INTRODUCTION

This document is intended to define the standard reference system to be used by the International Earth Rotation Service (IERS). It is based on the Project MERIT Standards (Melbourne, *et al.*, 1983) and the IERS Standards (McCarthy, 1989) with revisions being made to reflect improvements in models or constants since the previous IERS Standards were published. If contributors to IERS do not fully comply with these guidelines, they will carefully identify the exceptions. In these cases, the institution is obliged to provide an assessment of the effects of the departures from the standards so that its results can be referred to the IERS Reference System. In the case of models, contributors may use models equivalent to those specified herein. Different observing methods have varying sensitivity to the adopted standards and reference systems. No attempt has been made in this document to assess the sensitivity of each technique to the adopted reference systems and standards.

The recommended system of astronomical constants corresponds closely to those of the previous IERS Standards with the exception of the changes listed below. The units of length, mass, and time are in the International System of Units (SI) as expressed by the meter (m), kilogram (kg) and second (s). The astronomical unit of time is the day containing 86400 SI seconds. The Julian century contains 36525 days of atomic time. The Gaussian constant, k = 0.01720209895, is the defining constant relating the heliocentric gravitational constant ($GM_\odot$) to the astronomical unit of length (A) and to the unit of time through the relationship

$$GM_\odot = A^3 k'^2$$

where $GM_\odot$ is expressed in $m^3\ s^{-2}$, A is the astronomical unit in meters (derived from the measured value of the astronomical unit in light-seconds and the defined value of the velocity of light in $m\ s^{-1}$), and k' is k/86400.

In general, each observational technique uses different realizations of both the terrestrial and celestial frames. In addition, the techniques use different transformations between these frames. The J2000.0 epoch is recommended for use in reference system algorithms. The transformation from the 1950.0 frame to J2000.0 should use the IAU 1976 value of the precession constant. The value of the correction to the FK4 equinox is (Fricke, 1982)

$$E(T) = 0^s.035 + 0^s.085T,$$

where T is measured in Julian centuries from 1950.0. This expression for E(T) is adopted and is applied at the epoch J2000.0.

Differences Between This Document and IERS Technical Note 3

Most chapters of IERS Technical Note 3 have been revised, and known typographical errors contained in that work have been corrected in this addition. There are some major differences between the current version of the IERS Standards and the past version of the IERS Standards. The following is a brief list of the major modifications by chapter.

CHAPTER 1 Numerical Standards

Numerical values have been changed for the solar parallax, the ratio of the solar mass to the mass of the Earth, the ratio of the solar mass to that of the Earth-Moon system, the solar mass and GM of the Moon. Reference to scaling of masses necessitated by the use of the TDB time scale has been removed.

CHAPTER 3 IERS Terrestrial Reference Frame

The permanent solid Earth tide correction is no longer included in the site position. The permanent tide, an intrinsic constituent of site position, is now to be included as a site displacement. The chapter incorporates the material of Chapters 3 and 9 of IERS Technical Note 3. The NUVEL NNR-1 Model (DeMets, *et al.*, 1990) for plate motion has replaced the AM0-2 Model of IERS Technical Note 3.

CHAPTER 5 Transformation Between Celestial and Terrestrial Reference Systems

Chapters 4 and 5 of IERS Technical Note 3 have been combined, and the option of using the "non-rotating origin" (Guinot, 1979) procedure to transform between the reference systems has been added. Small terms not given in IERS Technical Note 3 for nutation have been added, and the effects of geodesic nutation are discussed briefly.

CHAPTER 6 Geopotential

GEM-T3 has replaced GEM-T1 as the adopted gravity field.

CHAPTER 9 Local Site Displacements

Horizontal components of site displacement due to ocean loading have been included.

CHAPTER 10 Tidal Variations in UT1

The effect of ocean tides has been added to the effects listed in IERS Technical Note 3.

CHAPTER 13 General Relativistic Models for Time, Coordinates, and Equations of Motion

The consequences of the resolutions adopted by the 1991 IAU General Assembly have been included.

CHAPTER 14 General Relativistic Models for Propagation

A consensus model for VLBI propagation delays replaces the previous models.

APPENDIX IAU, IAG and IUGG Resolutions

Resolutions adopted at the International Astronomical Union (IAU), the International Association of Geodesy (IAG) and the International Union of Geodesy and Geophysics (IUGG) General Assemblies in 1991 dealing with reference systems have been reproduced and included.

References

DeMets, C., Gordon, R. G., Argus, D. F., and Stein, S., 1990, "Current Plate Motions," *Geophys. J. Int.*, **101**, pp. 425-478.

Fricke, W., 1982, "Determination of the Equinox and Equator of the FK5," *Astron. Astrophys.*, **107**, pp. L13-16.

Guinot, B., 1979, "Basic problems in the kinematics of the rotation of the Earth," in *Time and the Earth's Rotation*, D. D. McCarthy and J. D. Pilkington (eds), D. Reidel Publishing Company.

Melbourne, W., Anderle, R., Feissel, M., King, R., McCarthy, D., Smith, D., Tapley, B., Vicente, R., 1983, *Project MERIT Standards*, U.S. Naval Observatory Circular No. 167.

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