# OPTImisation environment for joint retrieval of multi-sensor RADiances (OPTIRAD)


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# Motivation: land Surface DA

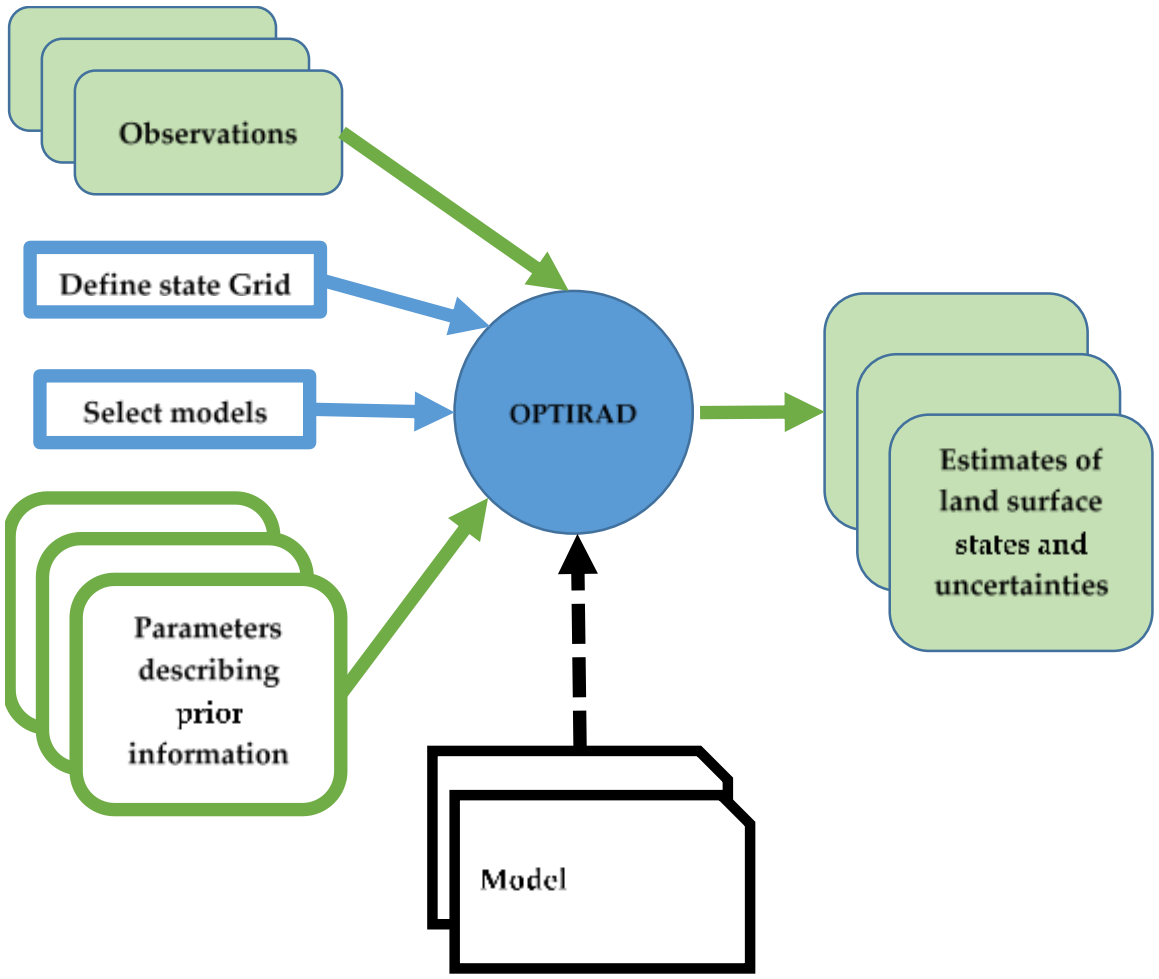
- **To derive physically consistent estimates of surface properties from multiple space borne instruments**
- Need to use diverse satellites in order to achieve the required sampling
- Lack of sensor independence and consistency in today's land surface products
- Lack of physical reality in mosaicked products
- Desire to link EO products to physical models, to produce consistent products with uncertainty estimates
- Evidence of the clear success of DA techniques in other domains (atmosphere, ocean)

