

Gravity, Oceanic Angular Momentum, and the Earth's Rotation

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The angular momentum of the oceans changes as both the direction and speed of oceanic currents change and as the mass of the oceans is redistributed. Since, in the absence of external torques, the angular momentum of the solid Earth-atmosphere-ocean system is conserved, then the changing oceanic angular momentum will cause the solid Earth's angular momentum to change, or, in other words, will cause the Earth's rotation to change.

Redistributing the oceans' mass also causes the Earth's gravitational field to change, an effect that will soon be measured by the CHAMP and GRACE satellite missions. By measuring changes in the second-degree spherical harmonic coefficients of the Earth's gravitational field, which are simply proportional to the elements of the Earth's inertia tensor, CHAMP and GRACE will, in effect, be directly measuring changes in the Earth's rotation caused by mass redistribution. In this presentation, estimates of the angular momentum of the oceans computed from oceanic general circulation models will be used to evaluate the effect of the changing mass distribution of the oceans on the Earth's rotation and second-degree gravitational field coefficients.