Topics (T)
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ESA'S EARTH EXPLORER MISSION HARMONY - RESOLVING CLIMATE STRESS IN THE EARTH SYSTEM

Abstract

As part of ESA's Earth Observation programme, the Earth Explorer 10 Harmony mission comprises two identical satellites orbiting Earth in convoy with a Copernicus Sentinel-1 radar satellite. Each of the two Harmony satellites carries a receive-only synthetic aperture radar, using Sentinel-1 as transmitter, and a multiview thermal-infrared instrument. Together with Sentinel-1, Harmony promises to provide a wealth of unique data on ocean–ice–atmosphere interactions at unprecedented resolution for more insight into the long-term impacts of climate change, upper-ocean heat exchanges, and drivers of extreme weather. Harmony will also measure small shifts in the shape of the land caused by earthquakes and volcanic activity, thereby contributing to risk monitoring. Uniquely, Harmony will quantify many different aspects of the cryosphere such as changes in the volume of ice held in glaciers, changes to the margins of ice sheet and changes to ice-rich permafrost, as well as deliver observations of surface motion of these ice bodies. The unique interferometric and 3D surface change mapping capabilities of Harmony will not only provide high-precision measurements of glacier mass balance but also an improved understanding of subglacial processes occurring thousands of metres below the ice surface. Rapid change in glacier mass is one of the largest uncertainties when it comes to projecting future sea-level rise. With millions of people at risk from rising seas, measurements from Harmony will help to better quantify how glaciers and ice sheets are adding to sea level, thereby contributing to the WCRP Grand Challenge of 'Melting Ice and Global Consequences', and 'Regional Sea-level Change and Coastal Impacts'. Surge-type glacier flow and permafrost landslides are associated with a range of natural hazards such as outburst floods, ice and debris avalanches, and land inundation. Harmony's novel measurements of terrain changes and land motion will provide new insights into the processes that cause these hazards, therefore contributing to the UN Sendai Framework for Disaster Risk Reduction, not least to its 'Understanding Disaster Risk priority'.