P2.3

A Comparison of Western Pacific ET-induced Rossby Wave packets with those associated with midlatitude cyclones

Ryan D. Torn[1] and Gregory J. Hakim[2]

[1]University at Albany, State University of New York [2]University of Washington

Introduction and Motivation

Previous studies have documented how the extratropical transition (ET) of tropical cyclones can spawn Rossby wave packets along the midlatitude storm track, which can be associated with high impact weather downstream of ET and decreased predictability. During NH winter, rapidly-deepening baroclinic cyclones in the western Pacific often produce a similar midlatitude response. As a consequence, a natural question is how does the Rossby wave packets associated with western Pacific ET storms compare to those spawned by baroclinic cyclones in the winter.

Hypothesis: The Rossby wave packets spawned by ET events have similar properties to those associated with wintertime midlatitude systems

Methodology

Apply the method outlined in Hakim (2003, MWR) and lag composite atmospheric fields for both ET and wintertime cyclones and computing Rossby wave packet properties

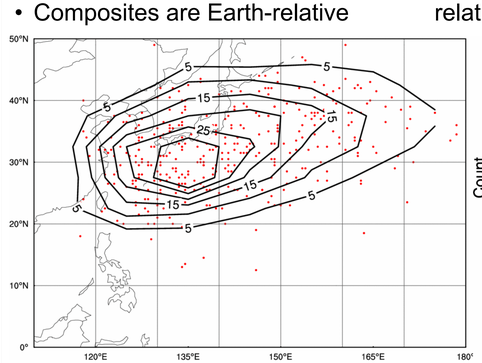
Data is derived from 6-hourly NOAA Climate Forecast System Reanalyses (CFSR) from 1979-2010 and JTWC best track data. Anomalies are computed with respect to a 28-day running climatology.

Winter Cyclones

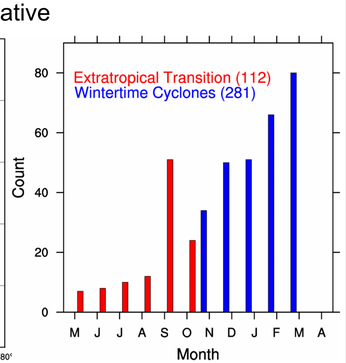
- Consider all Nov.-Mar. cyclones where 1000 hPa geostrophic vorticity > 1.0×10^{-4} sec^{-1} within 35-40°N and 140-150° E (climatological maximum)
- t = 0 h is point where cyclone first exceeds a critical value
- Composites are Earth-relative

Extratropical Transition

- Consider all recurving TCs that begin transition using (Hart 2003) phase space definition (B>10 m) between 30-35° N (maximum in ET location, see figure below).
- t = 0 h is first time when B > 10 m
- Composites are t=0 h storm-relative



