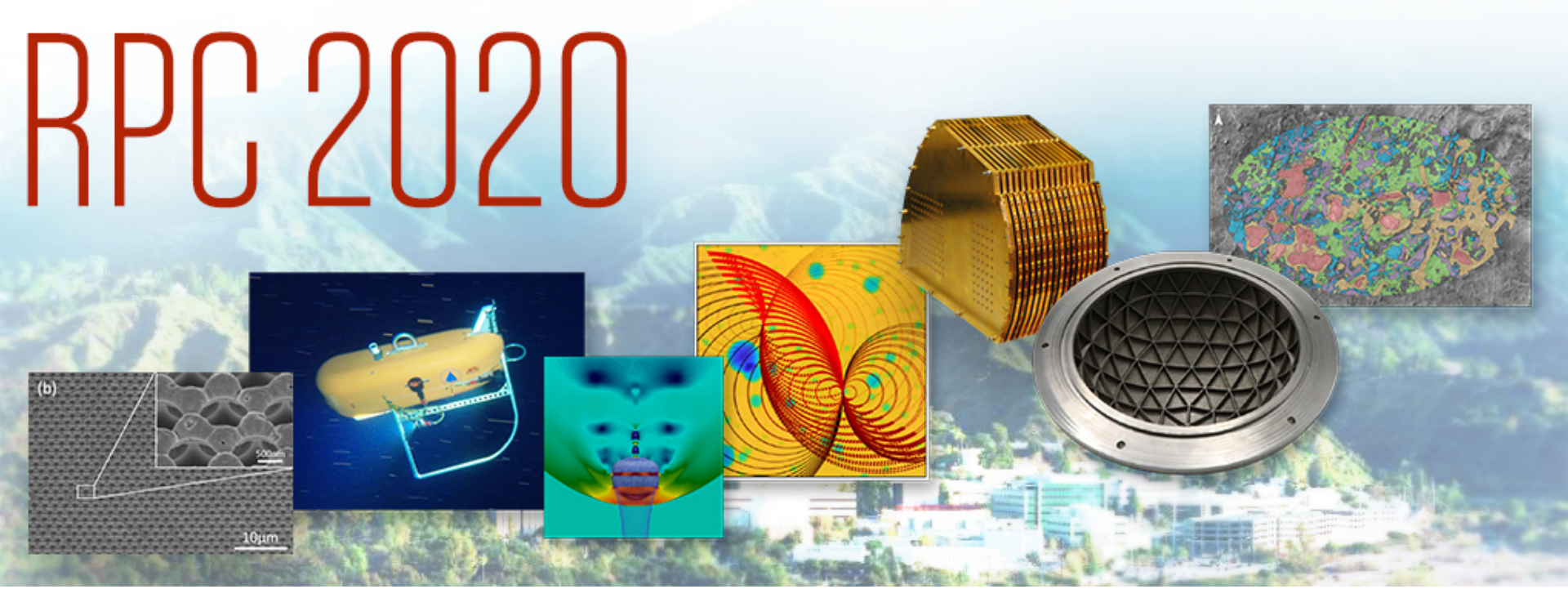
RPC 2020



Virtual Research Presentation Conference

Satellite-constrained land model for the CliMA Earth System framework

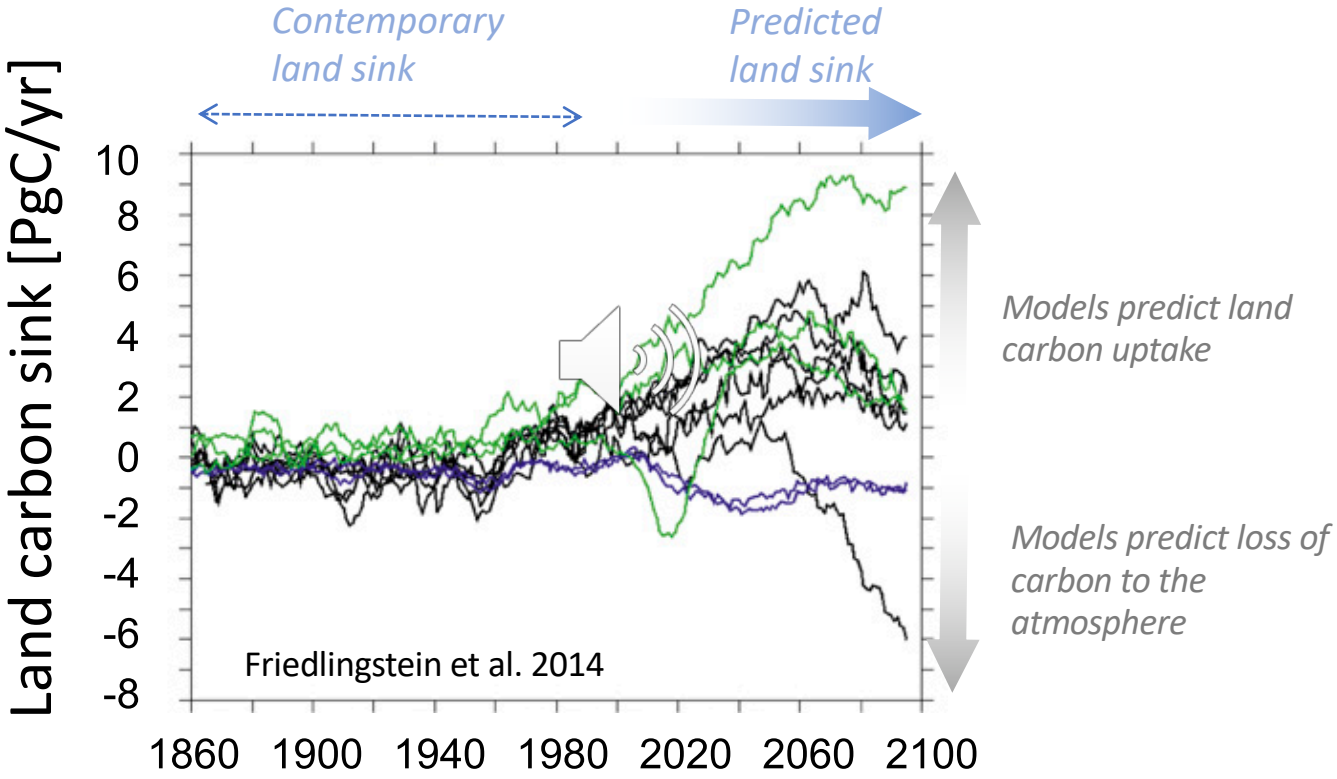
Principal Investigator: Anthony Bloom (329G)
Co-Is: Nicholas Parazoo (329G), John T Reager (329F), Elias Massoud (329F), Alex Norton (329G), Paul Levine (329F), Renato Braghiere (329G)
Program: Strategic Initiative

