



Solar wind modulation of UK lightning

Chris Davis, Giles Harrison, Mike Lockwood, Mathew Owens, and Luke Barnard

University of Reading, Department of Meteorology, Reading, United Kingdom (c.j.davis@reading.ac.uk)

The response of lightning rates in the UK to arrival of high speed solar wind streams at Earth is investigated using a superposed epoch analysis. The fast solar wind streams' arrivals are determined from modulation of the solar wind V_y component, measured by the Advanced Composition Explorer (ACE) spacecraft. Lightning rate changes around these event times are then determined from the very low frequency Arrival Time Difference (ATD) system of the UK Met Office. Arrival of high speed streams at Earth is found to be preceded by a decrease in total solar irradiance and an increase in sunspot number and Mg II emissions. These are consistent with the high speed stream's source being co-located with an active region appearing on the Eastern solar limb and rotating at the 27 day rate of the Sun. Arrival of the high speed stream at Earth also coincides with a rapid decrease in cosmic ray flux and an increase in lightning rates over the UK, persisting for around 40 days. The lightning rate increase is corroborated by an increase in the total number of thunder days observed by UK Met stations, again for around 40 days after the arrival of a high speed solar wind stream. This increase in lightning may be beneficial to medium range forecasting of hazardous weather.