



Summary of the IAU Working Group on Cartographic Coordinates and Rotational Elements and Its Current Report

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Abstract

Approximately every 3 years since 1979, the Working Group (WG) on Cartographic Coordinates and Rotational Elements of the International Astronomical Union (IAU) has issued a report recommending coordinate systems and related parameters (body orientation and shape) that can be used for making cartographic products (maps) of solar system bodies. These recommendations, which are open to further modification when needed, are intended to facilitate the use and comparison of multiple datasets by promoting the use of a standardized set of mapping parameters. This abstract is intended to draw attention to the WG's efforts and the recently published WG 2009 report [1]. The WG encourages input and can assist users, instrument teams and missions on cartographic issues.

1. Operation of WG

The WG consists of volunteers, currently including 15 members from 7 different countries. The WG considers new determinations of coordinate systems (e.g., body sizes and orientation) that have preferably been published in refereed papers and makes recommendations as to which to use based where possible on consensus decisions. The leadership role of the group in making these recommendations serves to regularize coordinate systems in a field where there is potential for inconsistency and conflicting conventions. However, it is also useful to note here those services which the WG cannot provide. As a volunteer organization the WG has no resources to verify results or conduct its own research so it relies on only published results and community input. The WG cannot verify or "bless" any particular results, and for reasons of practicality, these recommendations are not from the full IAU. The WG has no "enforcement" powers, but tries, in reflecting the planetary community consensus, to make useful recommendations. The WG also does not deal with issues involving the data formats of

mapping products. Such issues have largely been left to map developers, organizations such as the Planetary Data System and International Planetary Data Alliance or groups such as the NASA Mars Geodesy and Cartography [2] and Lunar Geodesy and Cartography [3] Working Groups and individual missions. Input from such organizations has been welcomed by the WG and the frequency of interaction highlights the strong need for such organizations at mission, space agency, and/or international levels.

2. Defining Longitude

One issue that has resurfaced recently is the question of whether the definition of longitude should be updated on solar system bodies, such as Mercury and the satellites of Jupiter and Saturn. The WG addressed this issue in its first report [4] and reiterates in the recent report that once an observable reference feature at a defined longitude is chosen, the longitude definition origin should not change except under unusual circumstances (such as perhaps a change in or disappearance of the feature). This implies that once such a feature has been adopted, a return to a longitude system defined by some other method (e.g., the principal axes of inertia for resonantly or synchronously rotating bodies such as Mercury, the Moon, or Jovian or Saturnian satellites) should be avoided. This does not preclude the use of smaller or more precisely determined features, multiple features, or even human artifacts to define longitude, as long as the original definition is maintained to within the accuracy of previous determinations.

3. Changes for Specific Bodies

The new WG report introduces improved values for the pole and rotation rate of Mercury, returns the rotation rate of Jupiter to a previous value, introduces improved values for the rotation of five satellites of Saturn, and adds the equatorial radius of the Sun for

comparison purposes. It also adds or updates size and shape information for the Earth, Mars' satellites, the 4 Galilean satellites of Jupiter, and 22 satellites of Saturn. Pole, rotation, and size information has been added for the asteroids Lutetia, Davida, and Šteins. Pole, rotation, or mean radius information has been added or updated for Ceres, Pallas, and Vesta. The high precision realization for the pole and rotation rate of the Moon is updated to use the JPL DE 421 lunar ephemeris, but rotated (by small fixed angles) to represent the mean Earth/polar axis system. Alternative orientation models for Mars, Jupiter, and Saturn are also noted. The WG has adopted the IAU Working Group for Planetary System Nomenclature (WGPSN) and the IAU Committee on Small Body Nomenclature (CSBN) definition of dwarf planets.

4. Updating Procedures

Upon request and to provide information more often than every three years the WG will consider providing limited updates to its recommendations via <http://astrogeology.usgs.gov/Projects/WGCCRE>, its web site. The tentative plan is to determine every ~6 months whether time-critical updates are necessary and, if so, announce them on the WG site. We will also offer on the Web site newly published and (preferably) peer-reviewed determinations related to solar system coordinate systems. These postings do not eliminate the need for our triennial reports, in which we will continue to publish the majority of our recommendations. Input for such updates (whether for WG consideration or information only) and comment on these procedures is welcome.

5. Recommendations to the planetary community

For the first time, in its recent report the WG also provided some general recommendations regarding current urgent needs relative to the development of planetary cartographic products. These include recommendations that controlled cartographic products be planned for, that the Mars orientation model be updated, and that further research and consensus is needed regarding Jupiter and Saturn's rotation. (See the report [1] for full details.)

6. Outlook for 2012 Report

Although specific changes for the next report will depend largely on what new results are published, the WG anticipates updates or new values in several areas including an improved lunar ephemeris; the orientation of Mars, Jupiter, and Saturn; and new results from on-going missions. Under proposed structural changes in the IAU, the WG itself may morph into an "IAU Standing Committee," but in the near term would likely operate much as it does now. The WG also will look into establishing or re-establishing links to other organizations, such as the International Association of Geodesy. On a best effort basis, it will continue to provide assistance on coordinate system and mapping issues to the community (missions, product developers, etc.)

7. Request for Participation and Input

Additional volunteer members for the WG are needed as the number of new missions, bodies studied, and new results increases. The WG particularly has need of expertise on the orientation of the gas giant planets.

The WG would also greatly appreciate receiving input from the planetary community, e.g., regarding the systems for specific bodies and the operation of the WG. As noted above, the WG would like to hear from the community on the need for updates more often than every 3 years and on the issuing of general recommendations. Please contact the authors for information or to provide input.

Acknowledgements

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References

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