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Future precession models

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IERS Conventions 2003 implement the IAU 2000A precession-nutation model that was adopted both by the IAU (IAU 2000 Resolution B1.6) and the IUGG (IUGG 2003 Resolution 4). This model uses the existing IAU 1976 precession and applies to it the MHB2000 nutation series (Mathews et al. 2002). In addition to the nutation proper, this series includes terms to correct the precession rates in longitude and obliquity and to reflect the offset between the J2000 mean pole and the ICRS pole.

The IAU 2000 precession, although of practical utility for the next few years, is by nature dynamically inconsistent and suffers, except for the improvements in the precession rates, from the same limitations as the IAU 1976 precession in the precision of the coefficients and compliance with up to date models for the ecliptic motion and non-rigid Earth. To address these limitations, new precession models consistent with IAU 2000A have been studied, as reported in recent papers by Bretagnon et al. (2003), Fukushima (2003) and Capitaine et al. (2003). An IAU Division I Working Group on "precession and the ecliptic" was established at the 2003 General Assembly in order to look into these issues and select an improved, dynamically consistent, precession model as a possible replacement for the precession component of IAU 2000A.

The "P03" solutions of Capitaine et al. (2003) for the equator and the ecliptic have been proposed as the replacements for the IAU 2000 precession. We report on the procedure that was used for developing the P03 solution and on the comparisons of this solution with other models and with VLBI observations. This shows that, unlike the IAU 2000 precession, P03 is dynamically consistent and moreover that it fits VLBI distinctly better than IAU 2000. We also report on "P04", the parametrized form of the precession solution that takes into account any future adjustments to the precession rates and the Earth's J2 rate. These precession models include expressions that support both the equinox-based and CIO-based (i.e. referred to the Celestial Intermediate

Origin) transformations. In parallel with these efforts, another IAU Working Group established at the 2003 General Assembly has been studying the nomenclature issues that the new transformations have raised, and their recommendations will be available when future editions of the IERS Conventions are being prepared.

Various methods have been studied to identify which transformations between celestial and terrestrial coordinates involve a minimum number of variables and coefficients. We report on their properties and on the real accuracy that can be achieved, which may help to determine which precession-nutation expressions and matrix transformations should be adopted in the updated IERS Conventions.