Assigned Presentation #

Jet Propulsion Laboratory
California Institute of Technology

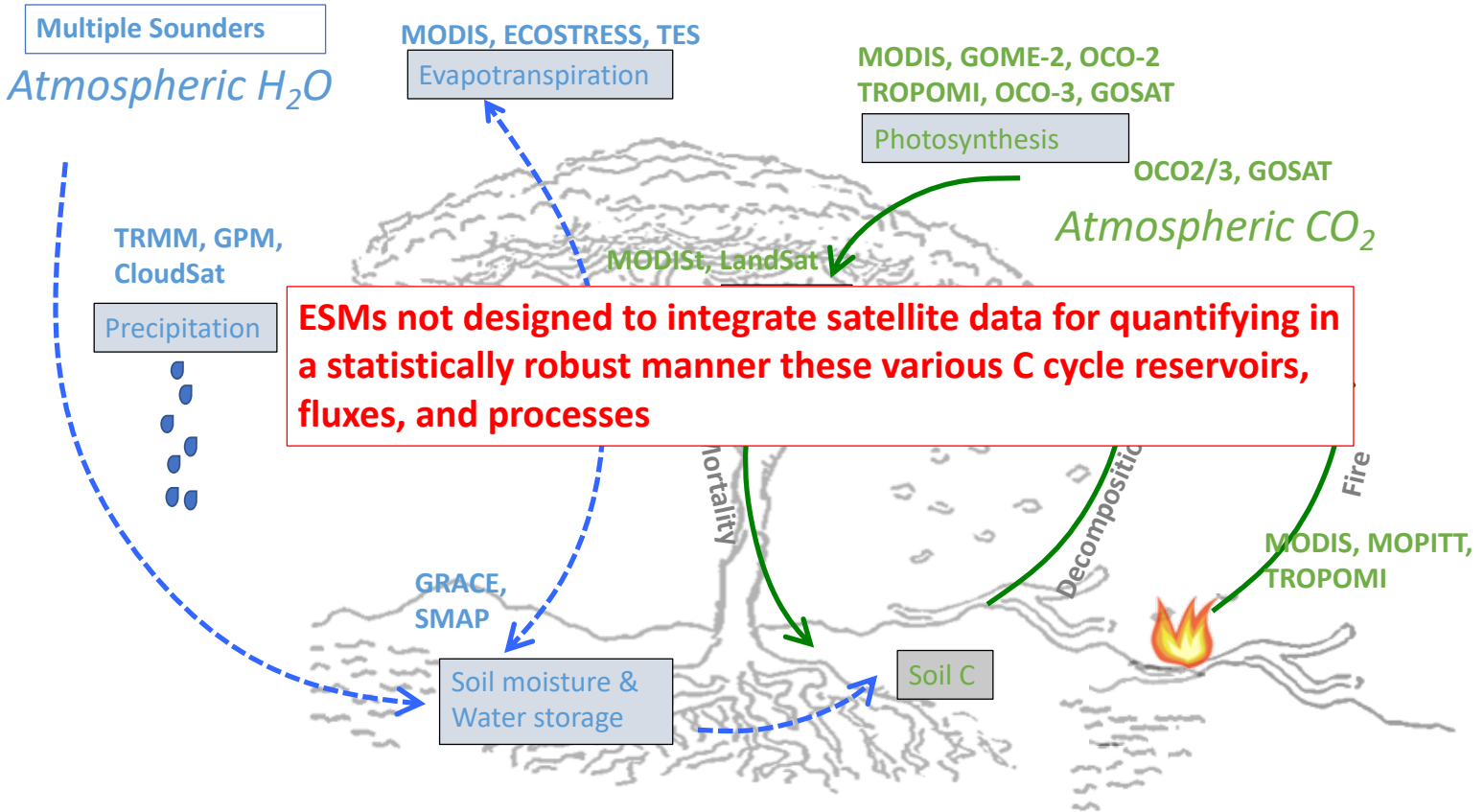
3: RPC-063

Earth system model predictions

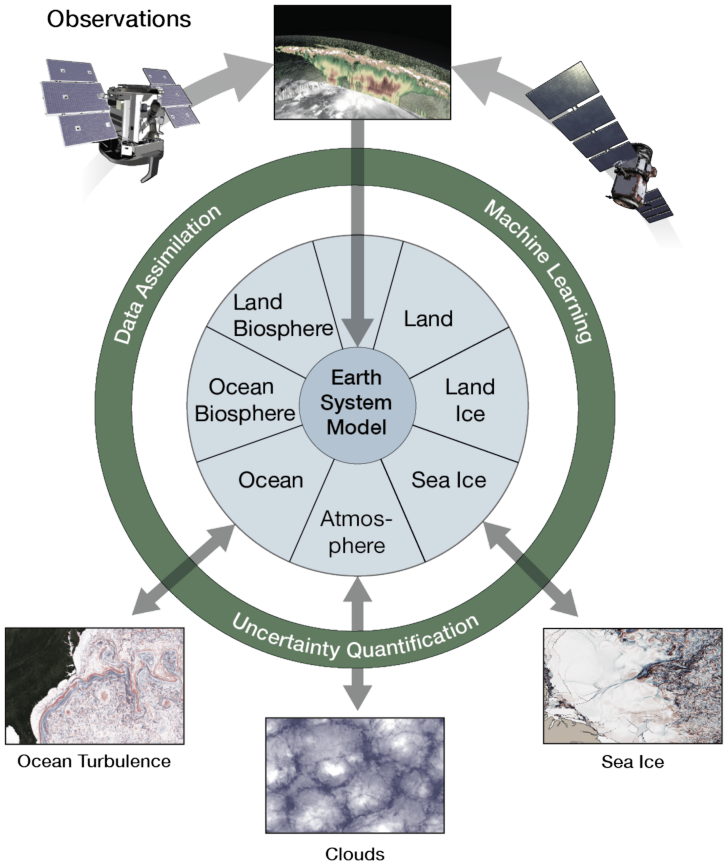


*Obs. Informed knowledge of **land biophysics** and **land biosphere** critical for accurate predictions of current & future carbon-climate feedbacks*

Opportunity: A constellation of satellites now exist to quantify terrestrial carbon, water & energy fluxes and processes



Caltech's Climate Modelling Alliance (CliMA) Earth System Model (ESM) Provides the Earth System Modeling and Data Assimilation Framework To Address our Science Objectives



