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This outline is an outcome of a workshop held in Hamburg in February 2020. For more details see the [full report](#). The outline is provisional.

Safe Landing Climates

Author(s): P. Friedlingstein, J. Box, P. Braconnot, N. Harris, G. Hegerl, M. Visbeck

Description of the activity

This Lighthouse Activity is an exploration of the routes to climate-safe landing 'spaces' for human and natural systems. It will explore present-to-future "pathways" for achievement of key, if not all, Sustainable Development Goals (SDGs) such as climate action SDG 13, zero hunger SDG 2, good health and well-being SDG 3, clean water SDG 6, life below water SDG 14 and life on land SDG 15. The relevant time scale is multi-decadal/centennial to millennial, consistent with the objectives of the United Nations Framework Convention on Climate Change (UNFCCC) Paris Climate Agreement, contributing to the long-term global response to climate change to protect people, livelihoods and ecosystems.

The Safe Landing Climates Lighthouse Activity will connect climate, Earth system and socio-economic development sciences and provide concrete outputs through new Earth system modeling tools for climate and Earth system change studies on long time scales, contribution to reports and resource available to scientists and non-scientists.

It will promote the development of new methodologies to include risks assessments of impacts on human and natural systems, of climate instabilities, extremes, and irreversible transitions at global and regional scales in the long term.

It will promote development of much improved process-based and highly parameterized models, as well as more conceptual frameworks, to enable robust climate science information to be used by science and decision makers in governments at all levels, and for the private and public sectors.

Form of activity

At the WCRP-level, the activity will consist of a global research activity (supported by a core working group) bringing together physical climate scientists, Earth system component scientists (e.g. ice sheet, land/ocean ecosystems, atmospheric composition, social scientists, economists, and sustainable development experts). Its task will be to plan, encourage and coordinate relevant activity across the world; communicate and disseminate key findings; and facilitate user-oriented climate safe-landing tools.

At the scientific community level, the activity will consist of collaboration across climate/Earth system/socio-economic science to design, develop, apply and facilitate the use of comprehensive Earth System modeling tools to represent climate, earth system, natural environments and human socio-economical systems to allow exploration of long-term response of climate and key SDGs for large sets of future human developments scenarios. At the public and policy user level, the activity will ultimately provide knowledge and user-oriented tools for exploration of future scenarios and impact on climate and SDGs from global to regional scales.

What will it deliver and/or achieve?

- Inform all parts of global society on sustainable pathways leading to desirable futures
- Better understanding of the role of climate in the SDGs
- Climate-proofing proposed sustainable development pathways
- Stronger understanding of processes central to quantitative understanding of the long-term climate evolution over the 21st century and beyond
- A new generation of climate/Earth system models to investigate how risks arising from climate instabilities, extremes, and irreversible transitions might affect society and natural systems, with potential feedbacks on the climate system
- New articulation and visualization of potential climate pathways and the consequences of near-term decisions for longer-term climate and the Earth system.
- A new generation of analysis systems (articulation, visualization, etc.) for specialists and non-specialists.

Relation to the World Climate Research Program Strategy, including as appropriate any aspect that is new or novel.

The safe-landing Lighthouse Activity directly relates to the overall vision of WCRP, that is “a world that uses sound, relevant and timely climate science to ensure a more resilient present and sustainable future for humankind.” More specifically, this Lighthouse is fully aligned with WCRP Scientific Objective 3 – Future evolution of the climate system, quantifying the responses, feedbacks and uncertainties intrinsic to the changing climate system on longer timescales; and WCRP Scientific Objective 4 – Bridging climate science and society, supporting innovation in the generation of decision-relevant information and knowledge about the evolving Earth system.

Science requirement; including new science and how this draws upon the core research expertise of the WCRP community.

- Significant climate and Earth System model development
- New process studies (e.g. focused on abrupt changes, threshold, non-linear processes, irreversibilities and hysteresis; extreme events breaching the limits of adaptability)
- Planetary boundaries (including input from paleo sciences)
- Risks of climate instabilities and irreversibilities (e.g. permafrost, ice sheets, ...)
- Better integration of Sustainable Development Goals (e.g. zero hunger, good health, clean water, life below water, life on land, ...) in Earth System Models
- Changing human and ecosystems habitability zones
- Better understanding of urban (built) / rural (natural) environments
- Climate and Earth system response to reducing climate forcings and to climate intervention approaches
- Co-design climate and socio-economic development sciences.
- Articulation and visualization of safe-landing zones tools (e.g. “Safe Digital Earths”)
- Explicit attention to union between physical and social sciences.

Partnerships needed to do this Activity; including if WCRP will be the Lead or if it will be a jointly-lead Activity (and if so, who are the key Partners).

WCRP would be leading this activity as the climate system is at the core of this Lighthouse. It would need partnership with Future Earth, the Integrated Assessment Modeling Consortium, the Belmont Forum, the Earth Commission, UN Sustainable Development Goals programme and projects such as the World in 2050. There is a possible connection to the ‘digital twin’ Lighthouse that would enable to visualize climate-safe landing points and the pathways leading to them at the landscape level.