ASSOCIATION OF THE SYNOPTIC PROPAGATION OF OCEAN WAVE TRANSIENTS WITH ATMOSPHERIC VARIABILITY

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OUTLINE:

- Atmospheric cyclones and characteristics of their intensity
- Synoptic variability of ocean waves at different time scales
- Co-propagating patterns of ocean wave characteristics and atmospheric variability
- Climate perspective

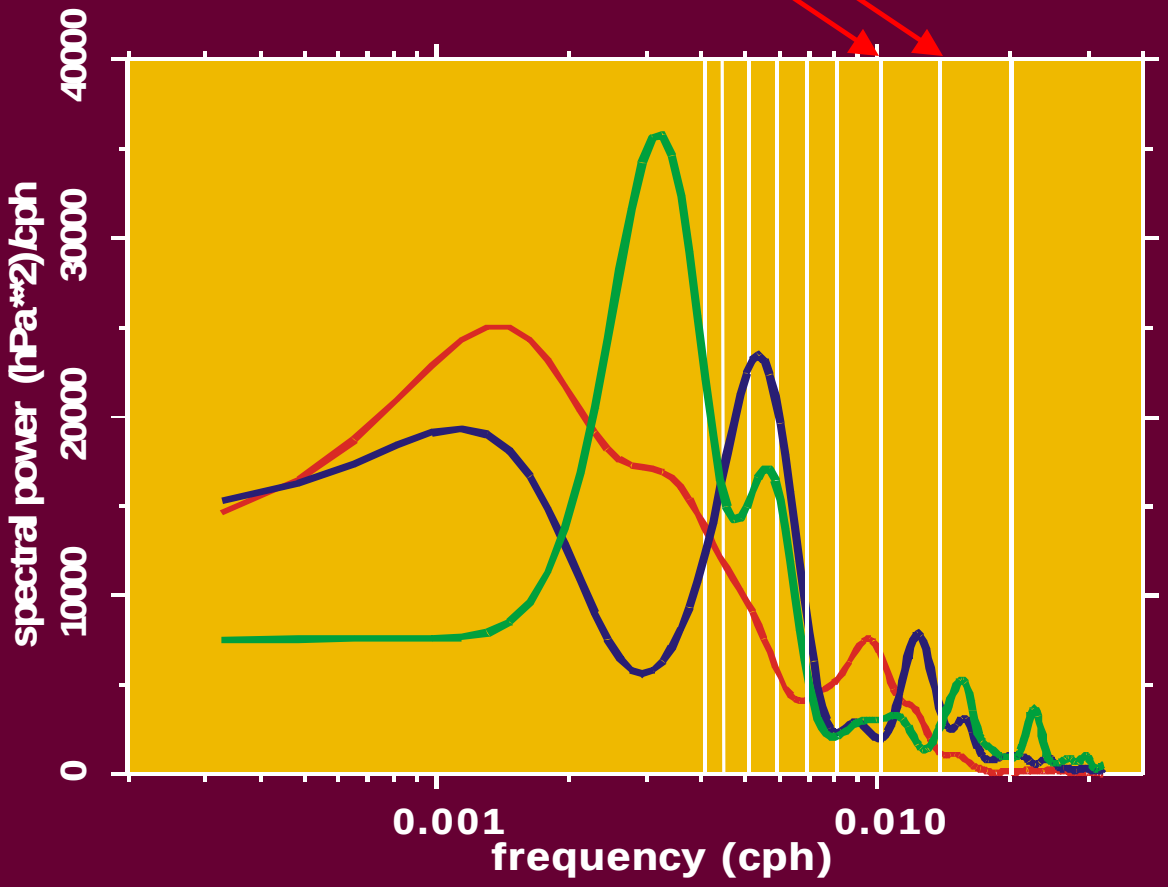
8th Wave Hindcasting and Forecasting Workshop, Hawaii, 14-19 Nov 2004

DATA:

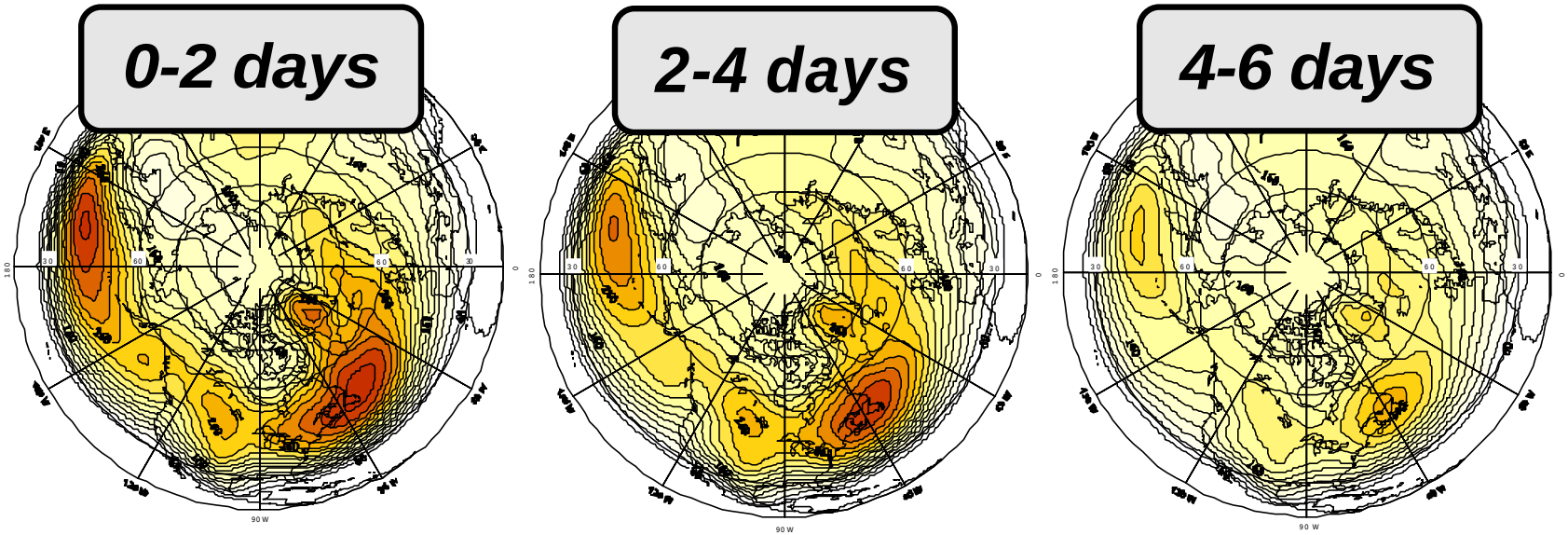
- ERA-40, 09/1957-08/2002 (45 years) 6-hourly snapshots of SWH, sea and swell
- ERA-40 6-hourly SLP snapshots
- Cyclone tracking (1958-2002)

