Assessment of the current state of climate including large-scale climate patterns worldwide and assessments of its likely evolution in the course of the next months

Roxana Bojariu, National Meteorological Administration, Bucharest, Romania

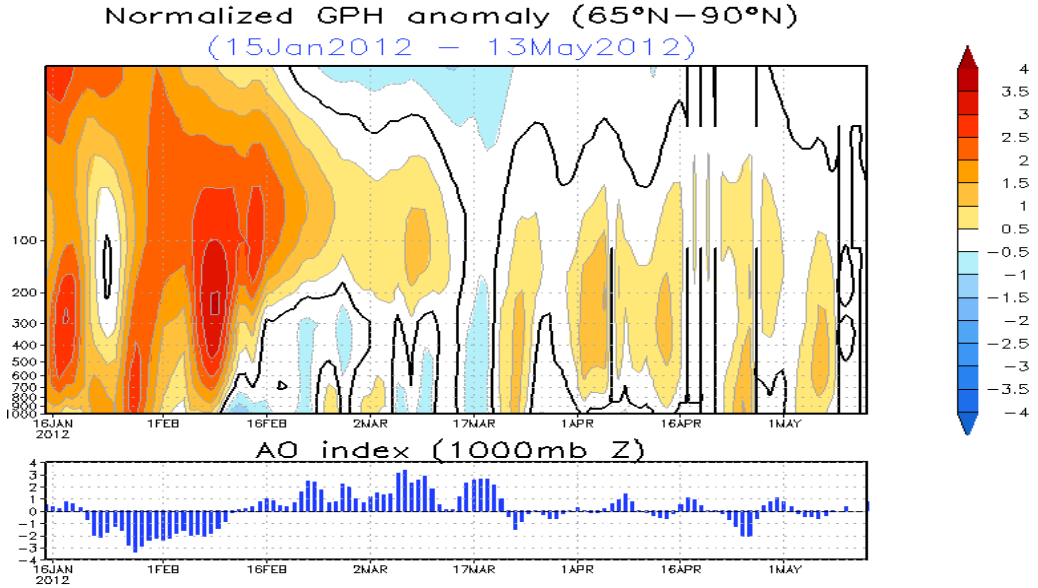
Large scale patterns as predictability sources

Potential sources of predictability are phenomena which favors the development of recurrent patterns such as El Nino Southern Oscillation (ENSO) and North Atlantic Oscillation/Arctic Oscillation (NAO/AO). The statistics of the recurrent patterns is determined by boundary conditions due to SST, soil moisture, snow cover over continents and sea ice extent in the Arctic. Winter North Atlantic Oscillation/Arctic Oscillation (NAO/AO) modulates to some extent summer temperature in Europe, especially over Mediterranean basin, by impacting winter precipitation which initialize the soil moisture state for the next seasons (Wang et al., 2011). Also, research recently carried out has revealed the important role played NAO/AO not only in winter, but also in summer. Summer NAO (SNAO) seems to significantly affect precipitation in the Mediterranean, particularly Italy and the Balkans (correlations of up to 0.6) (Blade et al, 2012). High SNAO is associated with strong anticyclonic conditions and suppressed precipitation over the UK and anomalously wet conditions over the Balkans region.

NAO/AO in winter 2011-2012 and spring 2012

AO developed a prolonged positive phase episode from the beginning of the winter up to mid January 2012 which was followed by an intense negative phase episode up to first part of February 2012. Positive phase conditions returned after that and last in the first part of March 2012 (figure 1 and 2).

Figure 1. Representation of Northern polar vortex (averaged geopotential height, coloured shades) and AO index (blue lines) taken from Climate Prediction Center, NOAA, USA



(http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml).

