

Using varying ERA-I reforecast errors to study a possible link between cloud cover and galactic cosmic rays.

Egil Kaas, Patrick Bülov, and Jacob Svensmark

University of Copenhagen, Niels Bohr Institute, Climate and Geophysics, Copenhagen, Denmark (kaas@nbi.ku.dk)

Various studies have investigated the possible link between galactic cosmic rays (GCR) and cloud cover on Earth. One method - also used here - is to estimate if there is a significant short-term decline in cloud cover in the days following Forbush decreases (FDs), i.e. short term reductions in GCR induced by solar coronal mass ejections. We largely use the same method as in Svensmark et al. (2016): first the FDs are ranked according to their expected impact on the ionization of the lower atmosphere; it is then investigated if there is a statistical decline in the global mean cloud cover. Here we use atmospheric re-analysis (ERA-I) cloud cover data in the period 2001 - 2016, i.e. we do not directly use satellite-based cloud cover as in Svensmark et al. (2016). We find that it is largely possible to confirm the original findings both for total cloud cover and for planetary albedo. ERA-I also include 10-day re-forecasts. Re-forecasts into the period following a FD cannot "know" the potential effects of the FD on cloud cover. Thus we can use errors in global forecasts of cloud cover to eliminate that part of the cloud variation, which is due to random - but predictable - weather fluctuations. By errors we here mean the difference between re-forecasts and the verifying re-analyses. We find that after FDs there is a statistically significant over-prediction of cloud cover in 0 - 6 day forecasts. This supports the idea that the cloud cover decline seen in the observations and in the re-analyses is not related to random weather fluctuations - but to "something else".