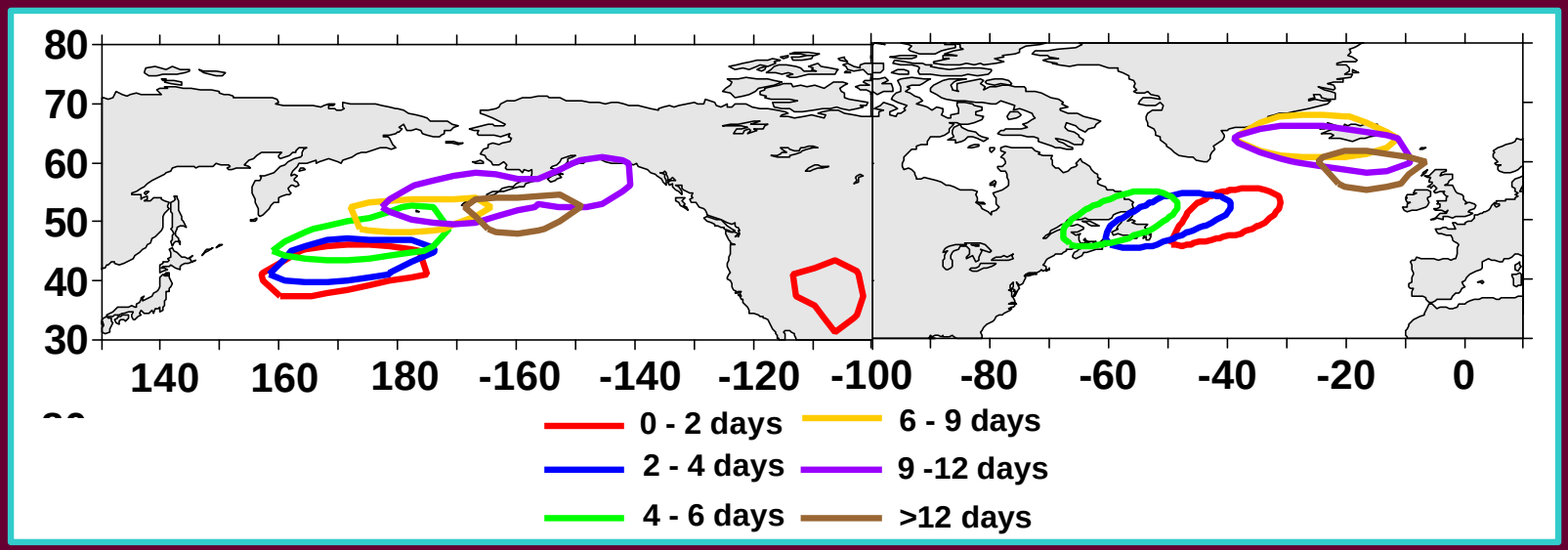
QUANTIFICATION OF SYNOPTIC VARIABILITY: BAND-PASS LANCZOS FILTERING

$$\int_{-\infty}^{\infty} x(t)dt \quad \Rightarrow \quad M[j_1, j_2] \quad \Rightarrow \quad \int_{j_1}^{j_2} x'(t)dt$$

