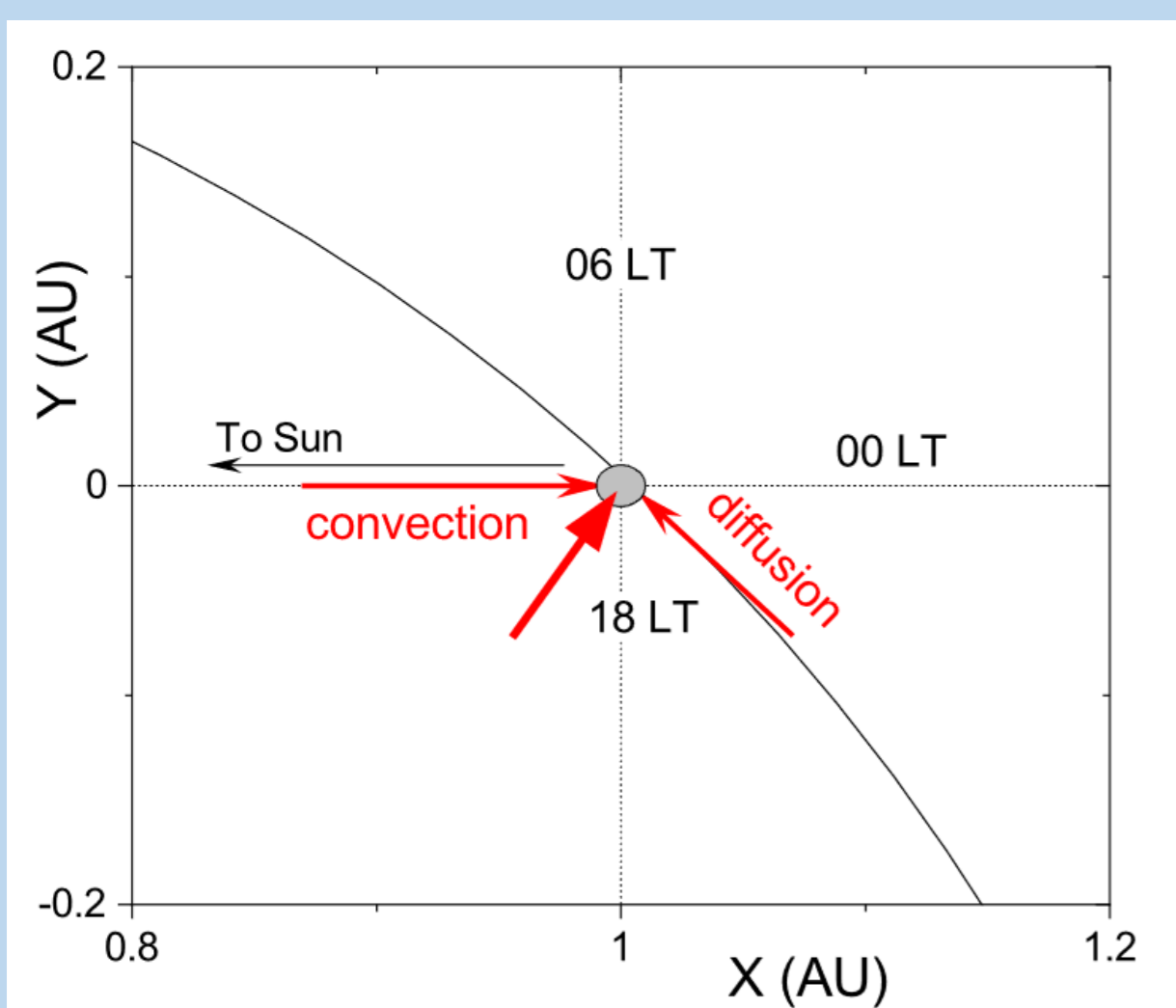


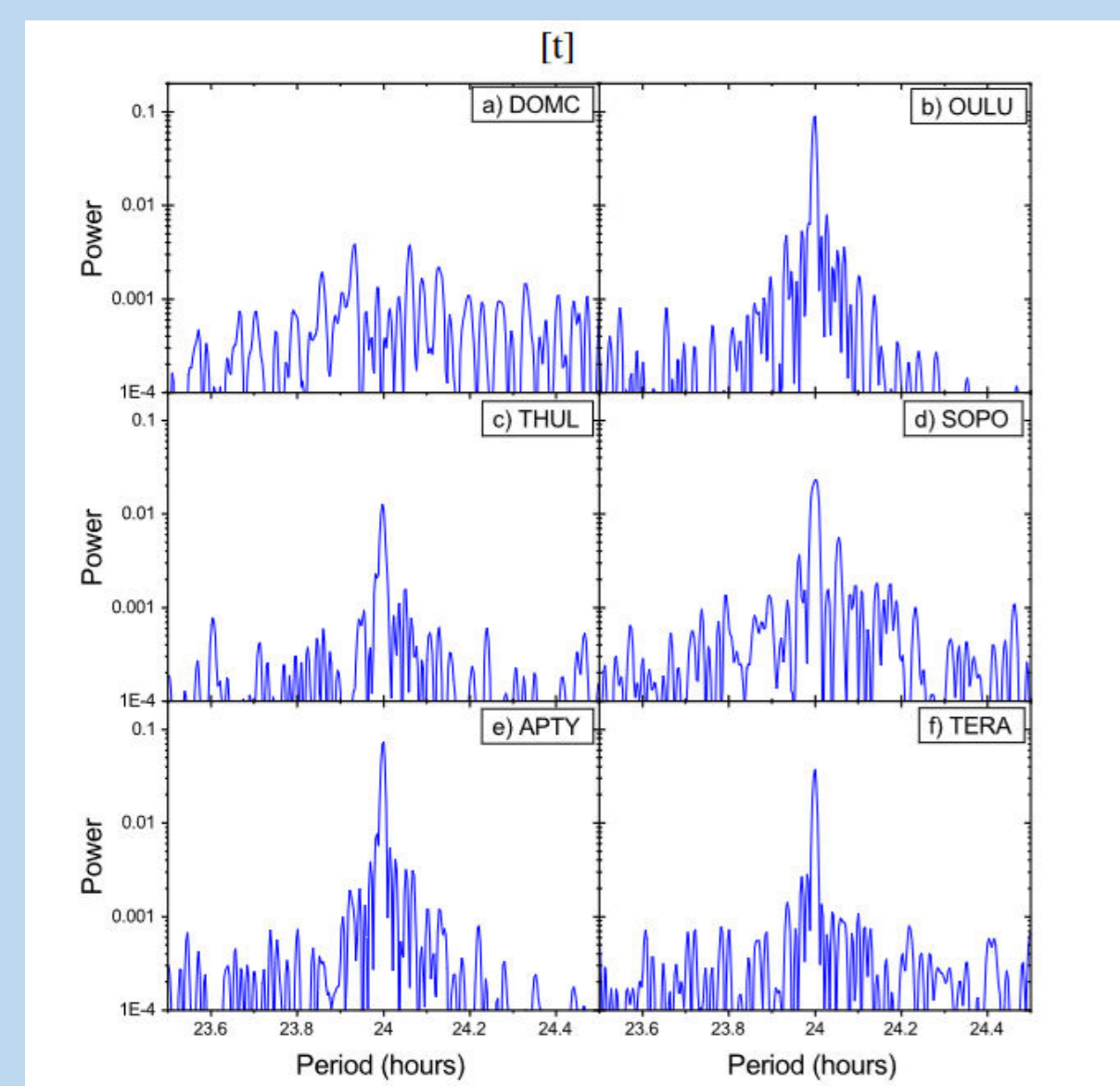
Agnieszka Gil^(1,2), Alexander Mishev⁽³⁾, Stepan Poluianov⁽³⁾, Ilya Usoskin⁽³⁾

(1) Siedlce University, Poland; (2) Space Research Centre, Polish Academy of Sciences, Poland; (3) The University of Oulu, Finland

