Geophysical Research Abstracts
Vol. 15, EGU2013-1534, 2013
EGU General Assembly 2013

Modulation of boundary layer relative humidity and rainfall in northwest Europe by SST patterns over the north Atlantic.

Benedetta Dini and Tim Hewson
Met Office, Exeter, United Kingdom (benedetta.dini@metoffice.gov.uk)

A large observational data set of atmospheric soundings from stations in Ireland, southwest England and northwest France has been used to explore connections between SST patterns to the west of the UK, boundary layer relative humidity and UK rainfall.

West to southwesterly is the prevailing wind direction for the UK, and airmasses that move towards the UK from such directions will show the effects of modulation by the underlying ocean's surface. SST anomaly data have been used for two areas of the north Atlantic: one remote from western Europe (extending as far as 40W) and one just to the west of the UK. The hypothesis under test is that when SST anomalies in these areas show a 'negative gradient' (warmer than average in the west and colder than average in the east), incoming airmasses will undergo, relative to the 'zero gradient' case, anomalous cooling from below, and thereby show an anomalous increase in boundary layer relative humidity. Conversely, with a 'positive gradient' in SST anomaly, the boundary layer will, in relative terms, be warmed from below and exhibit a decrease in relative humidity. Cloud base tends to lower as the moisture in the boundary layer increases, and as rainfall intensity shows a remarkably strong correlation with cloud base height (and consequently cloud depth) one would therefore expect higher rainfall in the 'negative gradient' case.

The study has highlighted marked differences in the frequency distributions of boundary layer humidity values for different SST scenarios, in 3 seasons out of 4. The exception is the summer season for which a connection is not found. This may be because SST data used was in monthly mean format, and in summer more than other seasons such averages are expected to be less representative of daily values. Results were also divided into 4 different surface pressure categories and it was found that for all but the lowest pressures the relationships held up.

In summary, this study has revealed that on most occasions surprisingly small SST anomalies, of order tenths of a degree Celsius, have a statistically significant impact on relative humidity and rainfall.