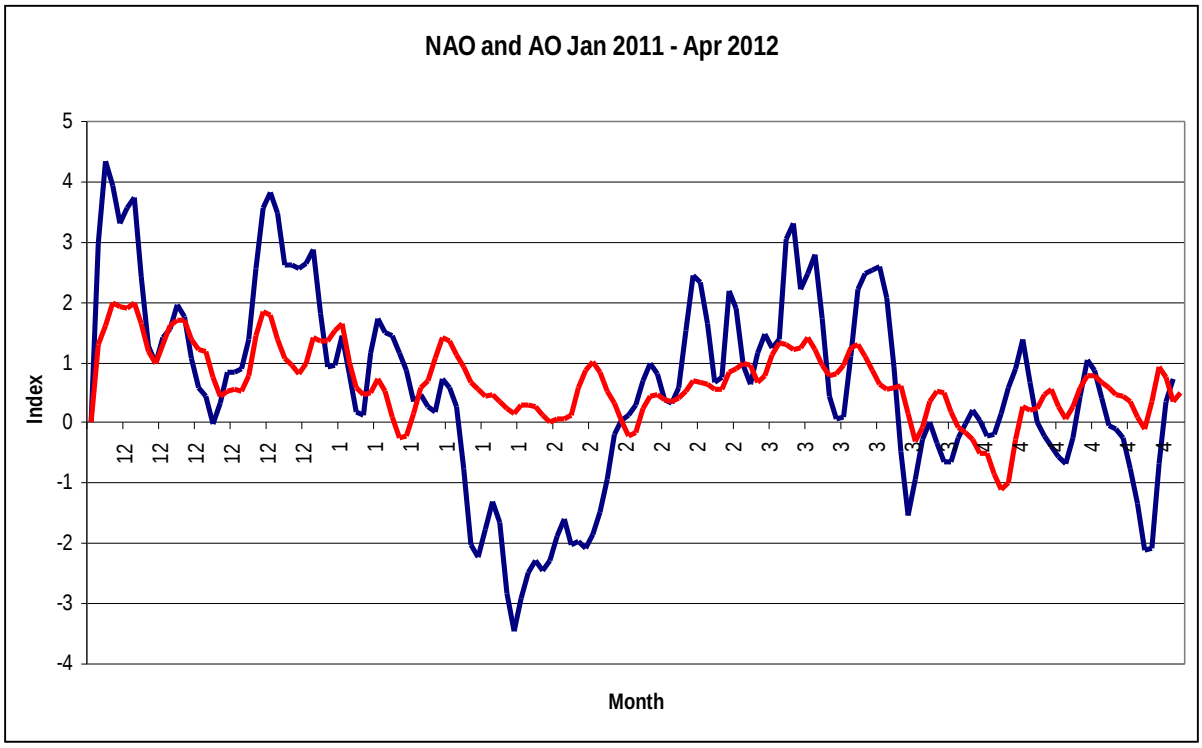


Figure 2. Daily evolution of NAO (red line) and AO (blue line) from 1st of December 2011 to 30th of April 2012 taken from Climate Prediction Center, NOAA, USA (http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/teleconnections.shtml).

It is interesting to mention that in the last winter NAO (which has usually the same evolution as AO) has developed this time an opposite phase from mid January to beginning of February. So NAO was in positive phase for almost entire winter and in the first part of March 2012 (figure 2).

ENSO state in spring 2012 and its future evolution

On 16th of May WMO issued an updated bulletin about ENSO evolution which stated that the 2011-2012 La Niña has ended in early April 2012 and model forecasts and expert opinion suggest neutral conditions for the summer of 2012.

Preliminary predictive assessments based on large scale climate patterns

For the next two weeks, Climate Prediction Center (USA) suggests a negative to near normal AO and NAO phase. An assessment of NAO/AO state beyond this time lead is hard to be made now. However, as recent literature suggests, the strong negative episode of AO with its associated abundent snowfall may imply more soil moisture over South Eastern Europe at the end of the winter which could in turn reduce the probability of strong and persistent heat waves in summer over the same region. The soil moisture state can be evaluated using Palmer Severity Drought Index (PSDI). The current values of this index are in figure 3.

PSDI field shows severe and extreme droughts mainly in the Western and North-Western part of our SEE domain. Moderate to severe droughts are in parts of Caucasus region, too. If this conditions will persist through the next couple of weeks we could conclude that the regions with severe to exceptional droughts have higher chances for strong heat waves to

occurr in the summer 2012. However, the PDSI may lag emerging droughts by several months, so we can not totally eliminate the posibility to greater chances for heat waves in the regions of the domain where no drought signal is present by now.

