The NASA Reanalysis Ensemble Service

Advanced Capabilities for Integrated Reanalysis Access and Intercomparison

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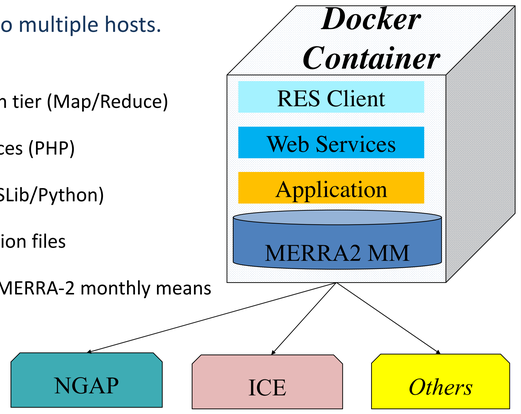
Features

1. Extended capabilities that enable single and multiple reanalysis area average, vertical average, re-gridding, standard deviation, and ensemble averages
   - Convenient, one-stop shopping for commonly used data products from multiple reanalyses, including basic sub-setting and arithmetic operations (e.g., avg, sum, max, min, var, count, anomaly)
   - Full support for the MERRA-2 reanalysis dataset in addition to, ECMWF ERA-Interim, NCEP CFSR, JMA JRA-55, and NOAA/ESRL 20CR.
   - The ability to compute and visualize multiple reanalysis for ease of inter-comparisons
2. Automated tools to retrieve and prepare data collections for analytic processing
3. Docker-ready RES application to deploy across platforms
4. Supporting analytic services for NASA Global Modeling and Assimilation Office (GMAO) Forward Processing datasets
5. Basic uncertainty quantification services that combine heterogeneous ensemble products with comparative observational products (e.g., reanalysis, observational, visualization)
6. Jupyter notebook-based distribution mechanism designed for client use cases that combines CDSlib documentation with interactive scenarios and personalized project management
7. New API that supports full temporal, spatial, and grid-based resolution services with sample queries

3 Cross-Platform Docker Container

Deployable to multiple hosts. Includes:

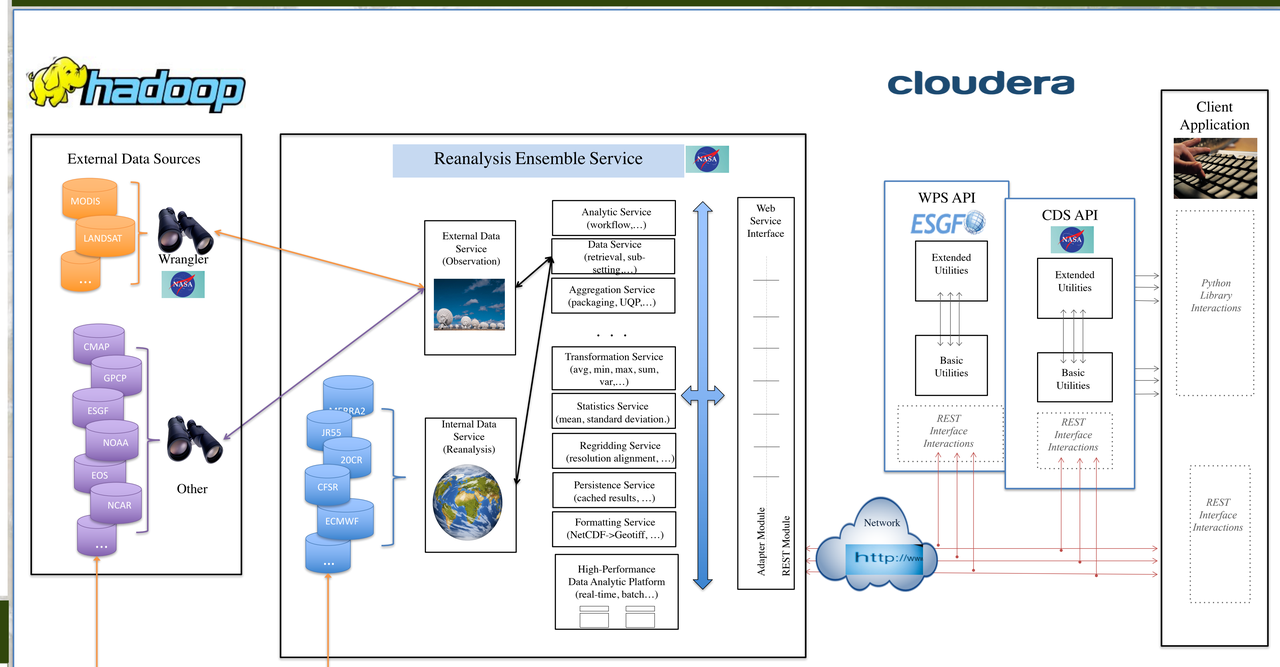
- Application tier (Map/Reduce)
- Web services (PHP)
- Client (CDSLib/Python)
- Configuration files
- Subset of MERRA-2 monthly means



