*) but details of the mean state matter