Space "hurricanes" as natural hazards

L. Dorman (1,2), N. Ptitsyna (3), G. Villoresi (4), V. Kassinsky (5), N. Lyakhov (5)

(1) Israel Cosmic Ray & Space Weather Center and Emilio Segre' Observatory, affiliated to Tel Aviv University, Technion and Israel Space Agency, Qazrin 12900, Israel;

(2) Cosmic Ray Department of IZMIRAN, Russian Academy of Science, Troitsk 142092, Moscow Region, Russia;

(3) Institute of Terrestrial Magnetism, Ionosphere, and Radiowave Propagation, St. Petersburg Branch, Russian Academy of Science, POBox 188, St. Petersburg 191023, Russia

(4) University "Roma Tre", Via della Vasca Navale 84, Rome 00146, Italy

(5) Irkutsk Institute of Railway Transport, Russia,

Contact information: Prof. Lev Dorman, P. O. Box 2217, Qazrin 12900, Israel;

E-mail: lid@physics.technion.ac.il,

Fax: 972-4-6964952, Tel.: 972-4-6964932 (of), 972-546816111 (mob)

Our planet exists with a space environment affected by constantly changing solar atmosphere producing charged particles and electromagnetic waves. This changing of space environment, or so called "space weather" influences performance of the Earth's technology, because information and energy are transmitted using the same vehicles as in nature: charged particles and electromagnetic waves. Eruptive activity of the Sun produce a chain of extreme geophysical events that are similar to the Earth's hurricanes: extreme speed of charged particles and magnetic field disturbances in the interplanetary space, extreme changes in the ionosphere and in the geomagnetic field, so-called geomagnetic storms. These space hurricanes are relatively rare events, but they can potentially destroy spacecrafts, kill astronauts and adversely affect airline crew and passengers, and even human health on the ground, lead to pipeline breaking, melt electricity transformers, discontinue transmission, stop trains and generally wreak havoc with human activities. For instance, a great geomagnetic storm on 13 March 1989 caused a nine-hour blackout of the Hydro Québec electric power system. In addition many other power utilities in North America experienced problems up to tripping out of lines and capacitors. An earlier historical example is the storm on May 15, 1921, when the entire signal and switching system of the New York Central Railroad below 125th street was put out of operation, followed by a fire in the control tower at 57th street and Park Avenue. Railroad officials formally assigned blame for a fire destroyed the Central New England Railroad station, to the magnetic storm. In Sweden the storm caused fires in telegraph equipment; the storm interfered with telephone, telegraph and cable traffic over most of Europe. Losses due to space hurri-

canes are very high. For example, $4 billion in satellite losses can be directly traced to space weather damage. Space hurricanes have cost the airline industry millions of dollars. Space weather events can damage equipment over wide geographic regions so that recovery delays become substantially longer and more costly. In our report we dealt with two consequences of space hurricanes: (i) rise of mistakes in operations and accidents on railways and (ii) rise of myocardial infarctions and brain strokes. The results obtained suggest the necessity of forecasting the extreme solar activity events and the related space storms to protect technology, and to minimize health-related impact. Improved geophysical methods for prediction of the space hurricanes are discussed.