Solid Earth Science Working Group
Recommended Observational Strategies

http://solidearth.jpl.nasa.gov

Timeline / Observational Strategies	Immediate (1–5 Years)	Near Term (5–10 Years)	Long Term (10–25 Years)	Plate Boundaries	Land Surface Change	Ice and Ocean Dynamics	Magmatic Processes	Mantle Dynamics	Magnetic Field
Surface deformation	Single dedicated InSAR satellite • L-band, left/right looking capability, and weekly access to anywhere on the globe • Precise orbit determination and ionospheric correction capabilities • 1 mm/yr surface displacement over 50-km horizontal extents in selected areas	Constellation of InSAR satellites • Improved temporal frequency of deformation maps to daily intervals • Maps at several-hundred-km width with full vector surface displace ments at accuracies of submillime-ter per year over 10-km spatial extents and 1-m spatial resolution • Complementary ground and seafloor geodetic observations	Constellation of InSAR satellites in low-Earth or geosynchronous orbits • Hourly global access • Increased density of continuous ground and seafloor geodetic observations						
High-resolution topography	Distribute all SRTM data, launch ICESat, and demonstrate imaging lidar capabilities in Earth orbit	Global mapping to supercede the SRTM data set • One-time global mapping at 2- to 5-m resolution and 0.5-m vertical accuracy for the ground surface • Ice-sheet mapping with 1-km horizontal resolution, 1-cm vertical accuracy for the ice or snow surface, and a repeat interval of months (for annual changes) to years (for long-term changes)	Continuously operating, targeted, high-resolution topographic mapping and change-detection capability • Targeted local to regional mapping, with global access, at 1-m resolution, 0.1-m vertical accuracy for the ground and water surfaces • Repeat frequency of hours to years depending on the rate of topographic change						
Variability of Earth's magnetic field	Support of analysis of geomag-netic observations from current satellites • Development of a modularized instrument package to facilitate taking advantage of missions of opportunity	Constellation of 4–6 satellites • At a range of local times • Approximately 800-km altitude in polar orbit	Complete, 12-satellite constellation • Adding satellites at lower altitude (300 km) in polar orbit (to enhance study of the crustal field) • At 800 km in a low-inclination orbit (to enhance recovery of mantle electrical conductivity) • Technological advancements on incorporating star trackers on magnetometers and improved lifetimes at low altitudes						
Variability of Earth's gravity field	GRACE • Monthly estimation to within a few millimeters of surface water-equivalent load at a few-hundred-kilometers spatial resolution	GRACE follow-on mission • Demonstration of satellite-to-satellite laser interferometry technology	Gravity measurement improved by 2–3 orders of magnitude in sensitivity • Satellite-to-satellite laser interferometry, or • Spaceborne quantum gradiometer						
Imaging spectroscopy of Earth's changing surface	Continued spaceborne and airborne imaging in the solar reflected spectrum • Develop airborne measurement capability in the TIR (3–5 and 8–12 micrometers)	Improved spaceborne imaging spectrometer • 100-km swath and 30-m spatial resolution in the VNIR • Demonstration of spaceborne TIR imaging spectrometer: 30-km swath, 30-m spatial resolution	Continuous full-spectrum spaceborne imaging spectrometry • Targeted local to regional mapping, with global access, across multiple wavelengths • Repeat frequency of hours to years, depending on the rate of change of the studied process						

Scientific Challenges	Color Code	Examples of the Benefits to Society
What is the nature of deformation at plate boundaries and what are the implications for earthquake hazards?		Rapid response to seismic disasters
How do tectonics and climate interact to shape the Earth's surface and create natural hazards?		Floods, landslides, and coastal erosion risk assessment
What are the interactions among ice masses, oceans, and the solid Earth and their implications for sea-level change?		Improved estimates of future sea-level rise
How do magmatic systems evolve and under what conditions do volcanoes erupt?		Advanced planning for high-risk populations near volcanoes
What are the dynamics of the mantle and crust and how does the Earth's surface respond?		Understanding mantle and crustal dynamics role in hazards
What are the dynamics of the Earth's magnetic field and its interactions with the Earth system?		Forecasts of magnetic field for space weather effects on satellites