Problem 1: Describe the main characteristics of point-geodetic observations versus imaging techniques in terms of spatial and temporal resolution and coverage.

Space-geodetic tracking methods provide time series of point movements. Their temporal resolution and accuracy are usually high. Remote-sensing techniques in general have much lower temporal resolution but they provide information with potentially higher spatial resolution and have much better coverage, including the surface of oceans, lakes, and ice sheets.

Problem 2: What is the "station motion model" and how does it enter into the analysis of point-geodetic techniques?

Stations are not static on the earth. Their motion could be described by models, such as tidal models, etc.

Data analysis requires a good a priori station motion model describing in, particular any variation with periods shorter than the analysis interval.

Problem 3: Which space-geodetic techniques provide the origin of the reference frame with respect to the center of mass and which provide the scale? Why?

Satellite laser ranging (SLR) and lunar laser ranging (LLR) can provide range measurements of a few millimeters precision which are accumulated to help define the origin of terrestrial reference frame.

VLBI can provide the scale.

Problem 4: Explain the principle of GNSS reflectometry.

GNSS reflectometry is passive sensing that takes advantage of and relies on separate active sources - the GNSS satellites generating the navigation signals. Direct and ocean-reflected signals are detected by spaceborne receivers and altimetric height information is extracted from the delay in arrival times of the reflected in relation to the direct signals.

Problem 5: Why are laser retroreflectors on satellites like Global Navigation Satellites, altimeter satellites, and other satellites that use geometrical principles important?

Laser retroreflectors installed on these satellites can allow people to track the trajectories of the satellites. This is called orbit determination.

Problem 6: Explain briefly the principle of InSAR and identify the major limitations for accuracy and applicability. How could these challenges be addressed?

InSAR is a processing technique for SAR images. Synthetic-aperture radar (SAR) is a form of radar whose defining characteristic is its use of relative motion between an antenna and its target region to provide distinctive long-term coherent-signal variations that are exploited to obtain finer spatial resolution than is possible with conventional beam-scanning means.

During the SAR mission, the intensity and phase of the reflected signal are measured. In order to measure topography, two antennas separated in space are used to measure phase differences between the two antennas from a radar signal reflected from one point on the Earth's surface.

SAR is more sensitive to vertical movement and it’s best to combine with point measurements.

Connection to a global geocentric reference frame; Atmospheric effects sometimes are severe.

Problem 7: What are the main characteristics of in situ, airborne and spaceborne gravity measurements in terms of temporal and spatial resolution, as well as accuracy as function of spatial and temporal scale?

Gravity was measured in situ, airborne or shipborne and combined with leveling (in situ) and tracking (ship, airplane). Problems are: It is difficult to measure gravity and topographic height (leveling) on the whole earth surface; the long wave length has large errors (due to leveling); and the theory is first order. Advantage is that it has high spatial resolution for short wave length.

Problem 8: Explain the principle of GRACE and its main limitations in terms of accuracy.

One satellite follows the other and their distance is measured by ranging system. This technique is called SST.

Limiting factors for GRACE gravity field determination are: The sensor accuracy can be improved. There are many disturbances on measurement. Spatial-temporal sampling is limited. It is a huge number of parameters as the degree and order goes larger.

