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World of Earth Science | Convection (Updrafts and Down-drafts)

Convection is the vertical transfer of mass, heat, or other properties in a fluid or substance that undergoes fluid-like dynamics. Convection takes place in the atmosphere, in the oceans, and in Earth's molten subcrustal asthenosphere. Convective currents of air in the atmosphere are referred to as updrafts and downdrafts.

In addition to heat transfer, convention can be driven by other properties (e.g., salinity, density, etc.).

Convection in the mantle drives motion of the lithospheric plates. This convection is, in part, caused by temperature differences caused by the radioactive decay of the naturally radioactive elements uranium, thorium, potassium.

The temperature differences in water cause ocean currents that vertically mix masses of water at different temperatures. In the atmosphere, convection drives the vertical transport of air both upward and downward. In both cases, convection acts toward equilibrium and the lowest energy state by allowing the properties of the differential air or water masses to mix.

Thermal convection is one of the major forces in atmospheric dynamics and greatly contributes to, and directly influences, the development of clouds and storm systems. Convective air currents of rising warm and moist air allow a transfer of sensible and latent heat energy from the surface to the upper atmosphere.

One meteorological hypothesis, the convection theory of cyclones, asserts that convection resulting from very high levels of surface heating can be so strong that the current of air can attain cyclonic velocities and rotation.

Convection with the earth's mantle results from differential temperatures in mantle materials. In part, these differences can manifest as hot spots or convective currents where less dense and warmer mantle materials form slow moving vertical currents in the plastic (viscous or thick fluid-like) mantle. Phase change differences in materials also change their density and buoyancy.

Convective currents in the mantle move slowly (at a maximum, inches per year), but may last millions of years.

See also Adiabatic heating; Atmospheric circulation; Atmospheric composition and structure; Atmospheric inversion layers; Atmospheric lapse rate; Atmospheric pressure; Insolation and total solar irradiation