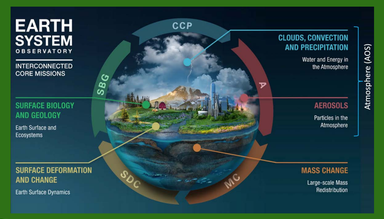

An Analytic Collaborative Framework for the Earth System Observatory

IN53B-0451

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Science and Technology Objectives

- UseCloud-optimized representative datasets for the ESO missions and the PoR for prototyping an *Analytic Collaborative Framework*
- An *Algorithm Workbench* for enabling experimentation and exploration of synergistic algorithms involving the AOS, SBG and the PoR
- Science demonstrations: use of synthetic data to demonstrate capability of new observing system
  - SBG atmospheric correction
  - Evaluate lidar-polarimeter retrievals
  - Explore synergistic algorithms

Application Objectives

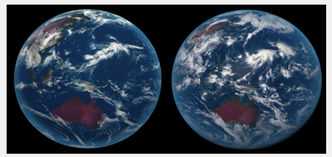
- Concrete Open-source Science demonstrations including use cases that span science discovery and end user applications with direct societal impact.
  - Tracking of PyroCbs
  - Solar energy application
  - Bio-diversity application

Benefits to Earth Science

- Bridges the gap between advanced earth system modeling and realistic simulation of future observing systems
- Early development of new concepts in model-data fusion enabling science investigations aimed at elucidating physical processes and their representation in models.

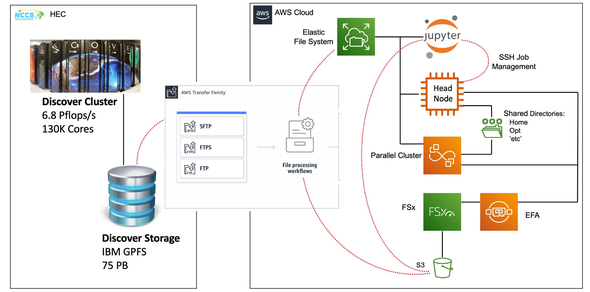
Relationship to ES Digital Twins

- Develops a **Digital Replica** of the future ESO observing system based on realistic, high-resolution Earth system model simulations
- Provide a framework for observing system simulations and tools to conduct *what-if* investigations and trade studies for the benefit of NASA missions in development.

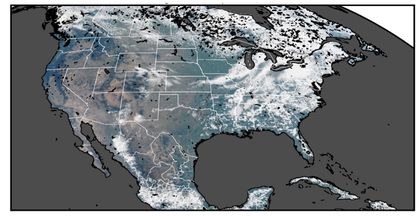


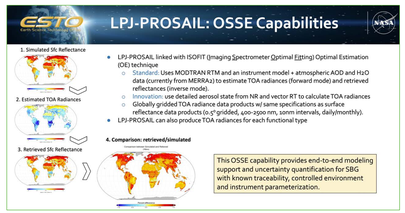
Technology Approach

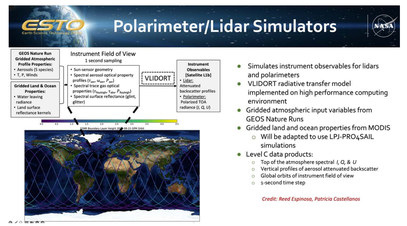
- Based on a global storm resolving GEOS Nature Run, simulate the AOS observing system
- Simulate SBG reflectances at TOA
  - Synthetic surface reflectances
    - Ames MODIS-based spectral filling
    - LPJ/PROSAIL model
  - Storm resolving atmosphere with 20 aerosols
- Implement an Algorithm Workbench on AWS for developing testing and evaluating AOS, SBG and synergistic AOS+SBG retrievals
  - Uncertainty quantification
- Open-source Science demonstrations by exploring advanced data analysis and easy access to cloud-optimized (simulated) datasets.
  - Explore use of IceSat2 Slide-rule framework



Simulated TEMPO RGB Image



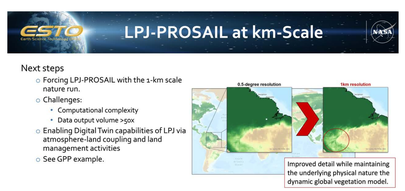


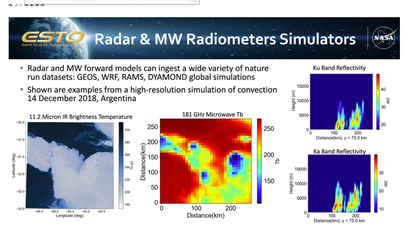


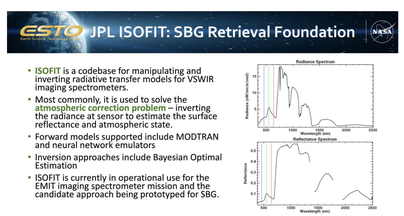
- Slide Rule Earth enables low-latency access to data products using processing parameters supplied at the time of the request.
- The Slide Rule backend package H5Coro provides cloud optimized access to HDF-5/NetCDF-4 files on S3.
- Investigating extension of the NetCDF C library by means of a H5Coro plug-in.

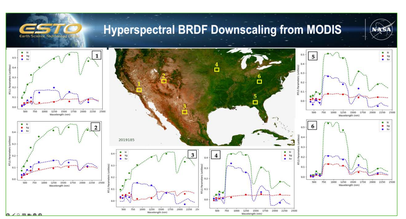
SlideRule runs in AWS us-west-2 and currently has access to ICESat-2, GEDI, Landsat, and ArcticDEM datasets stored in S3.

Extending these capabilities to simulated SBG/AOS data will accelerate algorithm development trade studies and provide the end user a sneak preview of that the ESO measurements can provide.



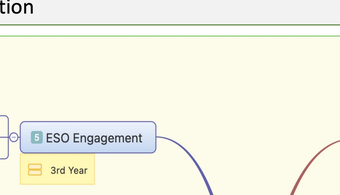






Work in Progress

- Completing generation of km-scale Nature Run (related project)
- Completing dataset acquisition:
  - Interface LPJ/PROSAIL to high resolution GEOS atmosphere from km-scale Nature Run
  - Generate reflectances and synthetic retrievals from GEOS km-scale Nature Runs and Ames/LPJ surface reflectances:
    - AOS Instruments: Lidar, polarimeter, Ku and W/Ka radars and microwave radiometers
    - SBG radiometer using both Ames surface reflectance and LPL/PROSAIL
- Working onon algorithm workbench for AOS and SBG instruments
  - Exploring adoption of SlideRule Earth technologies for cloud optimized data access (via H5Coro) and on-demand generation of customizable algorithms.
- Working on tracking of Pyro Cb Plumes application using *tobac* cloud object technology.



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