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Preface

Nature knows several ways to kill Humankind through violently affecting components of the environment that support our existence. She has invented volcanoes, earthquakes, tsunamis, hurricanes, droughts, floods, tornadoes, heat and cold waves and sudden frosts. Fortunately, such events are not only scarce in both time and space but often give clear signs (for those who can read them) well before they arrive. Moreover, their impact area is usually quite limited and there is normally a way for smart people to escape and sometimes even to benefit from such events. The best way for Humankind to survive is to watch the tricks of Nature, to investigate their sources and appearance, to predict possible consequences and to invent new ways to avoid or mitigate the disasters. Although in many cases we cannot affect the course of the devastation, proper knowledge of physics and dynamics of such events is one of the major imperatives of Earth sciences.

During the last years Nature has been quite cruel. The most severe disasters of the last decade were the Indian Ocean Boxing Day tsunami on 26 December 2004 and the devastating earthquake in Haiti on 12 January 2010. Together they took half a million of lives and devastated extensive areas. Tōhuku earthquake of the magnitude of 9.0 and the associated tsunami on 11 March 2011 caused by an order of magnitude fewer fatalities mostly because of the systematic work, done by preparing Japan against such disasters. In this light, the Baltic Sea basin and Estonia should be happy because the visit of cyclone Gudrun on 8–9 January 2005 was properly forecast. Although it was one of the strongest storms of the written history and it caused the ever highest coastal flooding in Estonia, its consequences were still minor.

In the spring of 2010, an eruption of Eyjafjallajökull stopped the air traffic over a large part of Europe for more than a week, from 15 to 21 April. This event did not lead to fatalities but clearly demonstrated how fragile is contemporary civilization with respect to such a simple and almost invisible substance as volcanic ash. Another Icelandic volcano Grimsvötn tried to do the same in May 2011, but this time the Nature did not succeed in the formation of a suitable wind pattern and the airports suffered only in the United Kingdom and Ireland. Another attempt was more successful: Puyehue in Chile erupted on 4 June 2011 and due to the prevailing westerlies, the ash was carried to Western Australia where on 13 June all flights were cancelled. Owing to precautionary measures,

these events did not cause any direct fatalities. The tsunami after the Tōhuku earthquake caused a major failure of the Fukushima nuclear power plant and caused another invisible danger through radioactive contamination. In all these cases the advice from Earth scientists was crucial to avoid further consequences, caused by spreading dangerous substances owing to airflows and ocean currents.

These and other examples vividly demonstrate the importance of the competence in Earth sciences for mitigation of various impacts to Humankind. Several papers in this issue address various aspects of natural disasters. Ira Didenkulova, Efim Pelinovsky and Artem Rodin study numerically the interaction of long and steep shallow-water waves, a problem that sheds some further light to the formation of shock waves and bores during propagation of tsunamis. The paper by Priidik Lagemaa, Jüri Elken and Tarmo Kõuts demonstrates that sometimes a disaster is needed in order to reach an adequate treatment of meteorological or oceanographic problems. They describe the development of the operational sea level forecasting system that has been elaborated on the basis of the HIROMB model of the Baltic Sea and implemented in Estonia eight months after the Gudrun flood event. Precipitation extremes that may cause hazards for society and ecosystems are investigated in the paper by Piia Post and Olavi Kärner. Radiosonde measurements in Estonia and Finland are treated by Sirje Keevallik and Miina Krabbi, showing their invaluable role during the periods of volcanic eruptions when meteorological observations from airplanes are impossible. Finally, the paper by Tarmo Soomere, Maija Viška, Jānis Lapinskas and Andrus Räämet addresses the potential links between the alongshore wave intensity changes with the accumulation and erosion areas along a large section of the eastern Baltic Sea coast.

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