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Improving the Theory of the Earth's Rotational Variations

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The theory currently used to study small variations in the Earth's rotation that occur on time scales longer than a day is reviewed. This theory, which was developed in the late 1970s and early 1980s, is based on the principle of the conservation of angular momentum which states that changes in the rotation of the solid Earth are caused either by torques acting on the solid Earth or by changes in the mass distribution within it. When applying this principle to the rotation of the Earth a number of simplifying assumptions are made including: (1) linearity; (2) axisymmetry; (3) equilibrium oceans; (4) Tisserand mean-mantle; (5) the core is uncoupled from the mantle; and (6) the rotational variations occur on time scales much longer than a day. While the resulting theory has been successfully used in the past to interpret the observed variations in the Earth's rotation, it is argued that the accuracy of the observations has improved to the point that the current theory is no longer adequate and that a new, more accurate theory of the Earth's rotation is needed.