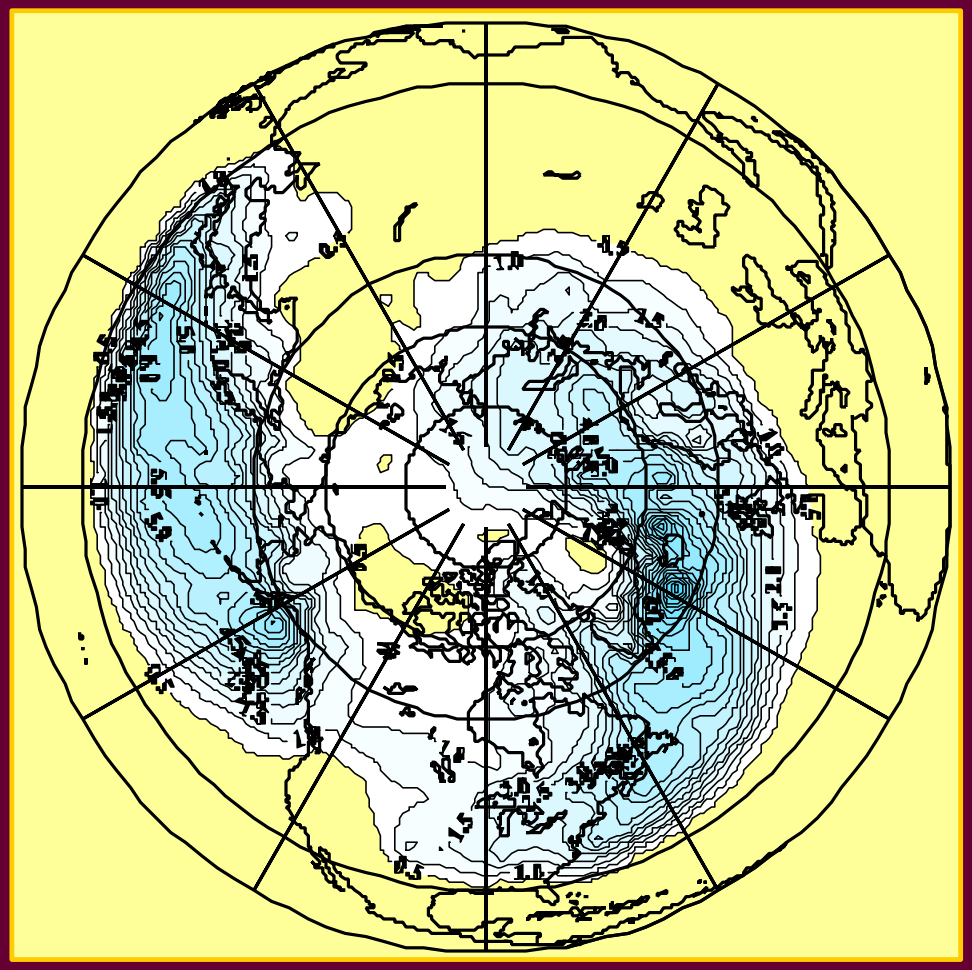


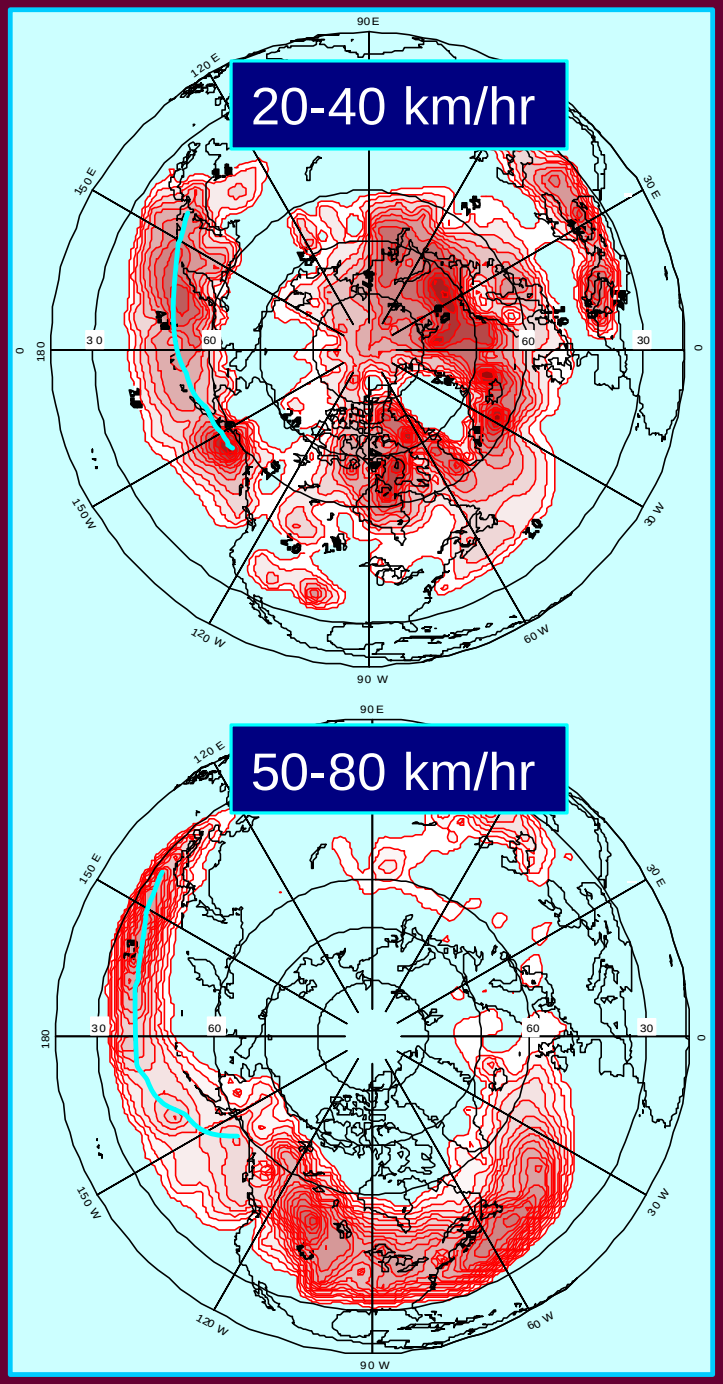
ATMOSPHERIC STORM TRACKS - bandpassing





ATMOSPHERIC STORM TRACKS – cyclone life cycle



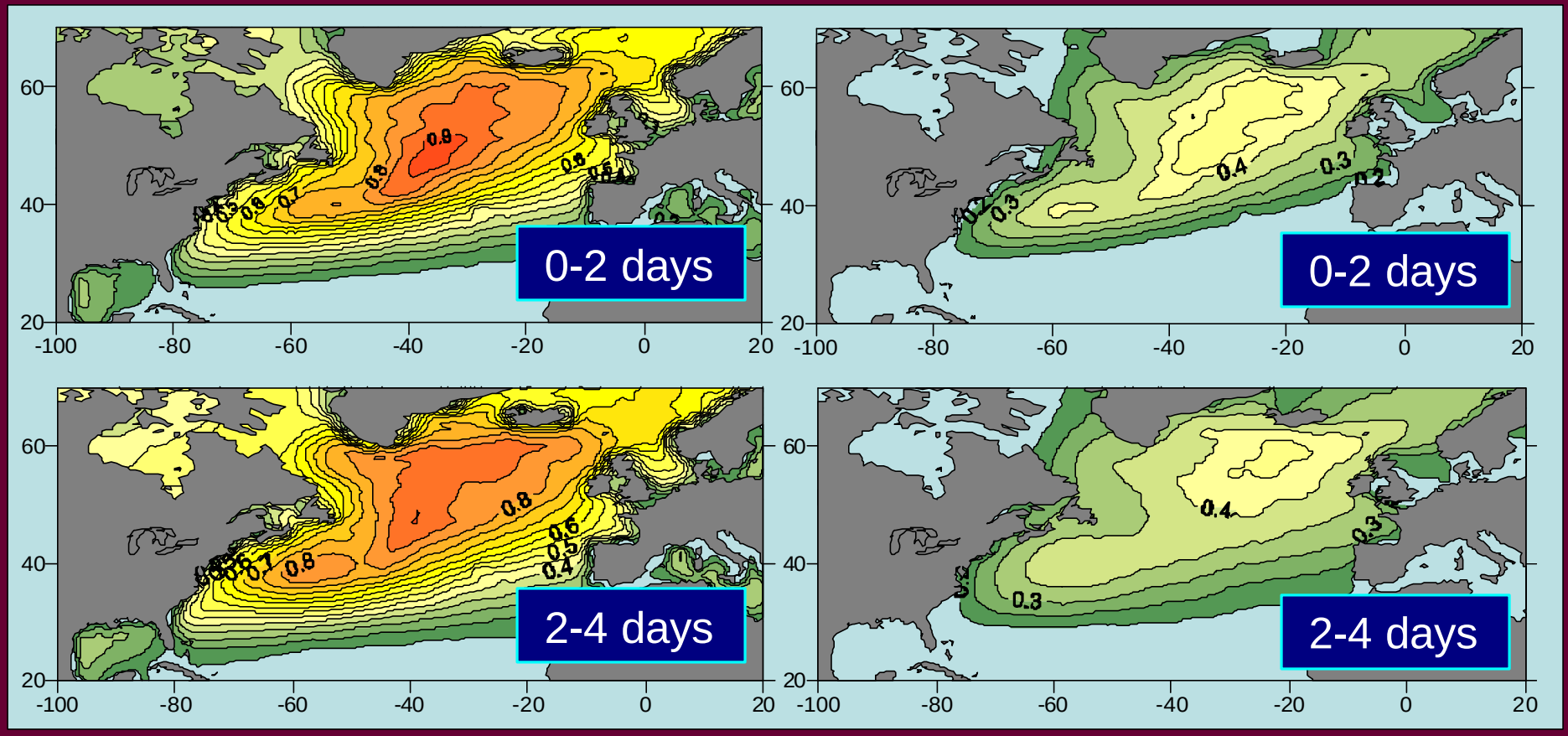


WAM wave variables bandpassing:

