

## **Synergetic use of IERS products with an Earth reference ellipsoid model**

(Transformation problems, alternative principles and the need for some conventional guidelines)

C. Kotsakis

Department of Geodesy and Surveying  
Aristotle University of Thessaloniki  
University Box 440  
Thessaloniki 54124, Greece  
Email: kotsaki@topo.auth.gr

The determination of geometrical (ellipsoidal) heights at points located on the Earth's surface is a common fundamental procedure for many geodetic applications. In the context of IERS-related products, the most accurate determination of such heights can be achieved through the combined use of ITRF spatial positions with a conventionally chosen reference ellipsoid that is attached and properly aligned on the corresponding Cartesian coordinate system. In cases where terrestrial geometric heights need to be transferred from a given ITRF solution to another, significant apparent biases may be introduced in their transformed values if the reference ellipsoid retains the numerical value of its semi-major axis in both frames. In particular, using the standard framework of Euclidean similarity transformation, a critical issue that affects the transformed geometric heights from one ITRF to another is whether, or not, the adopted reference ellipsoid should be 'adapted' to each frame's spatial scale that is inherent in the Cartesian coordinates  $(x, y, z)$  of the control stations. The aim of the present paper is to describe this type of 'relativistic' effect and its consequences in IERS studies (e.g. comparison of height time series obtained by different space geodesy techniques such as VLBI, GPS and SLR), and to highlight its implications for additional applications of geodetic and geophysical interest.