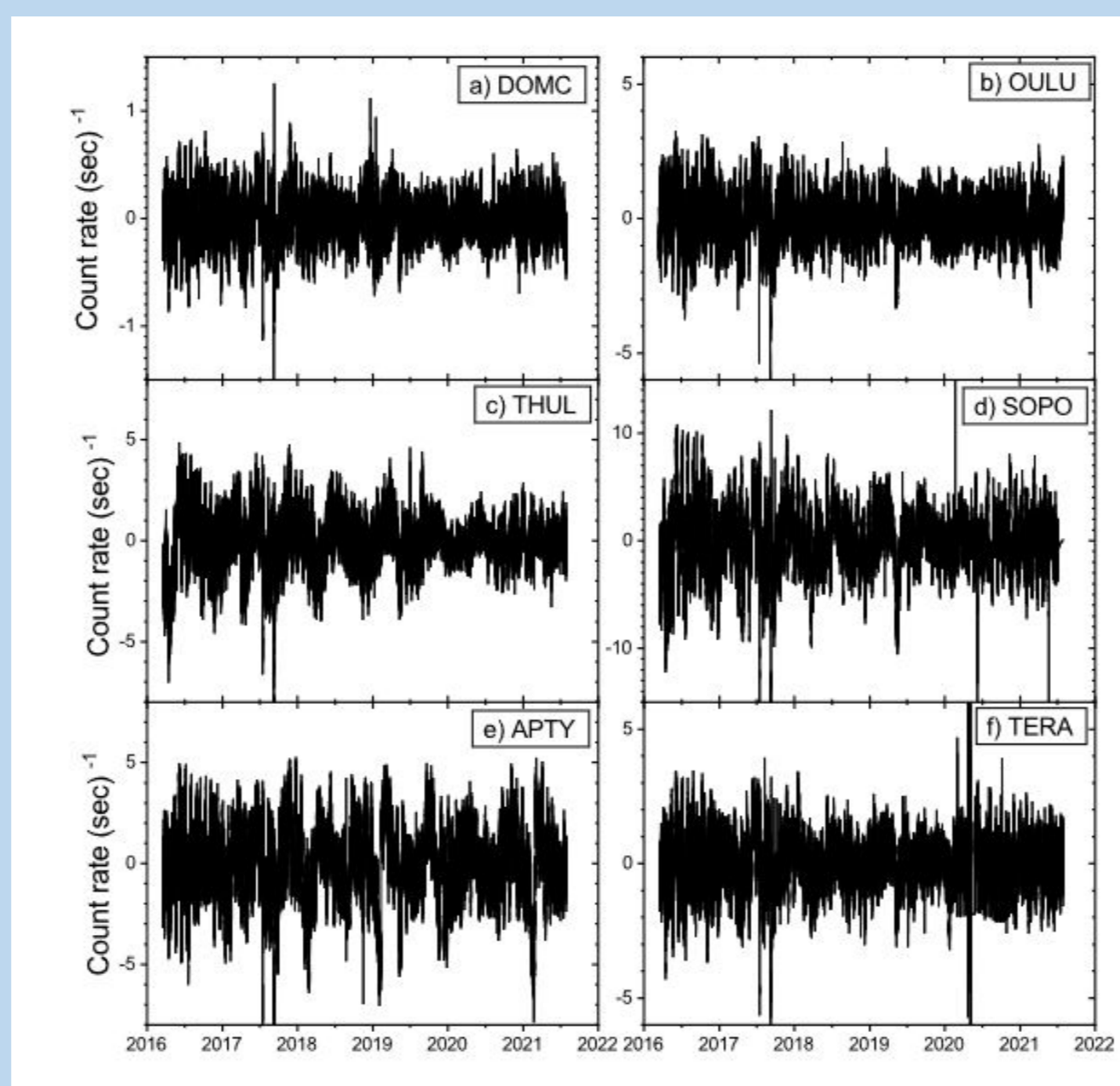
ABSTRACT: A small local anisotropy of galactic cosmic rays (GCR) due to geometrical and orbital parameters is observed as a diurnal variability by the ground-based neutron monitor (NM) count rates. The capability of observing the GCR diurnal anisotropy is different for various NMs because of their different asymptotic directions. Here, we present the results of an analysis of the diurnal variability of polar NM count rates that varies from 0.16% to 0.4%. The only exception is the Dome C (DOMC) NM, which does not depict significant diurnal variation, it is only at the level of 0.03%. We interpret this fact to the polar, viz. off the equatorial plane, the asymptotic cone of DOMC NM restricted nearly to the South pole, with geographic latitude above 75 degrees. This determines the uniqueness of the DOMC NM station, which accepts cosmic ray particles originating from the off-equatorial region that is essential for a detailed study of near-Earth cosmic ray transport, in particular for the anisotropic solar energetic particle events.