North Atlantic

Sea

Swell



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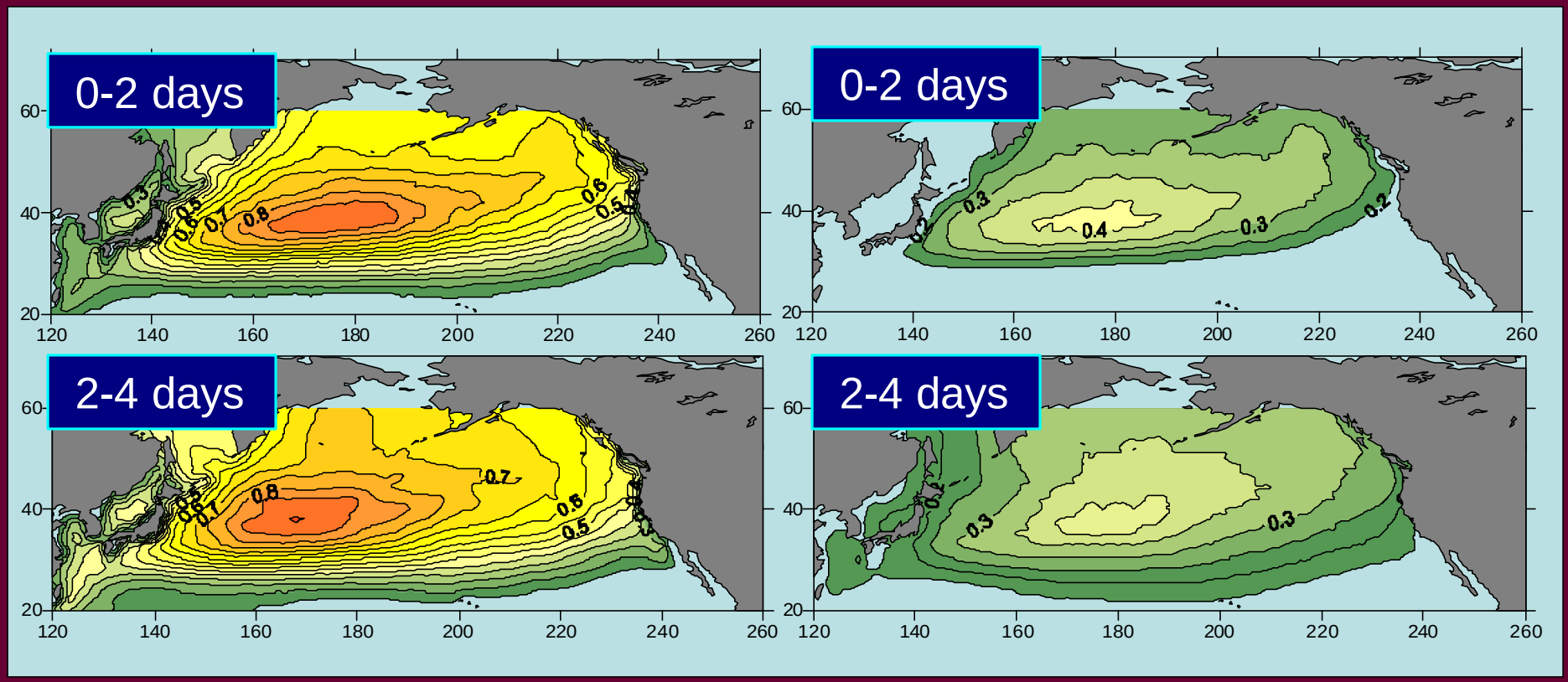
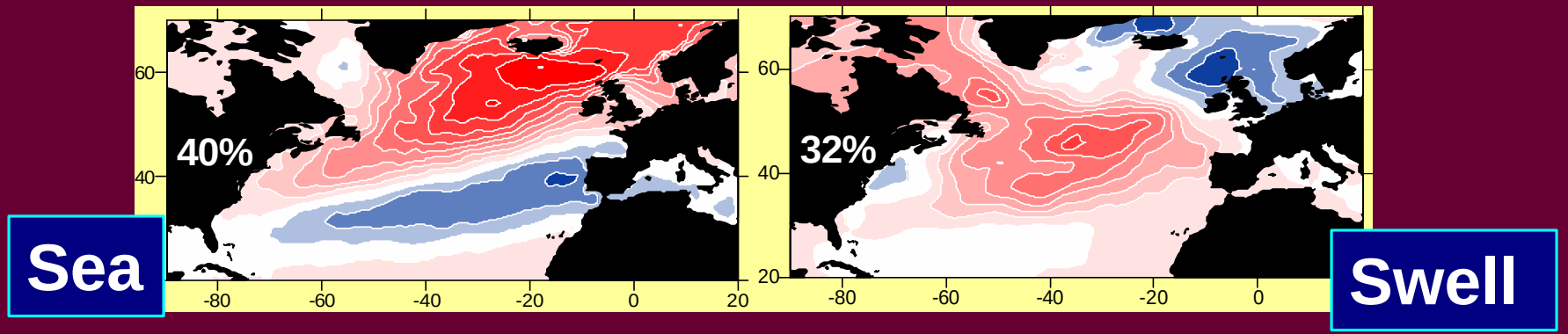
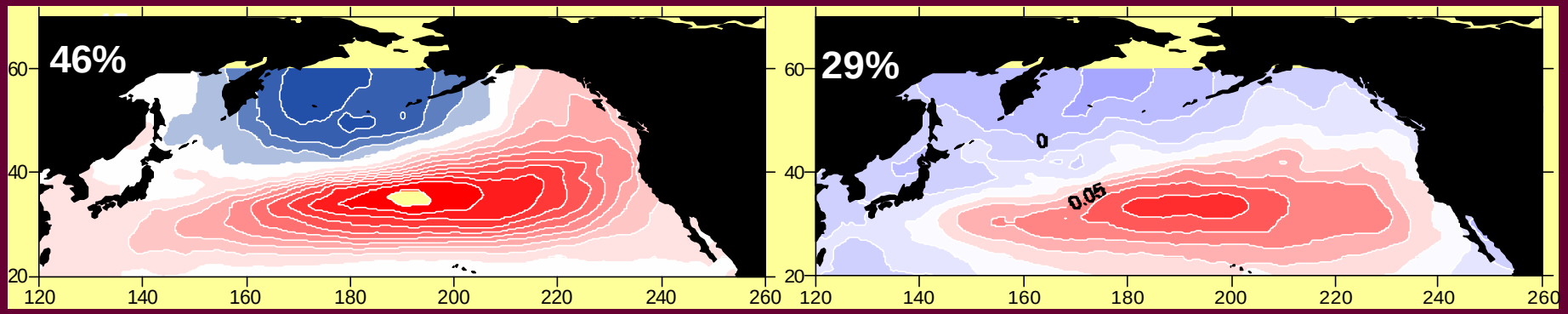
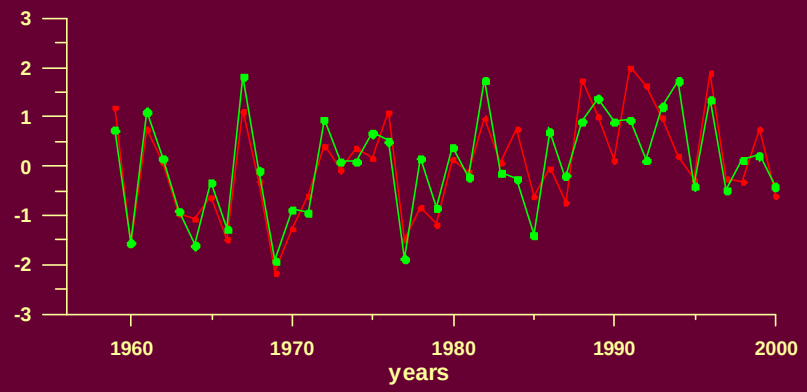
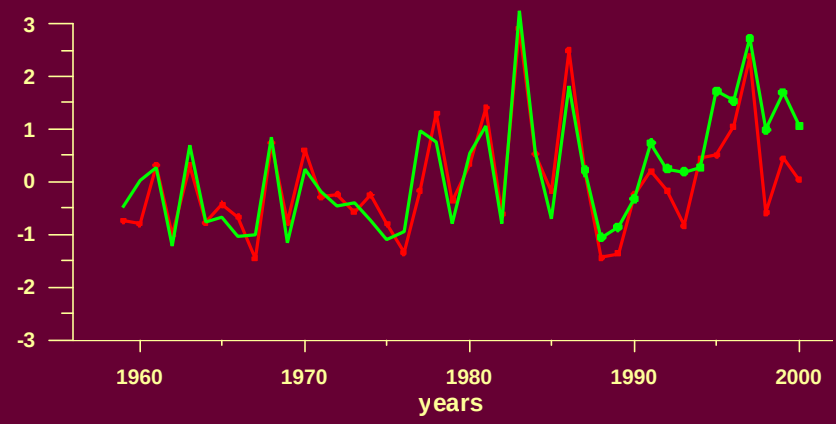