A Next Generation ESM For Predicting Climate

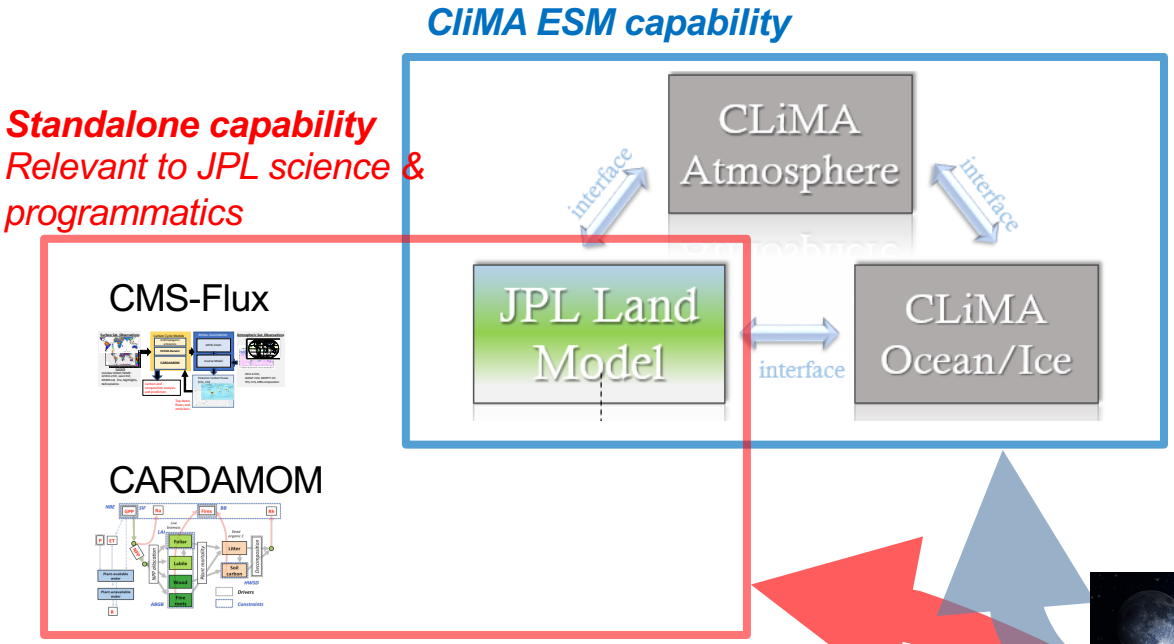
- Systems design (as opposed to organic) using latest software design techniques and modern programming language (JULIA)
- Designed to use satellite data to quantify climate-sensitive processes (e.g. water and carbon cycles) in a statistically robust manner

JPL role in CliMA effort

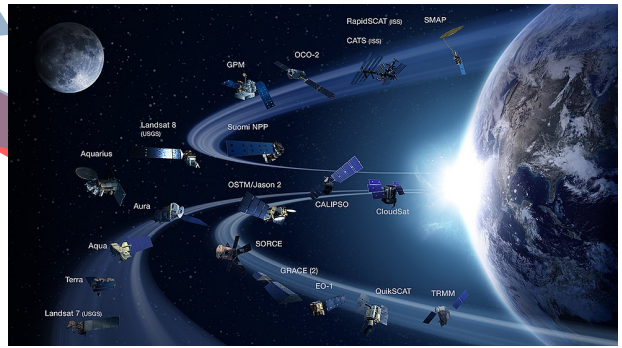
(1) Will (a) provide land biosphere model (b) support implementation of land biosphere + biophysics in CliMA framework.

(2) Will get access to unprecedented data-informed ESM capability (support science & programmatic objectives).

