NUTATION THEORY FOR A NON-RIGID EARTH: PRESENT STATUS AND FUTURE PROSPECTS

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ABSTRACT. The 1980 IAU nutation series includes effects of the Earth's non-rigidity. Certain simplifying assumptions were made in the model, including that the Earth is elastic and hydrostatically pre-stressed. The rationale was that geophysicists didn't understand the Earth well enough to justify a relaxation of those assumptions, and that the nutation observations were not accurate enough to detect the difference, anyway. Geophysicists are still not able to construct a more accurate model that is independent of the nutation observations, themselves. But, the observations have improved enormously. Recent results obtained from VLBI data show discrepancies with the IAU model of close to 2 milliseconds of arc: many times the observational uncertainty. Thus, the nutation observations are beginning to tell us things about the Earth that cannot presently be inferred as accurately from other techniques. I will discuss some of these possible geophysical applications. Among them are the shape and internal structure of the core, and the Earth's anelasticity.

Discussion

KAPLAN: Are the theoretical problems likely to be resolved within the next few years? Have we reached the point where the observational accuracy will continue to exceed the theoretical capabilities? Specifically, for astrometric use, perhaps should the IERS publish corrections to nutation angles based upon observations?

WAHR: I'm not prepared to recommend what the IERS should do. But my guess is that it will be several years before geophysicists can independently determine the important parameters well enough to give significant improvement in the nutation theory.

TREUHAFT: Is it possible that moving the 460-day period to a 430-day period is an over-correction, causing the six-month term to pop up? Or do all the observational data sufficiently constrain the shift from 460 days to 430 days, causing you to look elsewhere for the 6-month discrepancy?

WAHR: The shift to 430 days could, conceivably, be somewhat of an over-estimate. For example, if the effects of mantle anelasticity are added prior to fitting the period, then the new result could be a little larger than 430 days. But, you are still stuck with the problem of finding an effect that can perturb the retrograde annual term much more strongly than any other term. And, I see no reasonable alternative for solving this problem, than to change the period to something close to 430 days.

J. H. Lieske and V. K. Abalakin (eds.), Inertial Coordinate System on the Sky, 147.