

## **Bridging “Spheres,” Disciplines, Scales, and People in the Earth System**

**Most indicators that describe the health of our planet suggest that “patient Earth” is not doing well. The diagnostic is clear: our resources are diminishing, air and water pollution is growing, climate is changing, putting new stress in vulnerable parts of the world, biodiversity is declining, the fish in the oceans are disappearing, the Arctic ice sheet is melting, and ecosystems are suffering. At the same time, living standards, the level of education, the health of the population remain very uneven in different parts of the world. Climate models suggest that important changes are to be expected in the next Century: the planet will become warmer with many different consequences including shifts in the precipitation patterns, rise in sea level with severe impacts in several coastal regions of the world, a more frequent occurrence of heat waves, flooding events and droughts.**

**The causes of these changes are rather well understood. To a large extent, they are attributed to the human enterprise, including industrial activity, transportation, deforestation, agricultural practices, etc. What is less well understood is the response of “patient Earth.” Could amplification mechanisms push the planetary system into a new and very different stable equilibrium? What are the thresholds above which changes would become irreversible? To what extent will society be able to mitigate the causes of global change, and to what extent will it have to adapt to future changes?**

**To drive the planetary system towards a sustainable future, to develop mitigation strategies, and to implement adaptation approaches, government, industry and society in general need to access the best possible tools. Scientific research cannot anymore be driven only by intellectual curiosity; the scientific community must mobilize itself to help solve the global environmental crisis. The task is immense and will require multi-disciplinary approaches. The tasks must involve the international community with participation, not only of the richest countries, but also of the emerging world, which will play a key role in the future solutions. The approach will have to be global, but with the recognition that changes and their impacts occur primarily at the regional and even local levels. The dialogue that exists between the community of scientists and of policy makers needs to be considerably enhanced, and the appropriate tools to translate the results of the research into accessible information for society need to be developed. Just like 50 years ago when the scientific community decided to develop societally important weather prediction models, it is imperative today to establish an observational and modeling infrastructure that will monitor and predict the evolution of “patient Earth” and assess its likely response to possible actions by society. The “medication” ranges from changes in the behavior of the population, the adoption of new policies, to more controversial geo-engineering approaches.**

Today, the urgent measures needed to protect the Earth from a “dangerous” state, specifically regarding energy, food, and water, may have important, yet poorly understood consequences for the Earth itself. There is an urgent need to develop approaches that bridge the different “spheres” in the Earth system, the various scales that convey the signals of perturbations, the scientific disciplines that are needed to address the problem and the people of the world that will all be affected by expected changes in the Earth system.