Earth Global Reference Atmospheric Model (GRAM) Overview and Comparison to Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2)

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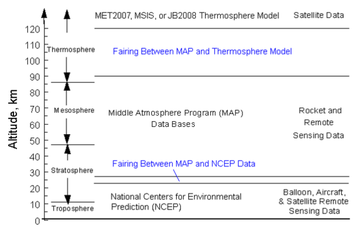
Earth-GRAM Overview

- Provides monthly statistics at any point in the atmosphere
- Monthly, geographic, altitude variation
- Current Version: Earth-GRAM 2016 - C++ software.nasa.gov
- Output Includes: pressure, density, temperature, horizontal and vertical winds, speed of sound, atmospheric constituents
- Used by engineering community to create atmospheric dispersions at a rapid runtime.
- Not a forecast model

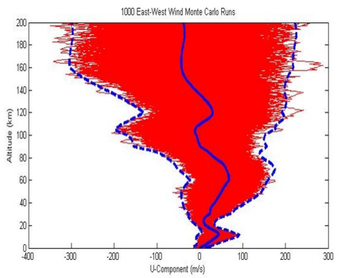
Model Input



Additional Data Options Include:

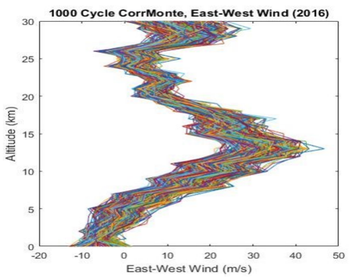
- Range Reference Atmosphere (RRA): site specific data options.
  - Available sets: 2013, 2006, 1983
- Planning release of 2019 RRAs
- Auxiliary user-defined data option

Perturbation Model



- Dispersions in Earth-GRAM generated by the perturbation model.
- Divided in small-scale and large-scale portion
- Driven by standard deviation
- Gaussian based dispersions

CorrMonte

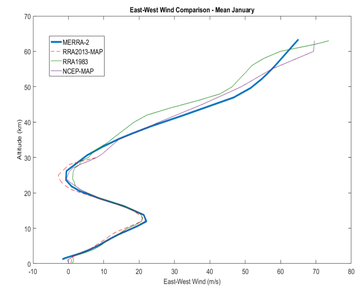


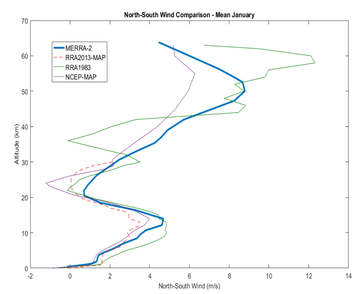
- Function within Earth-GRAM that evaluates multiple profiles separated by a fixed time increment.
- CorrMonte provides an hourly dispersion with Monte Carlo runs.
- CorrMonte produces several profiles that are cross-correlated.

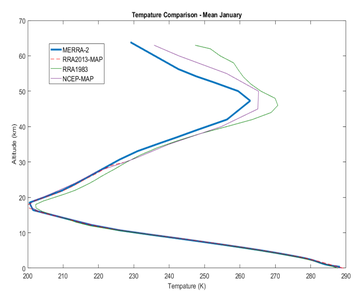
MERRA-2 Background

- Developed by NASA Goddard Modelling and Assimilation Office
- Horizontal Resolution: 0.625°x0.5° longitude-by-latitude grid (NCEP reanalysis I, 2.5°x2.5° currently used in Earth-GRAM)
- Vertical resolution: 72 model layers or interpolated to 42 pressure levels to 0.1 hPa (NCEP reanalysis I, surface to 10hPa at 17 pressure levels)

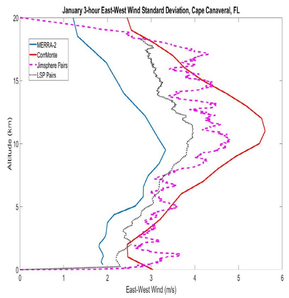
MERRA-2 vs Earth-GRAM - Cape Canaveral, FL

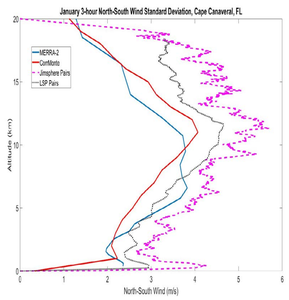






CorrMonte 3-hr Wind Persistence Comparison





Data Included in comparison:

- 3-hr MERRA-2 pairs
- Jimsphere balloon 3-hr seasonal pairs
- NASA Launch Service Provider (LSP) 3-hr pairs, composed of 50 MHz Doppler Radar Wind Profiler and 915 MHz Profiler

Summary

- Earth-GRAM compares well with MERRA-2 when analyzing monthly statistics.
- MERRA-2 has improved horizontal resolution and vertical coverage compared with NCEP reanalysis I.
- CorrMonte estimates hourly wind persistence better than MERRA-2. At times, CorrMonte compares well measured pairs.
- Open to suggestions for data input into Earth-GRAM.

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