NOAA's 27th Annual Climate Diagnostics and Prediction Workshop
Abstract

Downstream weather impacts associated with atmospheric blocking: Linkage between low-frequency variability and weather extremes

Marco L. Carrera, R. W. Higgins, and V. E. Kousky
Climate Prediction Center NCEP/NWS/NOAA
Email: **Marco.Carrera@noaa.gov**
Ph: (301) 763-8000 x7020
Fax: (301) 763-8395

A common finding among scientific studies is that long-lived weather extremes are often associated with recurrent atmospheric flow anomalies. Persistent anticyclonic anomalies (i.e., blocking events) represent a difficult forecast challenge, severely limiting the skill of medium range forecasts. In this study we will examine the linkage between low-frequency variability as expressed in terms of persistent anticyclonic anomalies and weather extremes in an effort to aid forecasters and decision makers.

Using the NCEP/NCAR reanalysis we identify persistent 500 hPa anticyclonic anomalies over both the Northeast Pacific (35 events) and Southeast Pacific (41 events) Oceans during their respective cold seasons between 1979 and 2000. These two regions were chosen owing to the high frequency of occurrence of persistent anticyclonic anomalies and the potentially significant downstream weather impacts which can occur over both North and South America. The mean signature over both regions is a pronounced ridge at 500 hPa over the key area flanked by upper tropospheric troughs both upstream and downstream. Our early findings for the Northeast Pacific region indicate a preference for persistent anticyclonic anomalies to occur during the neutral or cold phase of ENSO, while for the Southeast Pacific persistent anticyclonic anomalies are favored during the warm phase of ENSO.

In our study of weather extremes we will focus upon daily temperature and precipitation to address the question as to whether extremes of temperature and precipitation are favored during blocking events. For persistent anticyclonic anomalies over the Northeast Pacific, a large upper-tropospheric ridge is centered over the Gulf of Alaska with a pronounced downstream trough over central North America. The northwesterly flow between the ridge and the downstream trough supports anomalously cold surface temperatures stretching from northwestern Canada to the Gulf of Mexico. In the southwesterly flow downstream of the upper-tropospheric trough, anomalously warm surface temperatures are found over Florida and the Gulf Coast. Precipitation appears to be enhanced in two principal regions. Downstream of the upper-tropospheric trough precipitation is enhanced over much of the US East Coast, with the exact location of the precipitation maximum sensitive to the orientation and placement of the trough. In some of the persistent anticyclonic anomaly cases, a strong upper-tropospheric low in the subtropical eastern Pacific, equatorward of the persistent ridge, can act to enhance the moisture transport into the US West Coast leading to greater precipitation in this region. Our future work will examine the extreme nature of both the temperature and precipitation anomalies on a regional basis by subdividing the US into geographical areas and considering area-averaged anomalies.

For the Southeast Pacific events, the surface temperature impacts over South America are not as pronounced. The most notable signature is a cold surface temperature anomaly over extreme southern South America and a warm anomaly to the northeast over southern Brazil. This anomaly dipole can be explained on the basis of the split upper-tropospheric flow observed downstream of the persistent 500 hPa ridge. Using a daily precipitation dataset for Brazil we will examine the precipitation extremes associated with these persistent anticyclonic anomalies over a large area of South America.