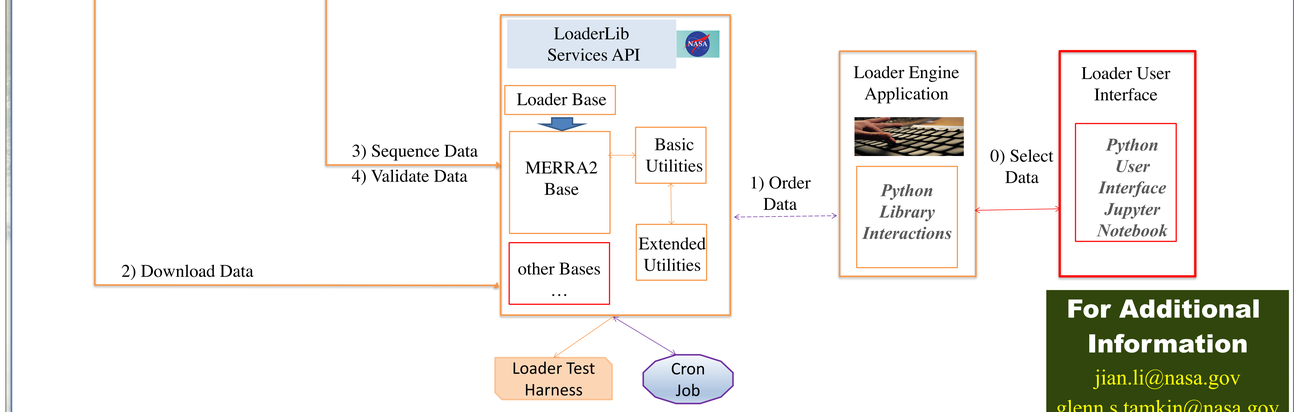
ABSTRACT

NASA's efforts to advance climate analytics-as-a-service are making new capabilities available to the research community:
(1) A full-featured Reanalysis Ensemble Service (RES) comprising monthly means data from multiple reanalysis data sets, accessible through an enhanced set of extraction, analytic, arithmetic, and intercomparison operations. The operations are made accessible through NASA's climate data analytics web services and our client-side Climate Data Services Python library.
(2) A cloud-based, high-performance Virtual Real-Time Analytics Testbed supporting select climate variables. This near real-time capability enables advanced technologies like Spark and Hadoop-based MapReduce analytics over native NetCDF files.
(3) A Web Processing Service (WPS)-compliant web interface to our climate data analytics service that enables interoperability with next-generation systems such as the Earth System Grid Federation (ESGF).

1 NASA Reanalysis Ensemble Service



2 Automated Analytic Data Provisioning (Loader)



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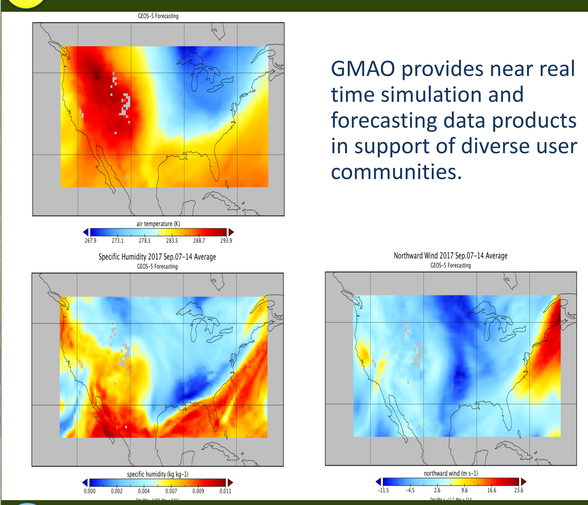
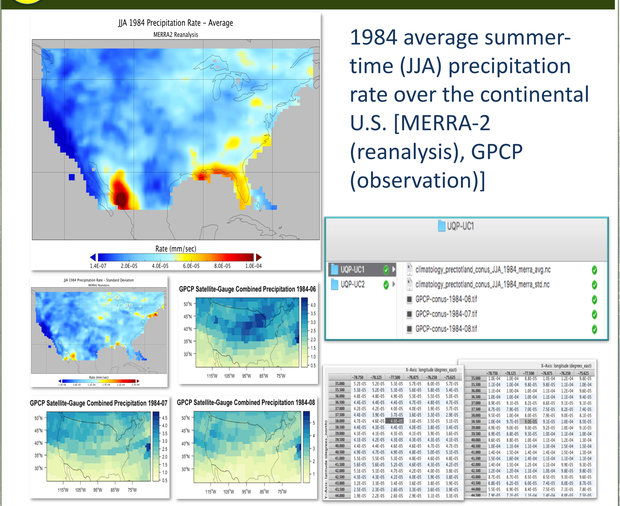
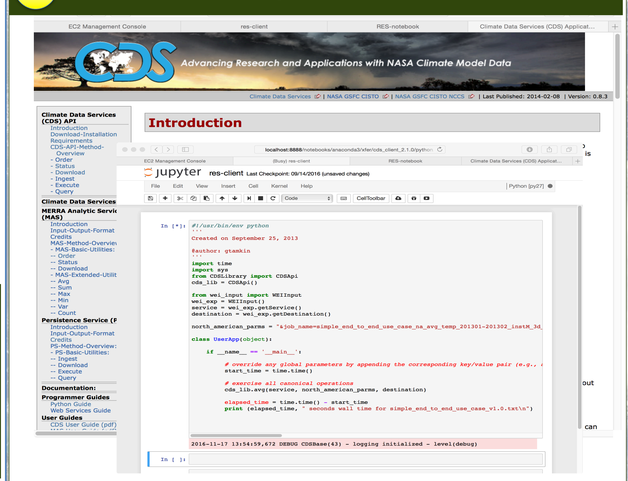
4 GEOS Forward Processing



GMAO provides near real time simulation and forecasting data products in support of diverse user communities.

5 Uncertainty Quantification



1984 average summer-time (JJA) precipitation rate over the continental U.S. [MERRA-2 (reanalysis), GPCP (observation)]

6 RES Jupyter Notebook