WAM wave variables bandpassing: EOFs

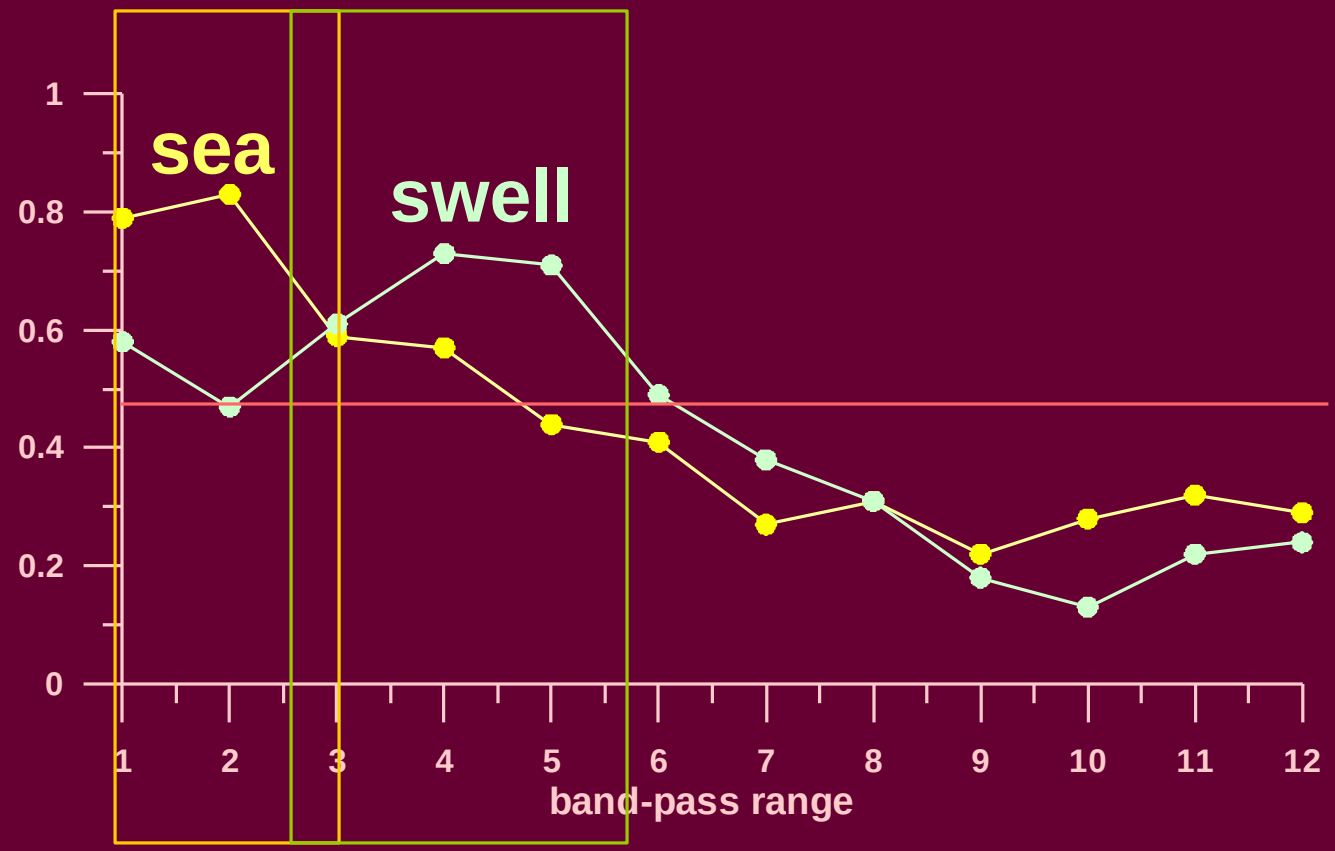




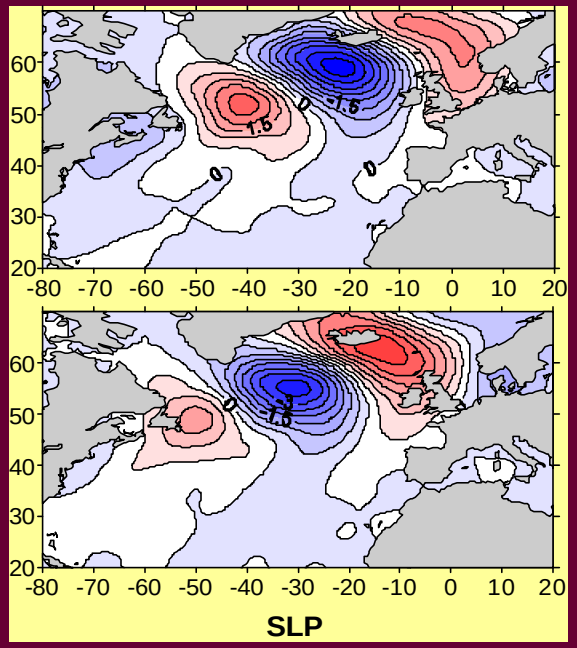




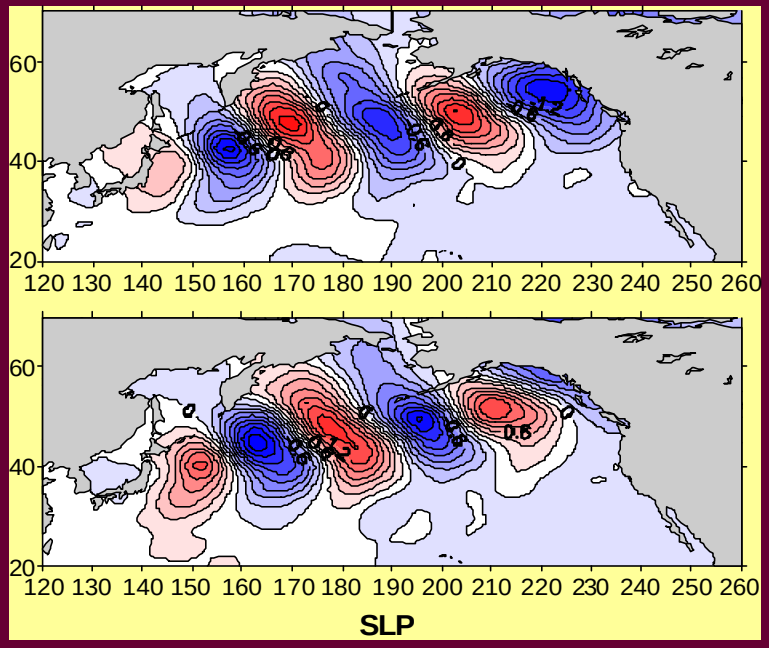
Correlation of the PCs of the STD of sea and swell with bandpass statistics of SLP for different ranges

