Geophysical Research Abstracts, Vol. 7, 10447, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10447

Possible causes of the south-central European heat wave of 2003 – a diagnostic perspective

K. Wolter (1), M. Baldi (2), T.N. Chase (1), J. Otterman (3), R.A. Pielke, Sr. (4) and I. Rasool (5)

(1) University of Colorado, Boulder, USA, (2) IBIMET-CNR, Rome, Italy, (3) NASA/GSFC, Greenbelt, USA, (4) Colorado State University, Fort Collins, USA, (5) Consultant, Paris, France (klaus.wolter@noaa.gov / Fax: +1 303-4977013 / +1 303-4976340)

The summer 2003 heat wave in south-central Europe was deadly. Over 30,000 people perished, more than in any European weather-related disaster in more than 50 years. Initial estimates of economic losses (at least US$ 13 Billion) place the European heat wave on top of all natural disasters of 2003. Most of this was due to agricultural (crop) losses and damages due to forest fires, in particular in Portugal.

Using *in situ* observational and NCEP-NCAR Reanalysis data we have investigated the possible causes of this unusual event. For the summer as a whole, the European heat wave appears quite unusual in that the 1000-500 mb thickness anomalies (as well as the surface temperature anomalies) exceeded three standard deviations in Europe while there were no similarly unusual anomalies elsewhere in the world. The global average 1000-500 mb thickness anomalies for the June-August period, however, were 1.3 sigma values (3^{rd} warmest) above the 1979-2003 global average so that the exceptional warmth in western Europe was exacerbated by an already warmer lower troposphere.

We propose that the anomalous circulation pattern during the summer of 2003 was associated with SST anomalies in the Atlantic and Mediterranean ocean basins. In turn, these SST anomalies may have been linked to typical lingering effects from the decaying El Niño event of 2002-03, as well as an unusually active West African monsoon. During the European spring season, mature El Niño events tend to create SST anomalies over the North Atlantic that are associated with below-normal rainfall over the Iberian peninsula and Western Mediterranean. In the subsequent summer season,

lower tropospheric temperatures are often above-normal over the same region, possibly amplified due to reduced soil moisture. This sequence was also observed during 2003. Meanwhile, if the West African monsoon reaches further north and is more intense than average, as in 2003, the summer tends to get hotter and drier than average in the western portion of the Mediterranean region. This hypothesis is supported by a separate modeling study using the Regional Atmospheric Modeling System (RAMS). While there are some indications that concurrent African summer monsoon seasons and ENSO events are inversely related (El Niño associates with Sahel drought), the following monsoon seasons appear unrelated to the preceding ENSO phase.

It therefore appears that the heat wave 2003 in south-central Europe was the unfortunate consequence of a combination of largely unrelated climate drivers, superimposed on an underlying warming trend, rather than as a direct result of lower tropospheric global warming.