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Preface

This volume includes a set of short articles to be presented at the 2018 International Carbon Conference, to be held on the 10–14th of September 2018 in Reykjavik, Iceland. This conference is a joint outreach meeting between three European projects: CarbFix2 (EC H2020 Project 317235), Science for Clean Energy (EC H2020 Project 764810), MetalAid – a Marie Skłodowska Curie Innovative Training Network (Project number 675219), and the Deep Carbon Observatory. The conference itself consists of two days of individual meetings of each network, a one day joint meeting consisting of eight invited talks and volunteered posters, followed by a two day field trip including visits to Þórsmörk and Vestmannaeyjar. The MetalAid summer school will be run parallel to the meetings, where PhD students from the four networks will be introduced to the sampling of high temperature two-phase wells, surface flux measurements of soil gases, and sampling of geothermal surface fluids in the Hellisheiði field near Reykjavik.

Each participant of the conference was invited to submit manuscripts to this volume, and 24 were received. These manuscripts span the broad field of carbon in the Earth and its transformation among the different reservoirs. Much of the focus is on the scale, consequences, and potential solutions of the current anthropogenic alteration of the natural carbon cycle.

This volume begins with a contribution by Glikson ‘The lungs of the Earth’, where he outlines the current global carbon challenge. The Earth’s atmospheric CO₂ concentration is currently increasing at an unprecedented rate in Earth’s history, perhaps at more than an order of magnitude faster than ever before seen on our planet. Moreover, the risk of yet further increases is high as numerous large terrestrial carbon pools, including those in the permafrost and in the high latitude peat lands, are extremely vulnerable to climate change. Not only does this threaten to increase global climate substantially, but such CO₂ concentration increases have also been linked to large-scale extinction events.

These challenges are being addressed in part through natural and engineered mitigation processes. Natural methods include mineral dissolution and precipitation reactions, for example as presented by Mulders et al. and Stockmann et al. One notable engineering solution is carbon capture and storage. Kelemen et al. outline subsurface carbon mineralization as a potential solution. Such an approach has been embraced by the CarbFix project in Iceland. A series of six manuscripts in this volume report on the details of the CarbFix project, and the International Carbon Conference will include a visit to the Hellisheiði geothermal power plant, site of this ongoing CO₂ capture and storage effort. These contributions emphasize that successful carbon capture and storage projects need not only scientific advances but also the support of industry, government, and the public in general. So too do other ongoing carbon capture and storage projects in Norway (see Ringrose et al.) and the United States (see Goldberg et al.).

The anthropogenic alteration of natural carbon processes in the subsurface is also a major threat to the quality of our drinking water. Novel approaches to mitigate the risk of the presence of carcinogenic chlorinated hydrocarbons in subsurface waters are explored by contributions of Schiefler et al., Perez et al., and Mangayayam et al.

We would like to thank all the authors for their efforts and enthusiastic contributions to this volume. These 24 manuscripts demonstrate that there has been much progress towards understanding the processes transferring carbon on and within the Earth. However, it is clear there is much additional basic science and engineering needed before we solve the global carbon challenge. We hope this collected volume does at least a small part in both moving these efforts forward and motivating our community to a more secure future.

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