Joint IPRC/Oceanography Seminar

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"The interannual variability of Jet stream Orientation and Weather over the North Atlantic"

Interannual oscillations have small amplitude with respect to the amplitudes of mid-latitude weather systems, like the winter cyclones. Thus it is not clear how these weak oscillations affect the weather systems. We study the effect of interannual variability of the jetstream orientation on weather systems over the North Atlantic basin (NAB) using reanalysis data. The daily total kinetic energy of the geostrophic wind at 400hPa (GTKE) is taken as a measure of the collective strength of the weather systems, i.e. of storm activity over the North Atlantic. The prominent GTKE variability contains three oscillatory modes, with periods of 8.7, 5.6 and 2.7 years. These oscillatory modes are highly significant statistically and close in period to the interannual oscillations found in the North Atlantic Oscillation (NAO) index (Feliks et al. 2010, 2013). We partition the NAB into four rectangular regions, divided by the 45 W meridian and the 40 N parallel, and calculate the winter (DJFM) average of GTKE for each quadrant. The number of winter days when the average wind is faster than 30 m/s is 13–103 days in the NE quadrant and 0–2 days in the SE quadrant over the 1948–2012 period. The GTKE strength in the NE quadrant is a result of the orientation angle of the jetstream, with larger values when the jet is more zonal. To gain insight into the relation between the orientation angle and its downstream impact, we used a quasi-geostrophic, baroclinic model in a -channel forced by a Gulf Stream–like narrow SST front. The results suggest that the interannual variability found in the angle of the jet stream and the GTKE are due to the interannual variability of the Gulf Stream's SST front. Further, preliminary results of the NCAR coupled ocean atmosphere high resolution community model CESM show prominent oscillatory modes in the atmosphere and ocean, with periods of 11.6, 8.5 and 2.6 years. These oscillation periods are close to those found in the spatial average of GTKE and NAO index.

This work done together with: Michael Ghil (UCLA), Andrew William Robertson (Columbia University) and Justin Small (NCAR).

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