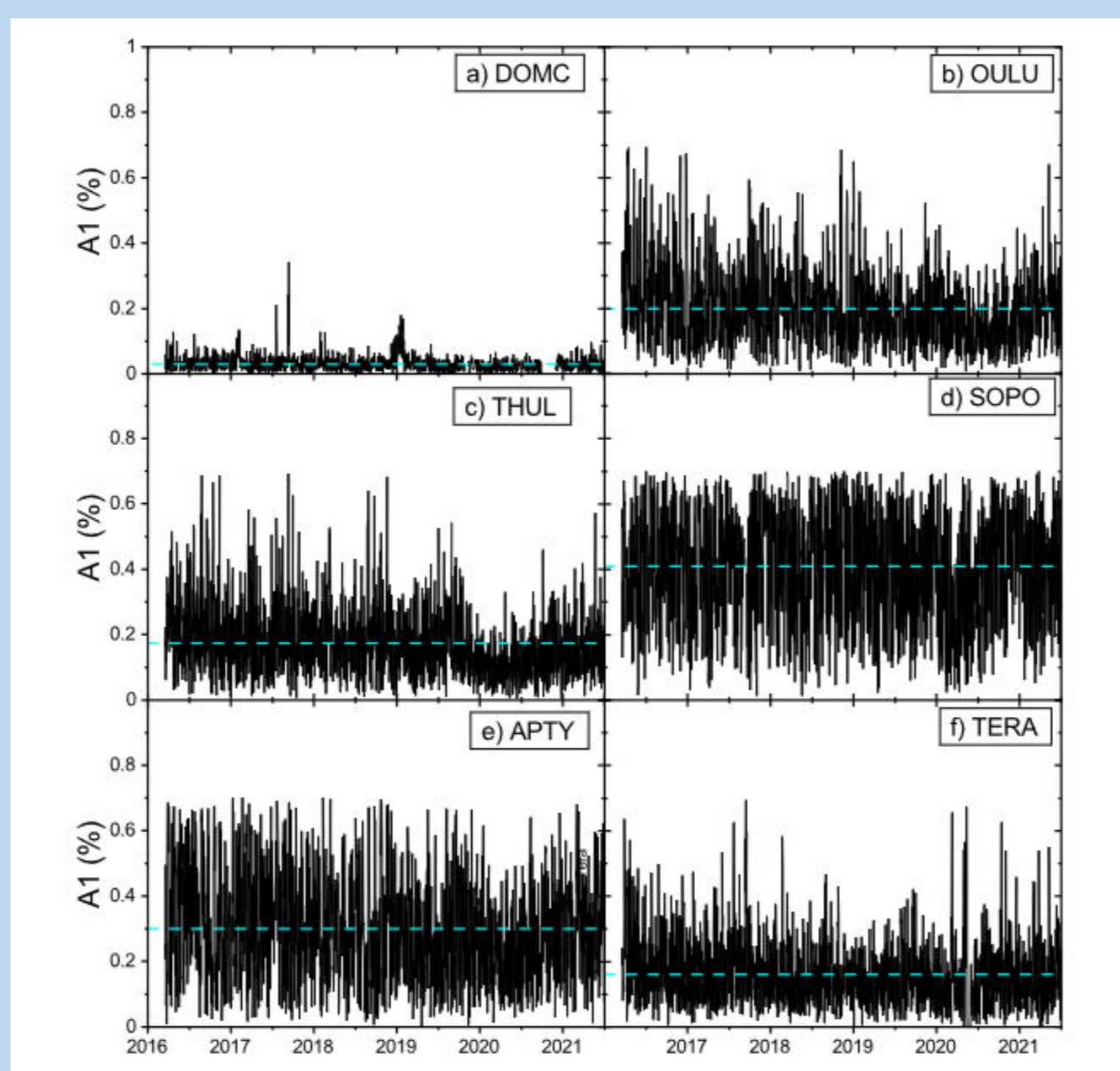
Simplified not-to-scale scheme of the GCR anisotropy in the vicinity of Earth (denoted as the grey circle): the plot corresponds to the ecliptic plane as viewed from the north. Two main mechanisms are: radial outward convection by the solar wind and inward diffusion along the HMF line. The summary anisotropy vector is shown by the thick red arrow. Other mechanisms, e.g., the Earth's movement, are not shown.



