New Efforts to Update NASA's Global Reference Atmospheric Models (GRAM)

Planned GRAM Upgrades

Venus-GRAM
- Upgrade topography, thermosphere model and Venus International Reference Atmosphere (VIRA) model (when available)
- Compare Venus-GRAM to Magellan, Venus Express and Akatsuki data

Earth-GRAM
- Update all atmosphere models
- Compare atmosphere, wind and dispersion models to Global Modeling Center data
- Complete comparison study of Earth-GRAM with recent flight data
- Update short term dispersion model (CorrMonte)

Mars-GRAM
- Update global circulation model and thermosphere model
- Compare Mars-GRAM to mission data
- Include additional MOLA topography options
- Improve dust tau modeling
- Revaluate hydrostatic approximations

Titan-GRAM
- Incorporate Titan empirical model (T-GITM)
- Update zonal wind model
- Compare Titan-GRAM with Cassini data products

Neptune-GRAM
- Determine if model updates are available

Develop new GRAMs for Uranus, Jupiter and Saturn

Motivation

NASA is at the forefront of planetary exploration. The inability to test planetary spacecraft in the flight environment prior to a mission requires engineers to rely on ground-based testing and models of the vehicle and expected environments. One of the most widely used engineering models of the atmosphere for many NASA projects is the Global Reference Atmospheric Model (GRAM) developed by the NASA Marshall Space Flight Center (MSFC). Over the past decade GRAM upgrades and maintenance have depended on inconsistent and waning project-specific support. Recently, the NASA Science Mission Directorate agreed to provide funding support in Fiscal Year 2018 and 2019 to upgrade the GRAMs. This poster summarizes the objectives, tasks and milestones of this effort.

Objectives

Primary
1. Upgrade atmosphere models
2. Modernize the code
3. Socialize plans and status to improve communication between users, modelers and developers

Secondary
1. Reduce amount of code and minimize bug fixes
2. Standardize model inputs to simplify and speed updates
3. Standardize data validation process
4. Publish data comparisons and user guides

Code Modernization

- Develop common framework that supports all solar system destination models
- Update software to C++
- Standardize call to atmosphere models
- Develop software documentation
- Generate unit test cases
- Incorporate SPICE ephemeris and topography capabilities
- Simplify GRAM implementation into trajectory codes

Project Milestones for Fiscal Year 2018/2019 and Beyond

1. Survey users to prioritize investments
2. Meet with key modeling groups
3. Identify and obtain atmosphere model upgrades for GRAMs
4. Identify and obtain observation and mission data sets for GRAM comparisons
5. Update code framework for Titan-GRAM
6. Develop Jupiter, Saturn and Uranus-GRAMs and add them to framework
7. Release initial version of integrated GRAM
8. Publish integrated GRAM user guide
9. Incorporate Venus and Mars-GRAM into the new framework; release updated version and user guide
10. Incorporate Earth-GRAM into the new framework; release updated version and user guide
11. Secure funding for long term maintenance of code and model upgrades

Destinations

Venus
Earth
Mars
Jupiter
Saturn
Titan
Uranus
Neptune

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