science strategy for the earth observing system

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Only a small fraction of the Earth’s alpine glaciers and ice caps have been carefully studied.

**KEY QUESTIONS**

- What are the current mass balances of the polar ice sheets?
- Through what processes are these ice sheets growing or thinning?
- What are the rates of snow accumulation, melting, and iceberg calving, and how do these reveal the key dynamics of ice flow?
- How will the climate system and its changes affect mass balances of alpine glaciers and ice sheets, and what is the resulting effect on sea level?
- Will changes in mass balances of ice sheets and glaciers cause a significant rise in sea level in the next century?
- How will snow cover change as the climate warms; in particular, will a greater fraction of the winter snowfall occur as rain?

**SCIENCE STRATEGY**

Before the EOS satellite series, airborne synthetic aperture radars, ERS-1 and -2, JERS-1, SIR-C/X-SAR, and Radarsat will provide useful data on extent and dynamics of ice sheets and loss of ice through calving. Radar altimeters designed for ocean topography observations will make some measurements of topographic change over parts of the ice sheets. Measurements of sea level and ice volumes require data on changes in ocean and ice elevation, control of satellite orbits, geodetic measurements of the vertical movements of the land around the oceans and ice sheets, and the establishment of a uniform global reference frame for vertical movements.

The primary EOS instruments capable of contributing to studies of the great ice sheets include GLAS, SALT, TMR, and DORIS—namely, the payload for the EOS-ALT series, whose first flight is scheduled for 2002. The laser altimeter of GLAS is the central instrument, designed to make mass balance measurements of the polar ice sheets.

MODIS, ASTER, and MISR will provide information on snow cover and glacier features. ASTER, a high-resolution imager on EOS-AM1, will yield data to infer glacier flow. MODIS—on both the EOS-AM and -PM series—will provide broad patterns of spatial extent and coverage. MISR, also on the EOS-AM series, will provide information on snow albedo and its angular variations. High-resolution instruments can then examine areas of change to determine how the climate affects the local mass balance.