

Surface Observables – Glossary

1. **Dynamic Topography:** topography due to deflection of a surface from stresses caused by viscous flow.
2. **Gravitational Potential:** the work required to move a unit of mass a given distance in a gravitational field. For a spherical earth with only a radial density structure the gravitational potential is a function height above the surface. In this a case any sphere from the surface of the earth and up forms an equipotential surface, that is a surface on which the value of the gravitational potential is the same. If there are lateral density anomalies in the Earth, then the equipotential surfaces are no longer perfect spheres.
3. **Reference Geopotential Surface:** the equipotential surface for a radially symmetric, rotating Earth (so its slightly ellipsoidal) that is at approximately the same radius as mean sea-level.
4. **Observed Geopotential Surface:** the observed equipotential surface for the Earth that is at approximately the same radius as mean sea-level. This surface is also referred to as the Geoid.
5. **Geoid Height:** The difference in radius between the observed and reference geopotential surfaces. The geoid height has an approximate range of ± 250 meters.
6. **Free-air Gravity Anomaly:** The residual gravity anomaly after corrections are made to the observed gravitational acceleration for the hydrostatic rotating earth and height of the measurement above sea-level.
7. **Spherical Harmonics:** An orthogonal set of solutions to Laplace's equation represented in a system of spherical coordinates (for the earth: latitude, longitude, radius). The solutions are generally expressed in terms of Legendre Polynomials. Like sine and cosine waves in the time domain, a infinite series spherical harmonics of vary "wavelengths" can be summed to represent any function on a the surface of a sphere.
8. **Rheology:** Study of the deformation and flow of matter (from the greek *rhei* for flows).
9. **Viscosity:** A property of a fluid that characterises its perceived "thickness" or resistance to pouring. It describes a fluid's internal resistance to flow and

may be thought of as a measure of fluid friction. Thus, methanol is "thin", having a low viscosity, while vegetable oil is "thick" having a high viscosity. The viscosity is defined as the ratio of the shear stress divided by the strain-rate (Units of Pascal-seconds: Pa s).

10. **Newtonian fluid:** a fluid in which strain-rate (velocity gradient) is linearly proportional to the shear stress. The constant of proportionality is known as the viscosity. The motion of Newtonian fluids is described by the Navier-Stokes equations.
11. **Non-Newtonian fluid:** a fluid in which the strain-rate is proportional the shear stress raised to some power
12. **Strain-rate:** within a viscous flow, the gradient of the flow velocity divided by the length-scale over which the change in velocity occurs.
13. **Poloidal Plate Motion:** the purely divergent and convergent component of plate motion.
14. **Toroidal Plate Motion:** the purely translational (strike-slip, transform) component of plate motion.