

High precipitation rates and floods: Relation to solar wind high-speed streams

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Precipitation datasets based on rain-gauge and satellite-sensor measurements are used to examine the relationship between daily precipitation rates and the solar wind high-speed streams from coronal holes. The superposed epoch (SPE) analyses show increases in occurrence of high precipitation rates following arrivals of high-speed streams, including their recurrence with solar rotation period. The cross-correlation analysis of high precipitation rate occurrence, the SPE averages of the corona intensity in the emission line (Fe XIV, 530.3 nm) observed by ground-based coronagraphs and supplemented by a proxy measurement of green corona intensity based on the emission line at 28.4 nm (FeXV) [1], and solar wind parameters measured upstream from the Earth [2], show correlation peaks at lags spaced by the solar rotation period. When the SPE analysis is limited to years around the solar minimum, significant intermediate correlation peaks spaced by about 9 days are also found. These quantitative results are consistent with the observed tendency of heavy rainfall and flash floods to follow the arrivals of high-speed streams, which is demonstrated for different geographical regions, in Australia, Japan and the U.S. The role of the solar wind-magnetosphere-ionosphere-atmosphere coupling in severe weather occurrence mediated by aurorally generated atmospheric gravity waves is discussed. The gravity waves propagate globally from sources in the high-latitude lower thermosphere, both upward and downward [3]. In the upper atmosphere, the gravity waves are observed as traveling ionospheric disturbances [4,5]. In the lower atmosphere, they can reach the troposphere and be ducted to low latitudes. Despite significantly reduced wave amplitudes, the gravity waves, subject to amplification upon over-reflection in the upper troposphere, can trigger/release existing moist instabilities, initiating convection and latent heat release, the energy leading to intensification of storms [5].

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