DRAFT

Radiation Update on Space Weather Event of 11 November (Armistice Day/Veterans Day??)- One Week On

Analysis of this event continues apace, and all numbers are provisional at this point in time. At Surrey Space Centre and the UK Met Office we were able to respond rapidly with balloon flights of our SAIRA monitor at both Lerwick and Camborne at latitudes embracing the extremities of the UK. These are being compared with data from newly-installed, ground-level neutron monitors at the same locations. At the same time, we are running our MAIRE model (Model for Atmospheric Ionising Radiation Effects) driven by data from neutron monitors at Oulu and Dourbes in Western Europe. This is showing that effective dose rate levels at 40000 feet probably exceeded 55 microSv per hour at the maximum of the event around 1030 UT on 11th Nov. This event was very anisotropic with various high latitude neutron monitors showing different maxima and profiles indicating that 80 microSv per hour could have been reached along some high latitude routes. The peak was short-lived and so this level would not have lasted for an entire flight, but a long tail continued for the rest of the day. It is possible that certain TransAtlantic flights could have received double the normal cosmic ray dose. This is not a major concern but in addition upset rates in computer memory chips could have reached some 60 per hour in 1 Gigabyte. The event was 1.5 to 2 % of the Feb56 event (a 1-in 50-to-70-year event) and, although the strongest in 20 years, has a return probability of every 3 years based on the full history of GLEs going back to 1942 (see our 2018 paper attached). The recent lull in activity has led to a false feeling of security and work must continue rapidly to get avoidance procedures in place such as altitude lowering and take-off delays. The conclusions in our 2018 paper are proving correct.

Ref: Extreme Atmospheric Radiation Environments & Single Event Effects, C. Dyer, A. Hands, K. Ryden and F. Lei, *IEEE Trans. Nucl. Sci.*, Vol. 65, Issue 1, pp. 432-438, Jan. 2018, doi: 10.1109/TNS.2017.2761258.

VIII. CONCLUSION (from above paper)

Severe atmospheric radiation environments are potentially hazardous and reasonably probable in comparison with other hazards (e. g. volcanic ash for air flights). Suggested worst-case environments and their probabilities given here should inform design and avoidance strategies. It is of high importance to maintain and utilise both ground-level and in-flight monitors together with reliable, real-time communications whilst acknowledging that these might not be available during an extreme ionospheric disturbance. It is recommended that a new space weather hazard scale relating to the Feb56 event be employed for warning and alert systems.

40.00 kft, 2025-11-11 10:30:00

UNIVERSITY OF SURREY