Geophysical Research Abstracts
Vol. 19, EGU2017-17553, 2017
EGU General Assembly 2017

A link between high-speed solar wind streams and mid-latitude cyclones

Paul Prikryl (1,2), Koki Iwao (3), Takumi Tsukijihara (4), Donald B Muldrew (5), Vojto Rušin (6), Milan Rybanský (7), and Robert Bruntz (8)

(1) Physics Department, University of New Brunswick, Fredericton, NB, Canada (paul.prikryl@unb.ca), (2) Geomagnetic Laboratory, Natural Resources Canada, Ottawa, ON, Canada (paul.prikryl@canada.ca), (3) National College of Technology, Kumamoto College, Yatsushiro, Japan, (4) Department of Earth and Planetary Sciences, Kyushu University, Fukuoka, Japan, (5) Emeritus, Communications Research Centre, Ottawa, ON, Canada, (6) Astronomical Institute, Slovak Academy of Sciences, Tatranská Lomnica, Slovakia, (7) Slovak Central Observatory, Hurbanovo, Slovakia, (8) Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA

Mid-latitude cyclone tracks in the northern and southern hemispheres are obtained from meteorological reanalysis datasets to study occurrence of explosively developing extratropical cyclones in the winter season in relation to arrivals of high-speed solar wind streams (HSS) from coronal holes. The new statistical evidence corroborates the previously published results (Prikryl et al., Ann. Geophys., 27, 1-30, 2009). For the northern and southern winters, this evidence shows that explosive extratropical cyclones tend to occur after arrivals of HSS when large amplitude Alfvén waves couple to the magnetosphere-ionosphere system. Solar wind Alfvén waves modulate Joule heating and/or Lorentz forcing of the high-latitude lower thermosphere generating medium-scale atmospheric gravity waves that propagate energy upward and downward from auroral zone through the atmosphere. It is proposed that these gravity waves, in spite of their small amplitudes but subject to amplification upon reflection in the upper troposphere, can trigger instabilities in the troposphere initiating convection to form cloud/precipitation bands. The release of latent heat is known to provide energy for rapid development and intensification of extratropical cyclones.