Geophysical Research Abstracts
Vol. 19, EGU2017-2066, 2017
EGU General Assembly 2017

The importance of wave break events for synoptic-scale buildups of Northern Hemisphere zonal available potential energy

Kevin Bowley, Eyad Atallah, and John Gyakum
Dept. of Atmospheric and Oceanic Sciences, McGill University, Montreal, Canada (kevin.bowley@mail.mcgill.ca)

Zonal available potential energy (ZAPE) is an estimate of the amount of potential energy in the atmosphere available for conversion to kinetic energy, providing a good proxy for the overall strength of the general circulation. Previous studies have estimated total hemispheric ZAPE, ZAPE generation, and conversion to kinetic energy, and proposed physical mechanisms to describe the annual ZAPE cycle as well as short term (sub-seasonal to synoptic) APE depletion events. Large, short term modulations of ZAPE have been shown to be associated with impactful weather events in the mid- and high-latitudes, including severe cyclones and high-amplitude ridging and blocking events

In this study, we examine the association of significant synoptic time-scale increases in ZAPE with dynamic tropopause wave break events. ZAPE buildup events are determined using a 1979-2011 daily Northern Hemisphere (20˚-85˚ N) ZAPE climatology calculated from the National Centers for Environmental Prediction (NCEP) Department of Energy (DOE) Reanalysis 2 global reanalysis dataset in an isobaric framework. To diagnose the importance of wave breaks in the troposphere, we objectively identify wave breaks using potential temperature on the dynamic tropopause, identifying and tracking both anti-cyclonic (LC1) and cyclonic (LC2) wave breaks during the 1979-2011 period. Our results indicate that LC1 wave break events in the equatorward jet exit regions appear to play an important role in ZAPE buildup events. The formation of these anti-cyclonic wave break events result in the development of statistically significant warm-core high pressure anomalies in these regions, acting to reduce baroclinic conversions. We will further demonstrate that changes in LC2 wave break activity in the climatological storm track during ZAPE buildup events are indicative of notable changes to the regions of significant cyclone activity, which are occurring in response to shifts and elongations of the jet stream.