JPL-CliMA land model: JPL & Caltech implementations



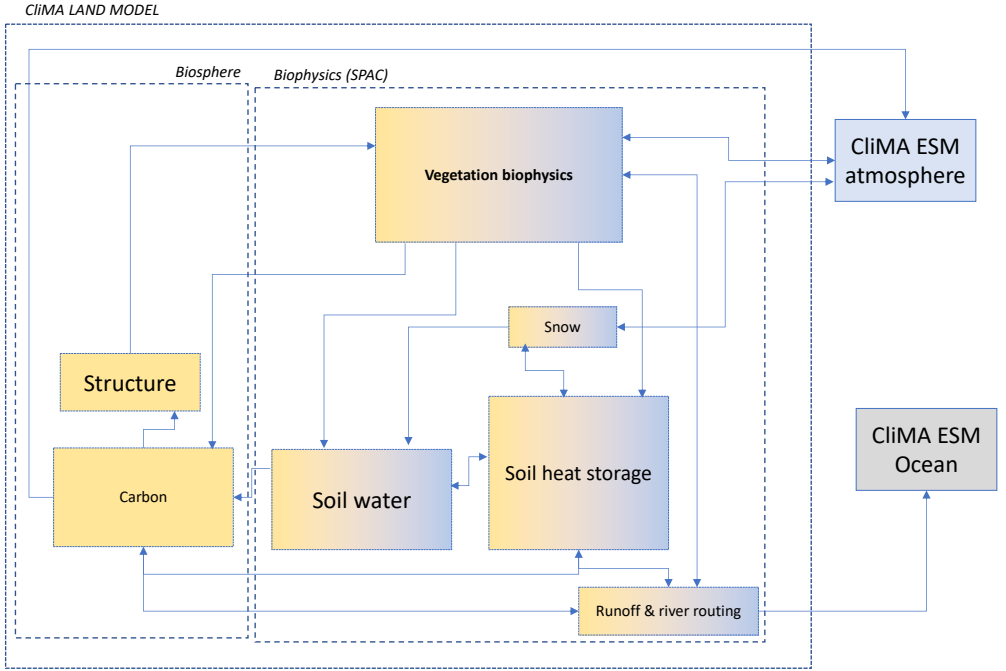
Satellite POR



1. ***Caltech online capability:*** *use land model to simulate future of Earth System*

2. ***JPL offline capability:*** *use land model with atmospheric re-analysis to ingest satellite POR into science and OSSE analyses (Emulation capability pushed to year 3).*

JPL-CliMA land model design



JPL
Caltech
Joint effort
Other
Dependencies

Land model task implementation

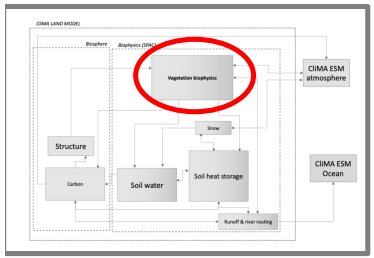
- **Joint effort on algorithm.**
- **JPL = implementation and testing**
- **Caltech = CliMA integration**

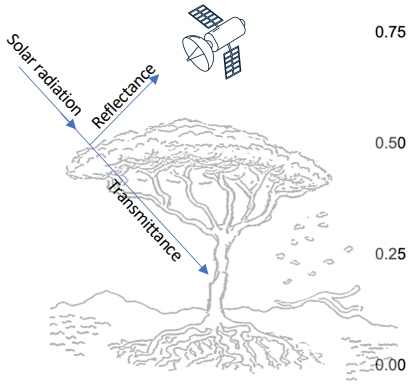
Based on JPL heritage code (CARDAMOM)

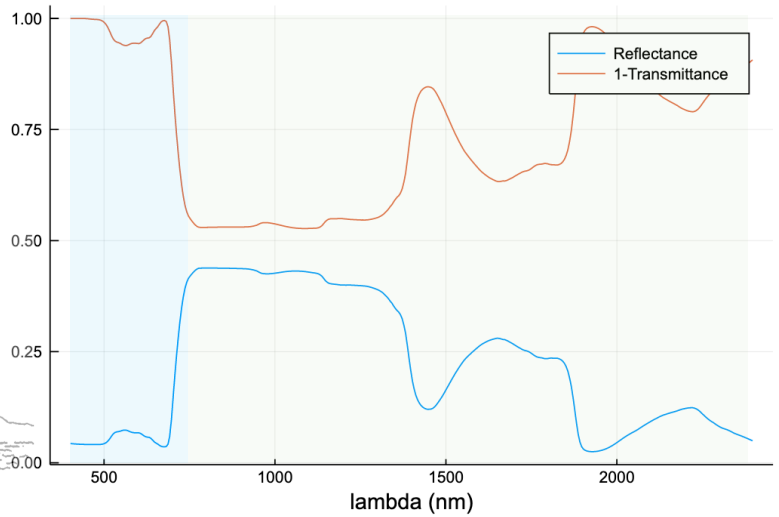
SRTD focus: collaborative design in partneship with CliMA

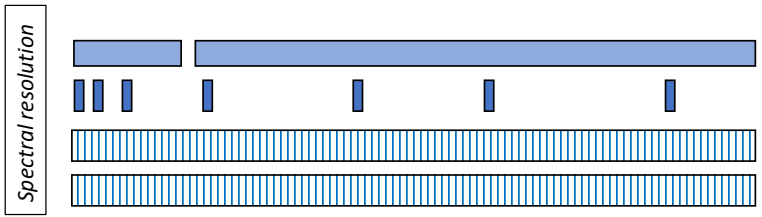
Existing CliMA ESM components (funded separately)