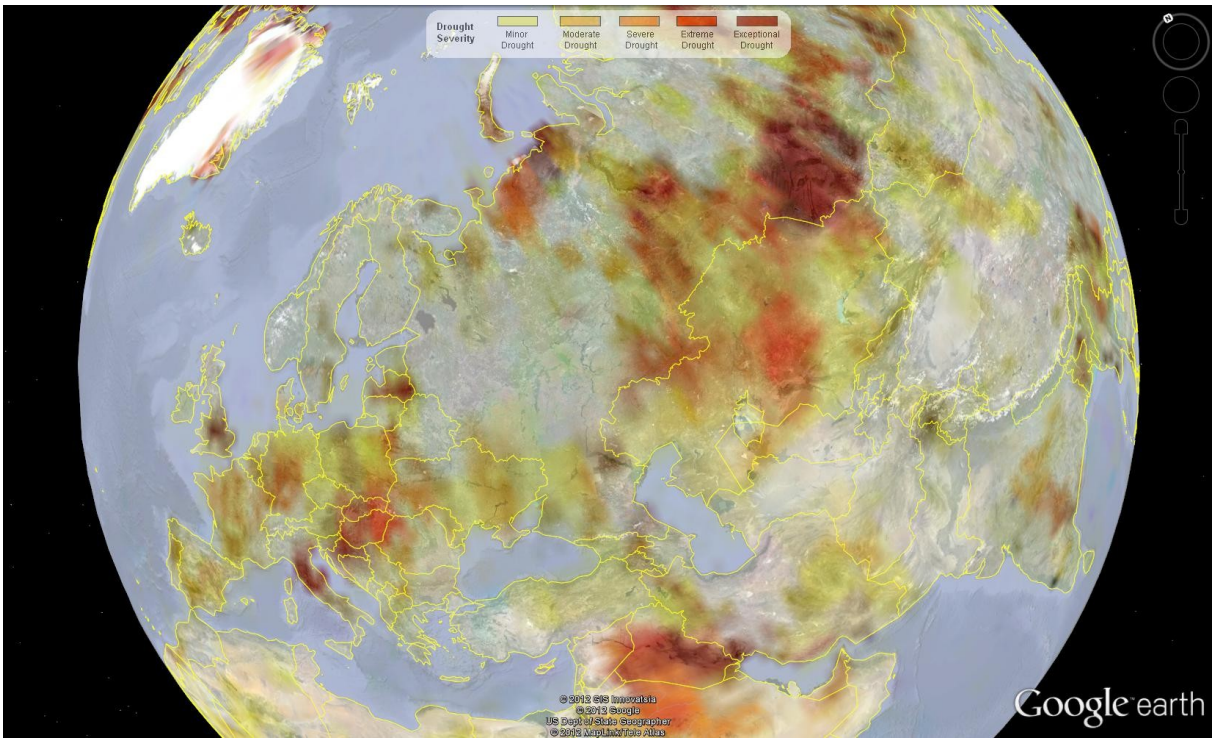


Figure 3. Palmer Drought Severity Index (PDSI) for May 2012 from UCL Department of Space and Climate Physics, AON Benfield UCL Hazard Research Centre (http://drought.mssl.ucl.ac.uk/drought.html).

As for the analog past conditions over Northern Hemisphere, spring 2012 is closer to springs of years **2003, 1998** and **1991**. Analogs have been computed using North Atlantic SSTs and ice concentrations, air temperature at 850 hPa, geopotential heights at 700 hPa and zonal winds at 300 hPa. The covariance matrix of multifield data allow us to define a hyperspace spanned by the first 3 EOFs (in this case). The analogs are identified computing the closest distances between present and past states in the spring hyperspace as in the paper of Barnett and Preisendorfer (1978). It's note worthy to recall that the summer of 2003 had strong and persistent heatwaves over almost all Europe.

Reference

Barnett, T. P. and R. Preisendorfer, 1978. Multifield analog prediction of short-term climate fluctuations using a climate state vector. J. Atmos. Sci., 35, 10, 1771-1787.