

TWO EXTREME CASES OF ATMOSPHERIC BLOCKING OVER EUROPE AND NORTH AMERICA

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ABSTRACT

Atmospheric blocking is simply the inhibition, on the synoptic and planetary scale, of the normal mid-latitude progression of migratory cyclones and anticyclones. While the block itself is readily observable as a 500-hPa positive geopotential height anomaly, the dynamical onset of the blocking flow is still not understood.

It has been shown through various studies that prolonged or episodic atmospheric blocking can impact the climatological character of the region in which they occur for one to two seasons following the event. Seasonal modifications imposed on a given region by blocking anticyclones not only deprive the area of the typical temperature and precipitation regimes, but also produce climatological extremes that can malignantly affect the land and populations residing in specific areas.

In this study, two cases of extreme blocking are analyzed using NCEP-NCAR gridded reanalyses. The first case is the 2003 European heat wave. This event was confined to Western Europe, where the ensuing heat wave produced a death toll on the range of 40,000 over the summer season. The most severe period occurred from 06 – 13 August 2003. The second case is

analogous to the 2003 European heat wave in scale and magnitude.

The 2004 Gulf of Alaska event, "Baked Alaska," prompted abnormally high temperatures and less-than-normal precipitation (over the period of June through August) that led to anomalous melting over the summer season. It should be noted that the Gulf of Alaska event was not merely one episode, but two distinct events.

As with events such as those above, the greatest problem affecting the study of blocking flows is the degree to which this phenomenon can be forecasted numerically. In this investigation, a mathematical entity, known as a Lyapunov exponent is utilized in an effort to determine the fluid stability of the atmosphere within a blocking flow. A better understanding of stability may yield an increase in the forecast lead-time as well as a greater understanding of blocking itself. While Lyapunov exponent analysis delves into the characteristics of flow stability, a more powerful tool emerges in that these exponents can examine the local predictability of the flow itself.