

THE DECADAL SURVEY'S ICESAT-II MISSION: A FUNDAMENTAL TOOL FOR UNDERSTANDING THE EARTH'S RAPIDLY CHANGING ICE COVER

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The Earth's polar ice cover is one of the most rapidly changing components of the Earth system, with the potential to impact global climate and sea level significantly. Despite its importance, observations to quantify how this ice is changing and the processes that control these changes remain very limited. The Ice Cloud and land Elevation Satellite (ICESat), launched January 12, 2003 has literally and figuratively added a new dimension to understanding of the Earth. ICESat has returned valuable information on the growth and shrinkage of the Greenland and Antarctic ice sheets as well as unprecedented detailed information on sea ice freeboard, from which sea ice thickness is estimated. Moreover, it has demonstrated utility for large-scale vegetation biomass assessment, as well as applications in the fields of hydrology, oceanography, solid-earth science, atmospheric science, etc. The capabilities of ICESat, which was planned as the first of three similar missions over a fifteen-year period have never fully been realized; due largely to unforeseen limitations in the lifetime of the first two of its three lasers. As a result, ICESat has been operating in "snapshot" mode for two or three 33-day campaigns each year, repeating measurements on a 33-day subcycle of its original 91-day exact-repeat cycle. Despite these complications, it has provided valuable new data across a range of disciplines, and the decadal survey has made ICESat-II, the follow-on mission to ICESat, one of its first-tier missions citing the urgent need to observe the rapidly changing ice cover. ICESat-II is expected to build on the original ICESat measurements by extending the ICESat time series with continuous operation to enable full characterization of the seasonal and interannual cycles and determine the trend of ice sheet and sea ice changes. In addition, the decadal survey has identified vegetation biomass assessment as an additional capability of the ICESat-II mission, which is expected to complement the more dedicated vegetation capabilities of the DESDynI mission. ICESat has provided an important new and valuable tool for understanding the behavior of the Earth's ice cover and various other aspects of the Earth system. ICESat-II will carry that capability into the future to enable trend assessments and robust model development and refinement.