Boule v0.5.0: Reference ellipsoids for geodesy and geophysics

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Abstract

This document describes Boule v0.5.0, a software package for representing reference ellipsoids geometrically, calculating their gravity fields, and performing some global coordinate conversions. "Boule" is also French for "ball" as well as a traditional shape of bread resembling a squashed ball (much like the Earth). It is part of the Fatiando a Terra project and is available on Zenodo.

1 Introduction

Boule is a Python library for representing reference ellipsoids and calculating their gravity fields.

Boule is designed for:

- Storing and manipulating ellipsoid parameters for spherical harmonic analysis and coordinate system conversions.

- Calculating normal gravity for generating gravity anomalies and gravity disturbances.

2 Changelog for Version 0.5.0

Breaking changes:

- Drop support for Python 3.7 (188).

New features:

- Add `geocentric_radius` to `TriaxialEllipsoid` (146).

- Add a `volume` property for the `Sphere` (152).

- Add `mass`, `mean_density`, and `volume_equivalent_radius` properties to classes (173).

- Add true mean radius for `Sphere`, `Ellipsoid`, and `TriaxialEllipsoid` (177).

- Add `area` and `area_equivalent_radius` to all three ellipsoid classes (178).

- Add new planetary ellipsoids and new naming scheme (180).

- Add attributes for the normal potential to `Sphere` and `Ellipsoid` (184).

- Add `normal_gravitational_potential`, `normal_gravity_potential`, and `centrifugal_potential` methods to `Ellipsoid` and `Sphere` classes (187).

- Add the `semimedium_axis` and `semimajor_axis_longitude` to the `Sphere` and `Ellipsoid` classes for compatibility with the `TriaxialEllipsoid` (192).

- Add `__str__` method to `Ellipsoid` classes (213).

Maintenance:

- Extend support for Python 3.11 (147).

- Add Blazej Bucha to `AUTHORS.md` (148).

- Update Leo's affiliation from Liverpool to São Paulo (149).

- Update Black format to version 24.2 (150).

- Use Burocrata to check/add license notices (153).

- Use Dependabot to manage updates to GitHub Actions (154).

- Use Trusted Publisher to deploy to PyPI (160).

- Move package configuration to `pyproject.toml` (171).

- Add link to Leo's ORCID (190).

- Extend support to Python 3.12 (189).

- Run tests with oldest dependencies on x86 macOS (200).

- Replace `_version_generated.py` with `_version.py` (199).

- Move push to Codecov to its own job in Actions (203).

- Update how output variables are stored in Actions (206).

- Replace `build` with `python-build` in `environment.yml` (207).

Documentation:

- Update the version of Sphinx and its plugins (170).

- Fix typo in installation instructions (172).

- Update coordinate conversions web documentation (212).

- Replace Sphinx Napoleon with Numpydoc (195).

3 Citation

Please cite this software as:

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