Distribution of ET locations from 1979-2010

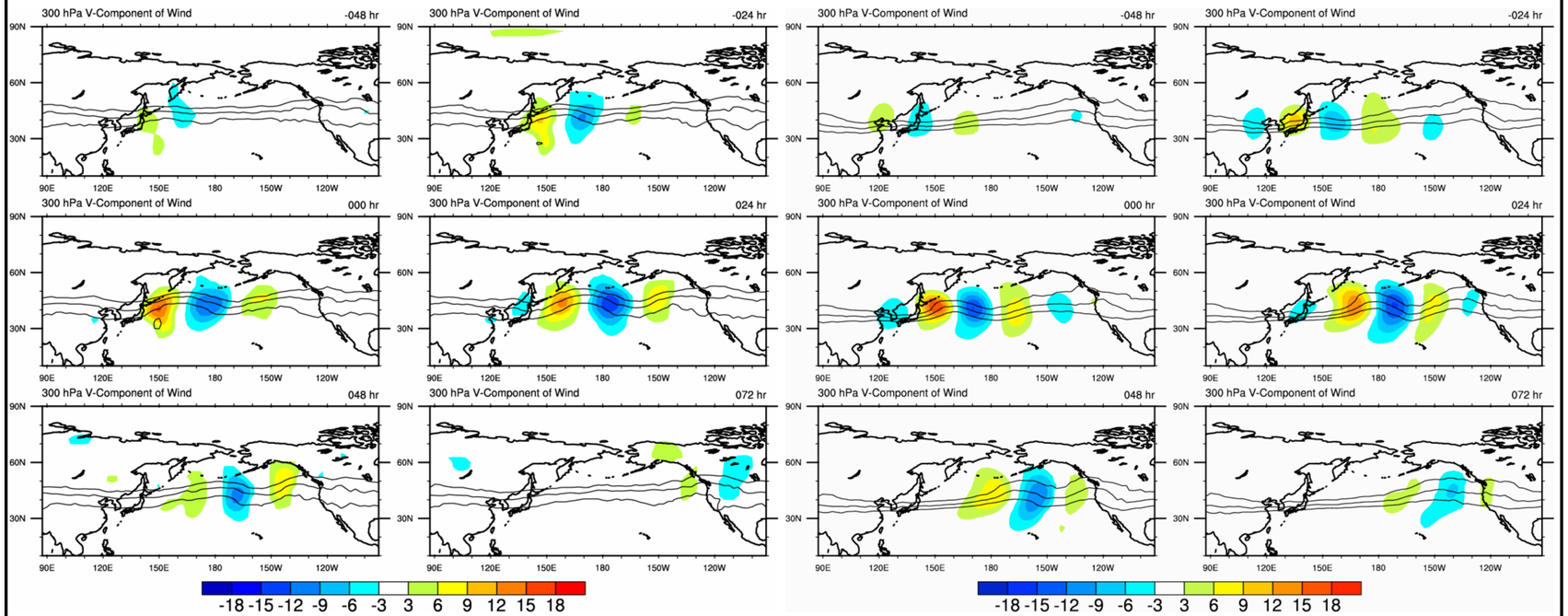


Number of ET and winter cases by month

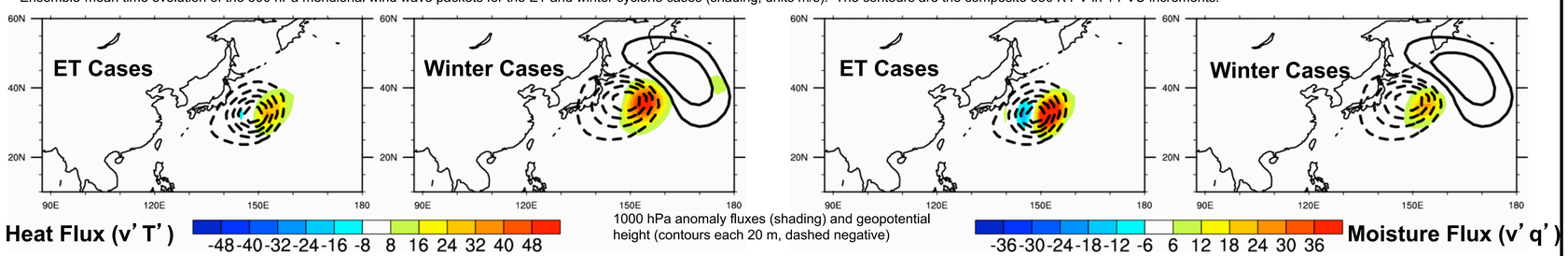
Results

Extratropical Transition

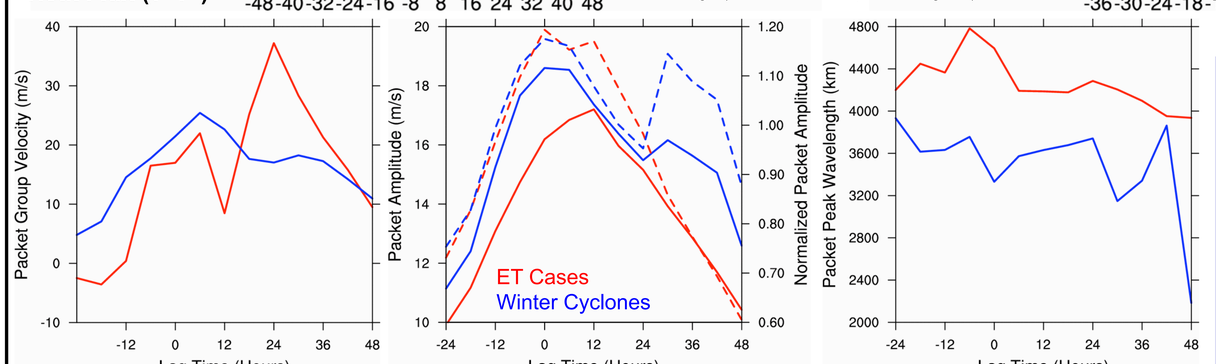
Winter Cyclones



Ensemble-mean time evolution of the 300 hPa meridional wind wave packets for the ET and winter cyclone cases (shading, units m/s). The contours are the composite 330 K PV in 1 PVU increments.



1000 hPa anomaly fluxes (shading) and geopotential height (contours each 20 m, dashed negative)



The solid line is the absolute packet amplitude, dashed is normalized by climatology

Conclusions

- Rossby wave packets associated with western Pacific ET are similar to wintertime cyclones, except:
  - ET Rossby wave is generated in situ, while winter cyclones amplify pre-existing wave packets
  - ET Rossby waves have a detectable signal further downstream compared to winter cyclones, which typically break in the central Pacific
- Future work will extend to other basins and evaluate downstream predictability