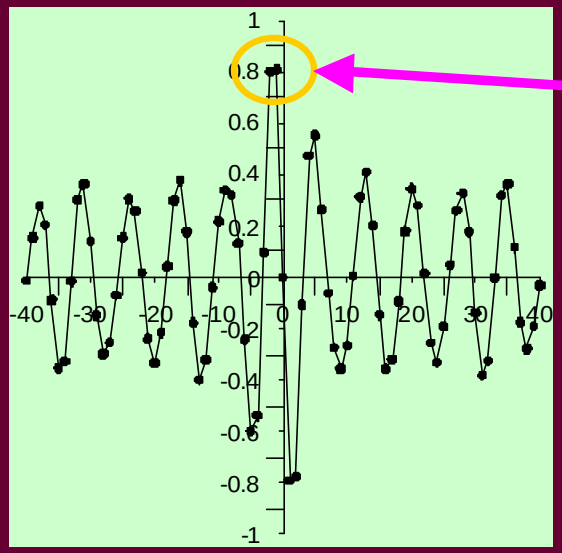


Propagating patterns: SLP

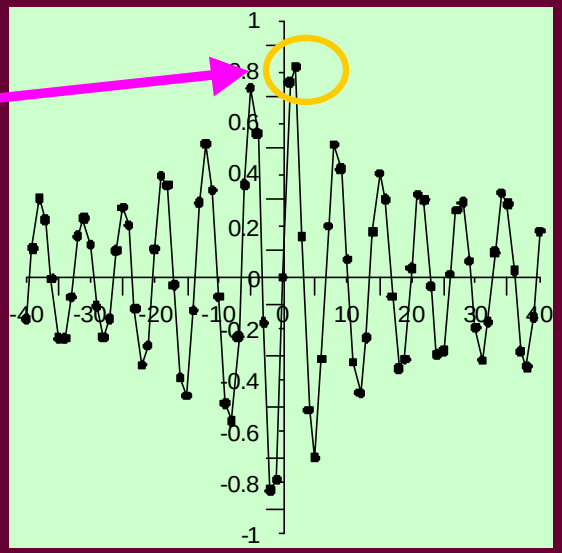


0-2 days



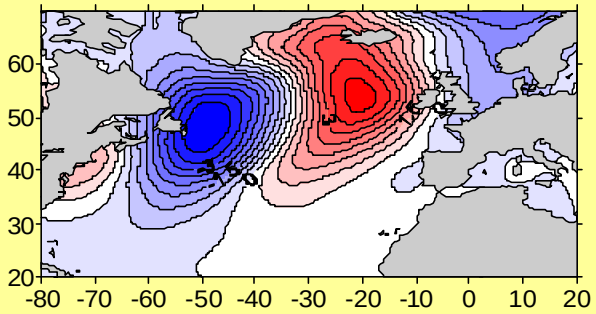


~60 km/hr

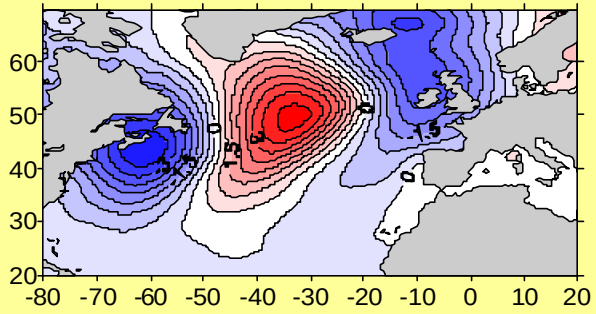


4-6 days

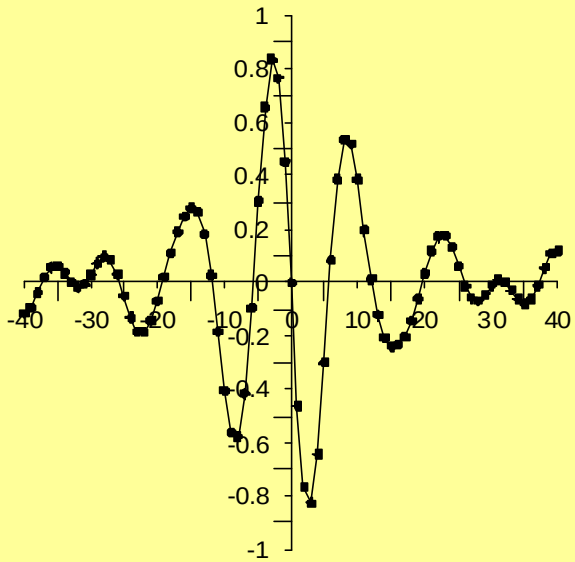
1 eof



2 eof



SLP



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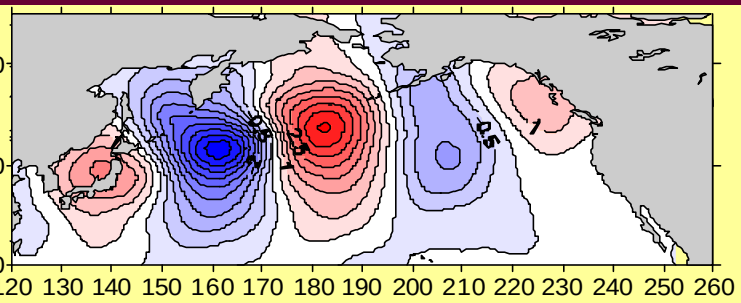

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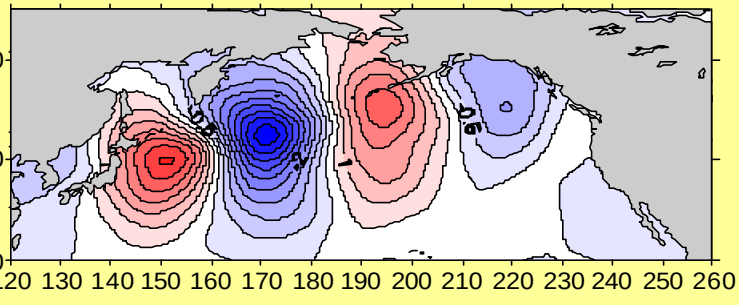
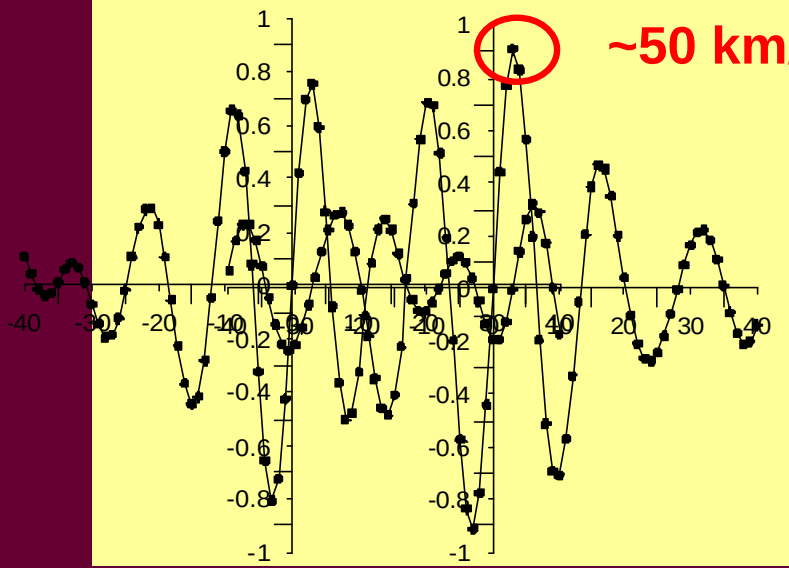


