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NEO Characterization

SENSITIVITY OF PREDICTIONS FOR CLOSE ENCOUNTERS OF NEAS WITH THE EARTH

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Keywords: *Close approaches, close encounters, near-Earth asteroids, ephemerides*

ABSTRACT

Close encounters of asteroids with the Earth and the consequent impact risks are usually characterized by the time moment and the distance of the minimal approach to the Earth. Predictions of these quantities provided by various ephemeris world services, like the IAU Minor Planet Center (Forthcoming Close Approaches To The Earth [1] and the Running Tallies [2]), the JPL Center for NEO Studies (CNEOS) [3], the ESA SSA-NEO Coordination Centre (NEOCC) [4] through its Space Situational Awareness Programme, the DynAstVO service [5] are far from being identical not only in the quantities mentioned but even in the lists of objects [6]. The same database of the measurements used for orbital fitting for NEAs should imply similarity in the prediction of the close encounters if the weighting of the measurements and dynamical modeling are the same. We apply sensitivity analysis for the time moment and the distance of each close encounter with respect to the numerically propagated NEAs position and velocity. Besides identifying the sources of uncertainty, it allows quantifying requirements for both the dynamical model and the numerical integration. We illustrate and discuss its application to future close encounters with the Earth within 0.05 AU for the near-Earth asteroids propagated for one year ahead by the various

services mentioned above. We emphasize the role of NEAs measurements taken at the moment of close approaches for reducing uncertainties in the prediction of such events and thus improving the corresponding orbits.

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