BOOK REVIEW

B. McGUIRE & M. MASLIN (editors), 2013. **Climate forcing of geological hazards**"
(Wiley-Blackwell - 311 pages - Hardcover - ISBN0978-0-470-65865-9 - ~75GBP)

What do volcanic activity, mass movements, marine hydrates, tsunamis and climate change have in common ? They are all part of the dynamic interrelations of the Earth system. The book 'Climate forcing of geological Hazards' edited by Bill McGuire and Mark Maslin , from the Hazard Centre and the Geography Department of Union College London respectively, is in line with this rather recent dynamic approach of the Earth system. Various feedback mechanisms are now studied more in detail since they induce important uncertainties in the existing climate models.

The book reviews a number of less commonly described impacts of Climate Change on the solid earth. According to the authors, the solid earth component will be the most impacted in higher latitudes by consequence of already ongoing warming and since higher latitudes underwent the most important climate changes during the Last Glacial and the Holocene period. Liggins et al. review climate change projections in the context of geohazards. Several environments may undergo geological hazards potentially linked with climate change. Coastal areas are subject to slope instability due to higher rainfall, inducing higher discharge with increasing ice melting, and to sea-level increase. The release of gashydrates may be another factor of slope rupture. Sea-level rise itself may be at the origin of fault rupture creating earthquakes and tsunamis. Volcanic regions and regions in faulted zones are therefore regions with a higher risk potential during climate change. Mountainous regions may undergo slope instability due to ice melting which increases rock fall. Increased melting may be responsible for outburst floods currently only observed in the Himalaya.

Several observations are done and in 2011, the IPCC, for the first time, explicitly addresses the impact of anthropogenic climate change on the geosphere with potential hazardous consequences. However, there is need for a better established and quantified correlation through more precise modeling and increased monitoring of already changing environmental conditions.

The authors review a number of case studies of potential hazards induced by climate change. K. Deeming et al. investigate Mount Etna in Sicily that experienced periods of lateral collapse, coinciding with pluvial episodes during the Early Holocene. H. Tuffen reviews volcanic activity worldwide, potentially triggered by iceloss and meltwater increase. The different mechanisms that can cause perturbations of snow and ice on volcanoes are reviewed and a tentative quantification of the rate of ice thinning and potential consequent volcanic activity, magnitude as well as frequency, is given. F. Sigmundsson et al. analyse potential stress-induced effects of unloading, due to ice melt, on deep mantle melting and on crustal magma chambers, in particular on Iceland and its well-known Vatnajökull. A. Hampel et al. shed new light on past and present seismicity in regions covered by ice caps in the past, e.g. Yellowstone, Basin-and-Range province, USA, and Scandinavia. These authors suggest that regions currently affected by deglaciation, in the context of global warming may ultimately experience an increase in earthquake frequency. Guillas et al. present statistical evidence for a temporal link between variation in the El-Nino Southern oscillation (ENSO) and the occurrence of earthquakes on the East Pacific rise (EPR). Strong South-East Trade winds strengthen the south equatorial current leading to a build-up of the water in the western equatorial pacific. The authors conclude that consequent lower sea levels in the eastern equatorial Pacific induce an increased frequency of earthquakes over the next 6 months! They demonstrate that even small atmospheric pressure changes through a cascade of consequences may have the potential to trigger significant earthquakes. These findings should change our view on alert systems and on the advertising signs of upcoming catastrophes.

D.R. Tappin reviews worldwide submarine mass failures (SMFs) resulting or not in tsunamis and discusses potential climate triggers for SMFs known as more commonly triggered by earthquakes. Slope failures in mountain regions are also controlled by a variety of factors, including climate. C. Huggel et al. focus on extreme short-term temperature changes of days to several weeks as a trigger of rock and ice avalanches. The authors warn for a future increase in large slope failures as the number of warm extreme events increases. In the same line, J. Knight et al. present two case studies from the European Alps, the 2003 heat wave and the floods in 2005.

M. Maslin and co-authors shed some light but mainly show the important gaps in our knowledge on the amount of methane stored in and below gas hydrates deposits and the potential limits of stability of these deposits in a warming world. Their sudden degassing may cause a global increase in surface temperature as could be the case during the Paleocene-Eocene temperature Maximum (PETM). For this last cited event, T.D. Jones et al. test the possibility of a gas hydrate cause by clarifying potential sources, quantifying the mass of the PETM carbon input and compare with the reconstructed 6°C increase.

The first chapters are partly overlapping and concern the potential causal linkages between climate change and geologic hazards and concerning the different regions affected by these phenomena. They make clear that the still incomplete evidence for ''this science in its childhood' needs more monitoring and modeling. The book therefore establishes a good base of where to start and gives a review on the investigation possibilities and directions to take.

Putting the problems of catastrophic events in the light of today's climate change has the positive effect to shed new light and special attention on the solid earth, a somewhat 'forgotten' component of the dynamic earth system relative to other components such as the hydrosphere or the atmosphere. A better understanding of the processes affecting this earth component is certainly crucial for a more efficient hazards and risk management.

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