SLP

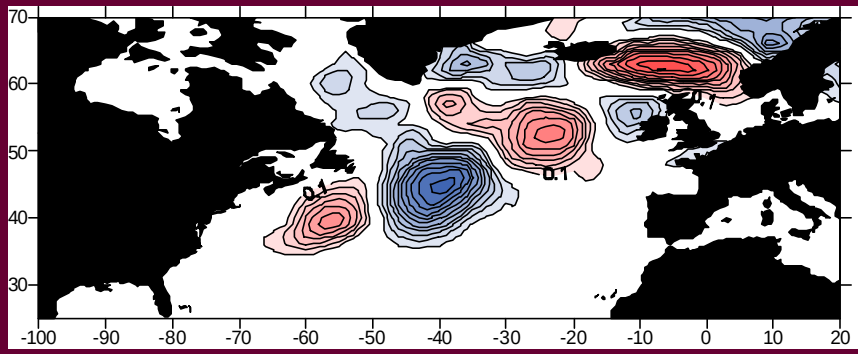
SWH



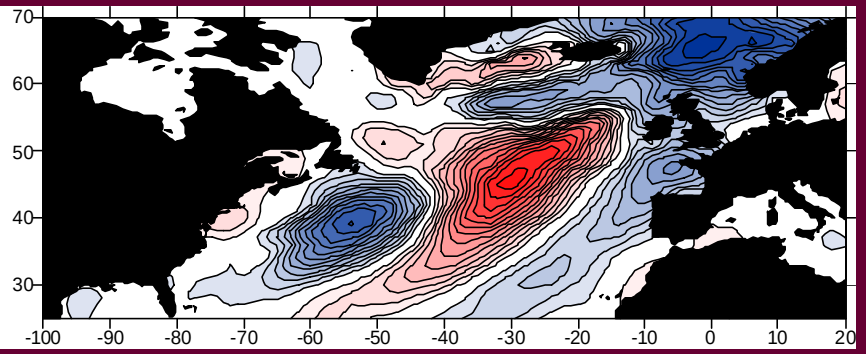
~50 km/hr

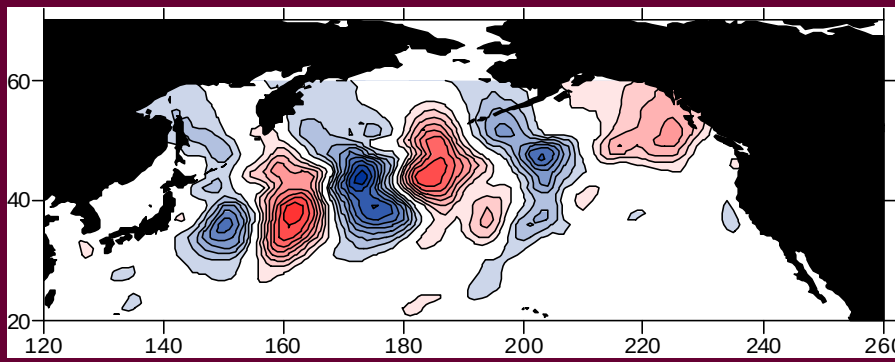
Propagating patterns: sea and swell

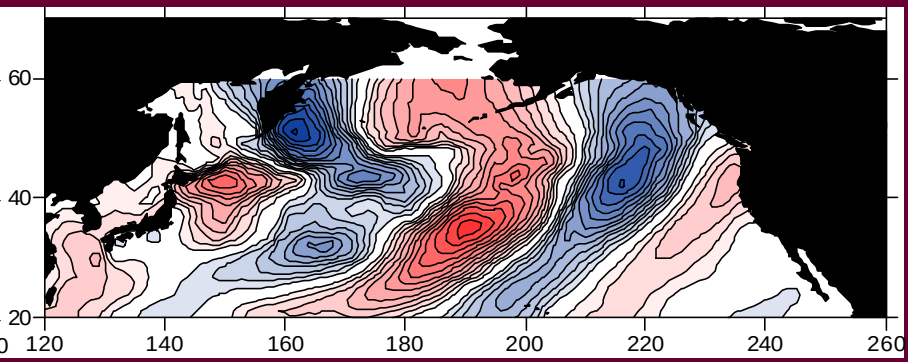
Sea



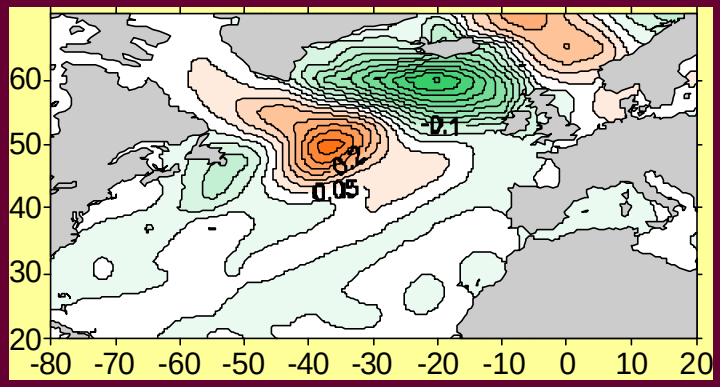
Swell

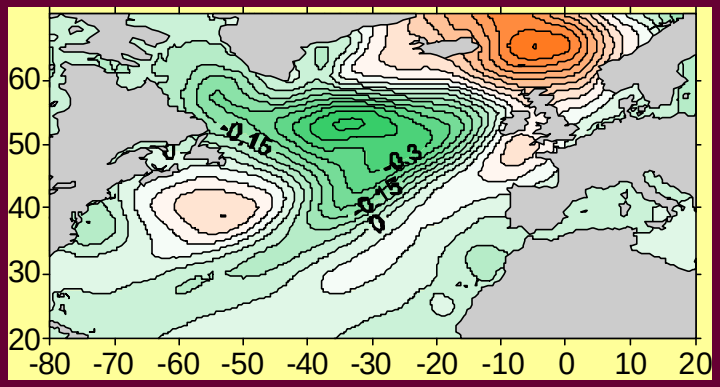


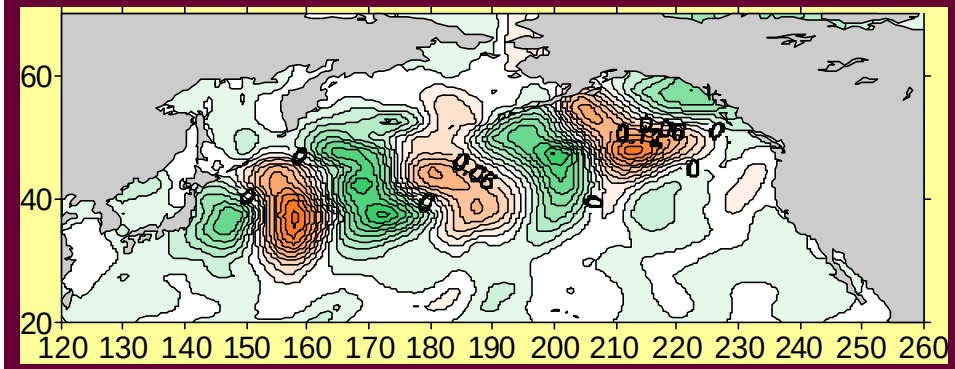


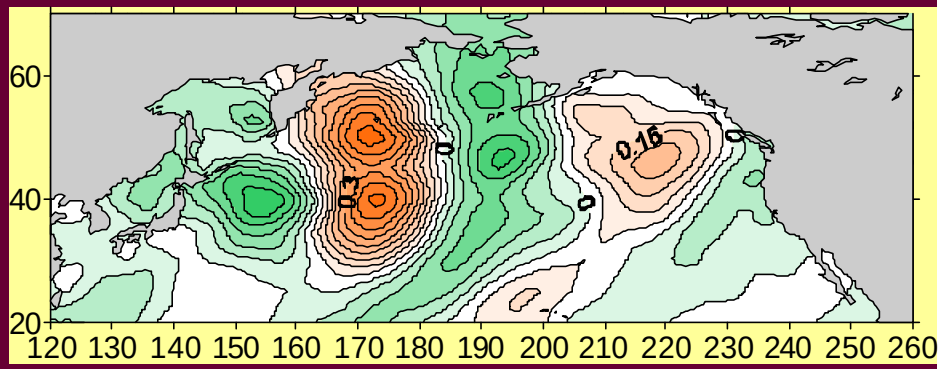


Propagating patterns: SWH







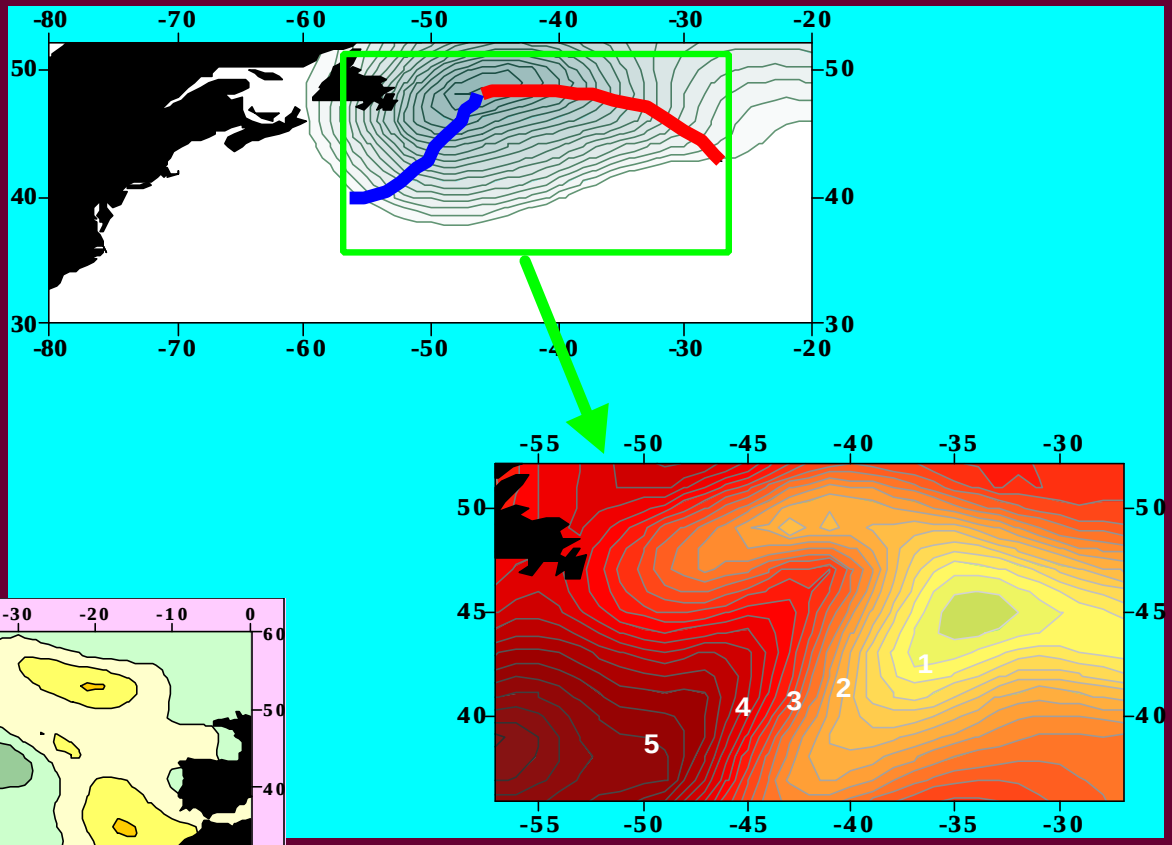


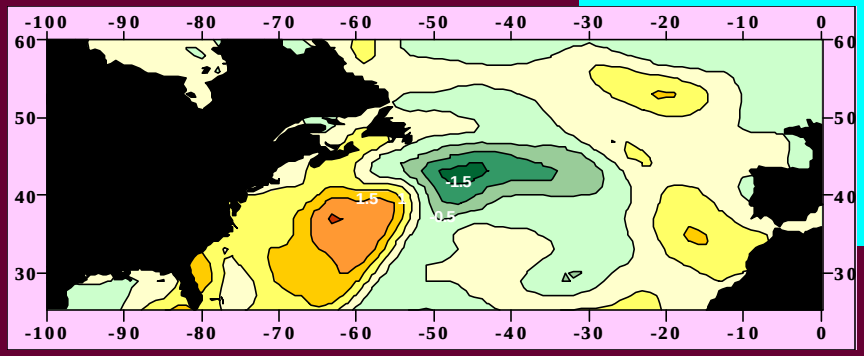
0-2 days

4-6 days

Composite of sea heigh of 32 cyclones with the location of center 48N, 47W

1982-1999





Comparison with VOS (WAM-VOS)

Conclusions:

Synoptic variability of the ocean waves from high resolution model hindcasts can be treated in the same manner as synoptic variability of atmospheric patterns

Propagating patterns in sea and swell from the ERA-40-WAM hindcast, associated with propagation of atmospheric disturbances were identified for different time scales: 1-2 days for sea and 3-6 days for swell

Spatial characteristics of the propagating patterns in sea and swell are quite different: sea patterns are very much the same as for atmospheric synoptic transients, while the swell patterns represent propagating fronts