Progress highlight 1: Vegetation Biophysics in CliMA-Land









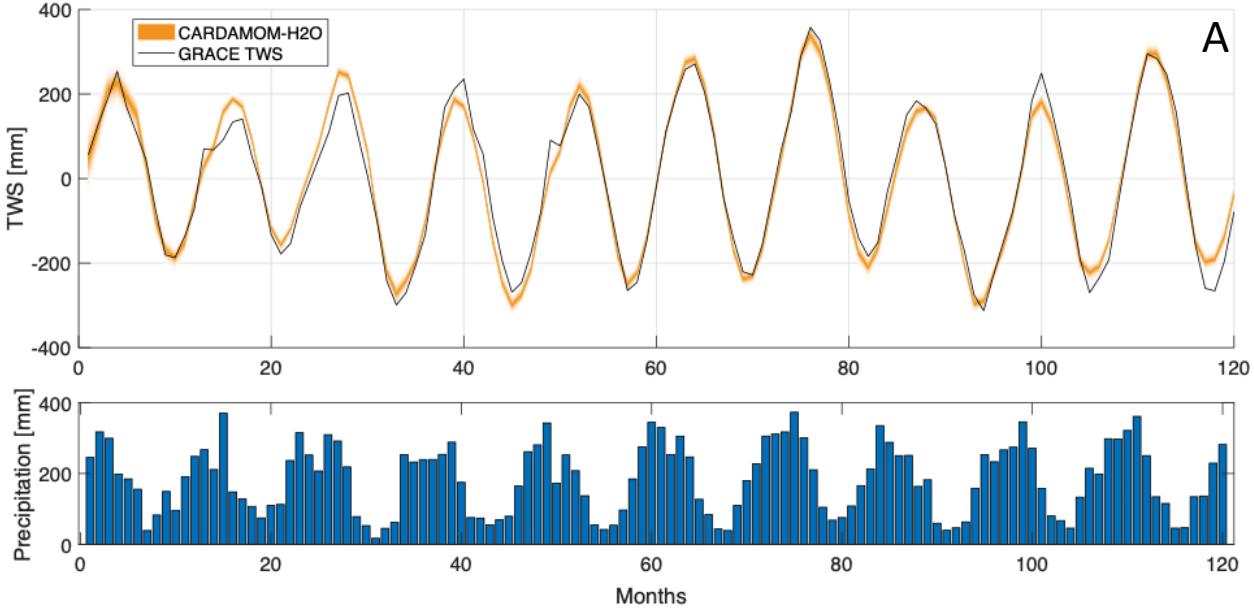
- Plant biophysics (photosynthesis, leaf area, vegetation water content) and their response to climate are critical for ES prediction.
- **Tailoring model development to observations at hand:** allows for accurate estimation of plant biophysical states and fluxes using existing (MODIS, TROPOMI) and upcoming missions (SBG).

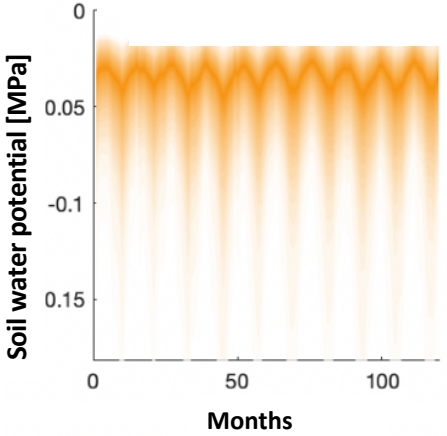
Braghiere et al., in prep.

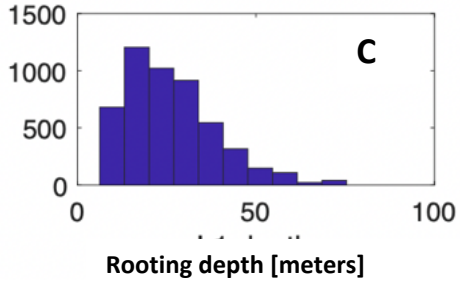
CLM: 2 bands
MODIS: 7 bands
SBG: 100s bands
CLiMA: 100s bands

Braghiere et al., in prep.

Progress highlight 2: GRACE-informed reduced complexity soil H2O prototype







- Assimilation of GRACE data into reduced complexity land model
- Assimilation leads to

Massoud et al., in prep.