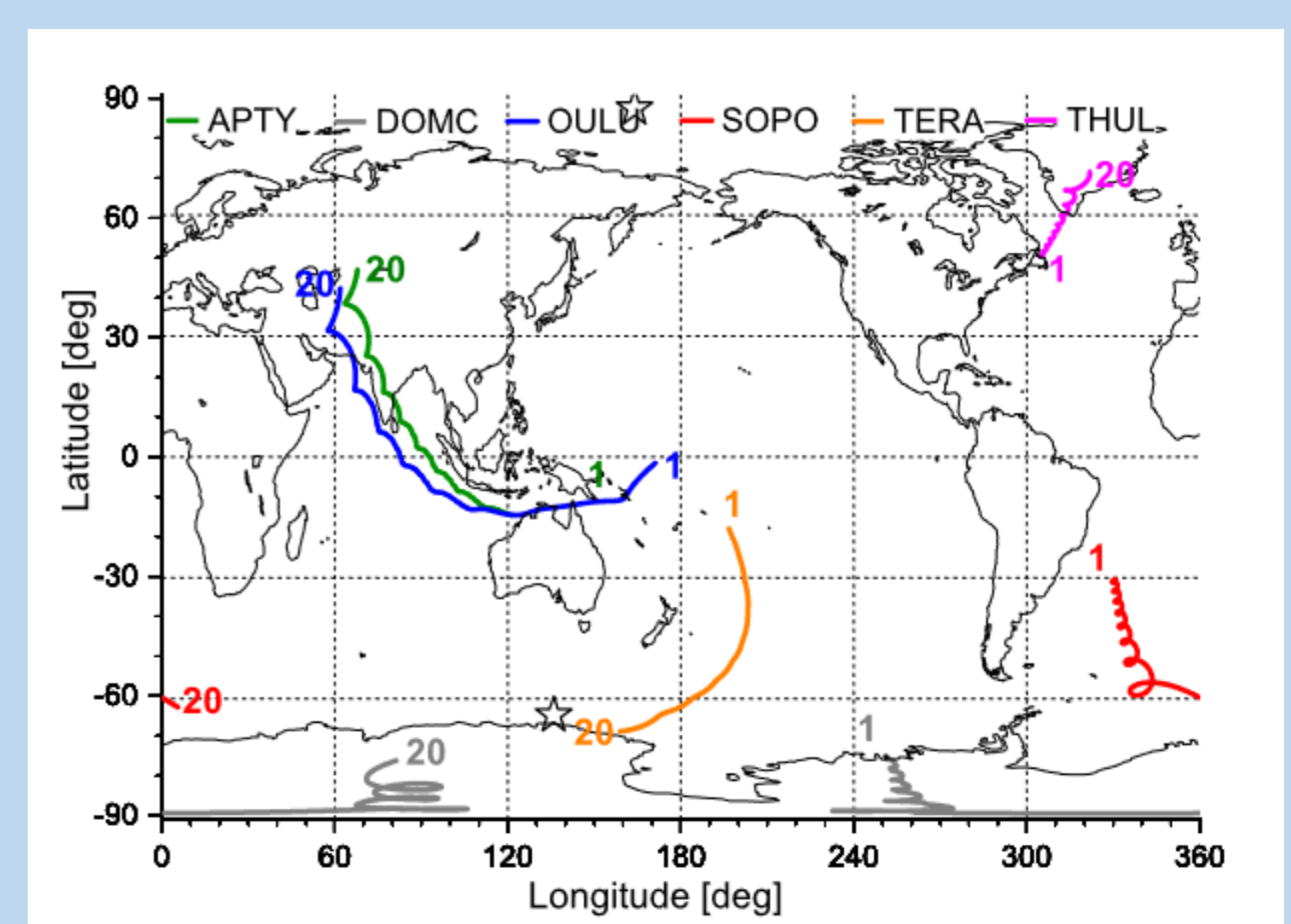
Power spectral density of the count rates for the six NMs: DOMC, OULU, THUL, SOPO, APTY, and TERA for the time interval between 16-Mar-2016 – 31-Aug-2021 around the 24-hr period



High-pass (2 years) filtered hourly count rates, for the period 16-Mar-2016 – 31-Aug-2021, for six neutron monitors studied here: DOMC (a), OULU (b), THUL (c), SOPO (d), APTY (e), and TERA (f).



Amplitudes of the diurnal variability calculated for the period of 16-Mar-2016 – 31-Aug-2021 for six NMs: DOMC, OULU, THUL, SOPO, APTY, and TERA (panels a – f, respectively). The blue dashed line denotes the mean amplitude for each NM.



Asymptotic directions (ADs) of the polar NMs considered here are represented by colored curves, as denoted on the top. Computations were made using the MAGNETOCOSMICS code for the date of 22-Aug-2016 for GCR particles with rigidity between 1 – 20 GV as denoted by the numbers near each curve. Locations of the geomagnetic poles (IGRF, epoch 2020) are indicated by stars.

Summary:

- DOMC is the only NM with nearly absent diurnal variability in its data. This is because this NM looks nearly vertically to the South-pole direction (latitudes above 75° south), as confirmed by the computations of its AD.
- The global NM network within the geomagnetic field can serve as a giant spectrometer, using the Earth's rotation to scan the space and evaluate the cosmic-ray anisotropy (see the "Spaceship Earth" concept, Bieber & Evenson, 1995).
- NMs at different locations with the corresponding rigidity cut-offs are sensitive to different parts of the incoming CR-particle spectrum and arrival direction since the response of each station depends on its location, particle rigidity, altitude and the angle of incidence of the incoming SEPs.