# Objectives of the project

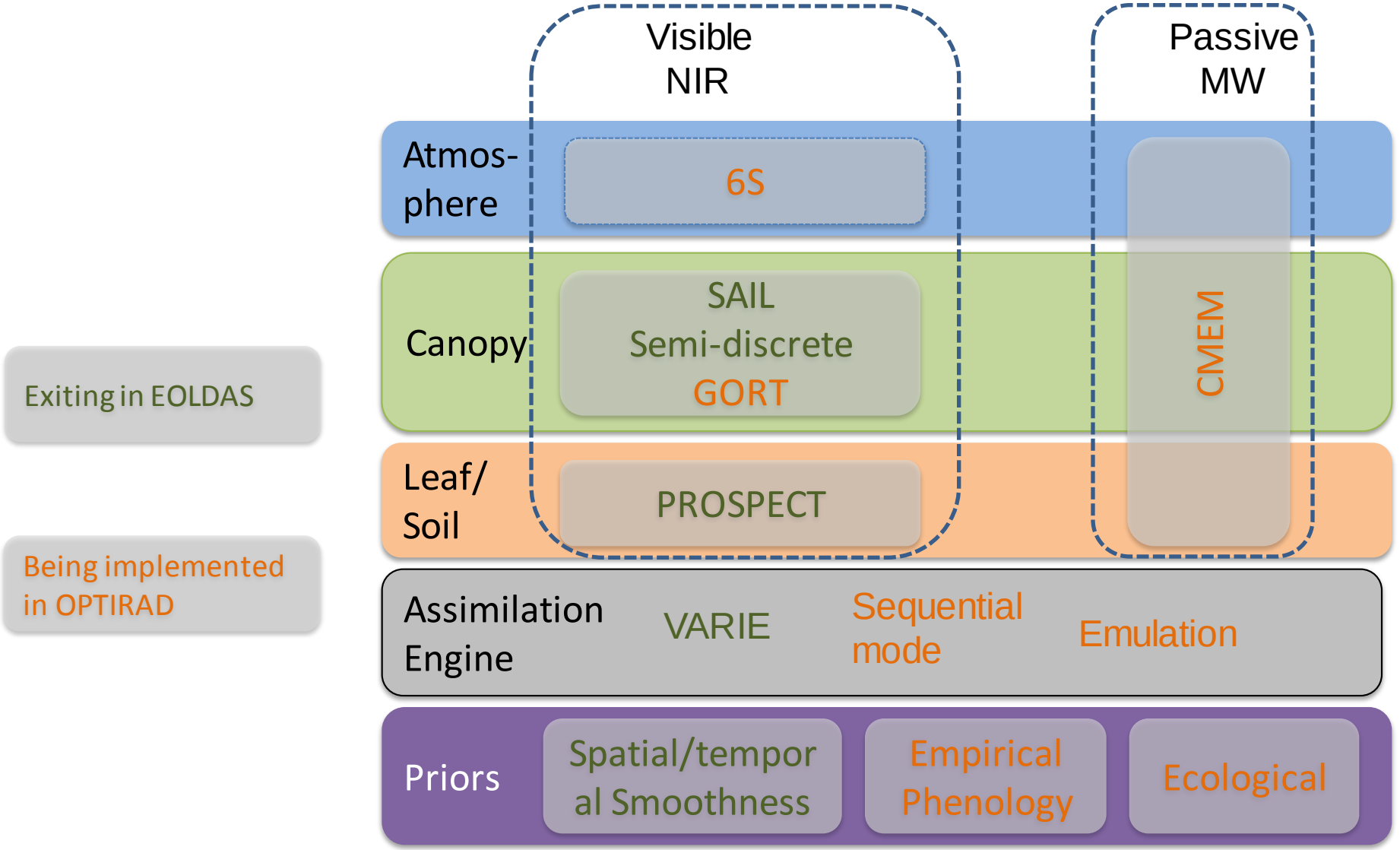
- Demonstrate effective assimilation of heterogeneous optical data for retrieval of land surface parameters
- Attempt joint optical / microwave retrieval
- Make EO land data assimilation a practical option for users
  - Implement a toolkit that makes use of cloud computing resources
- Make software available to users in an relatively easy-to use way

# OPTIRAD Capabilities

- Simulation of ToC radiance based on veg/soil state
- Variational data assimilation to give optimum estimate of state with uncertainty
- Spatial, temporal ecological prior constraints



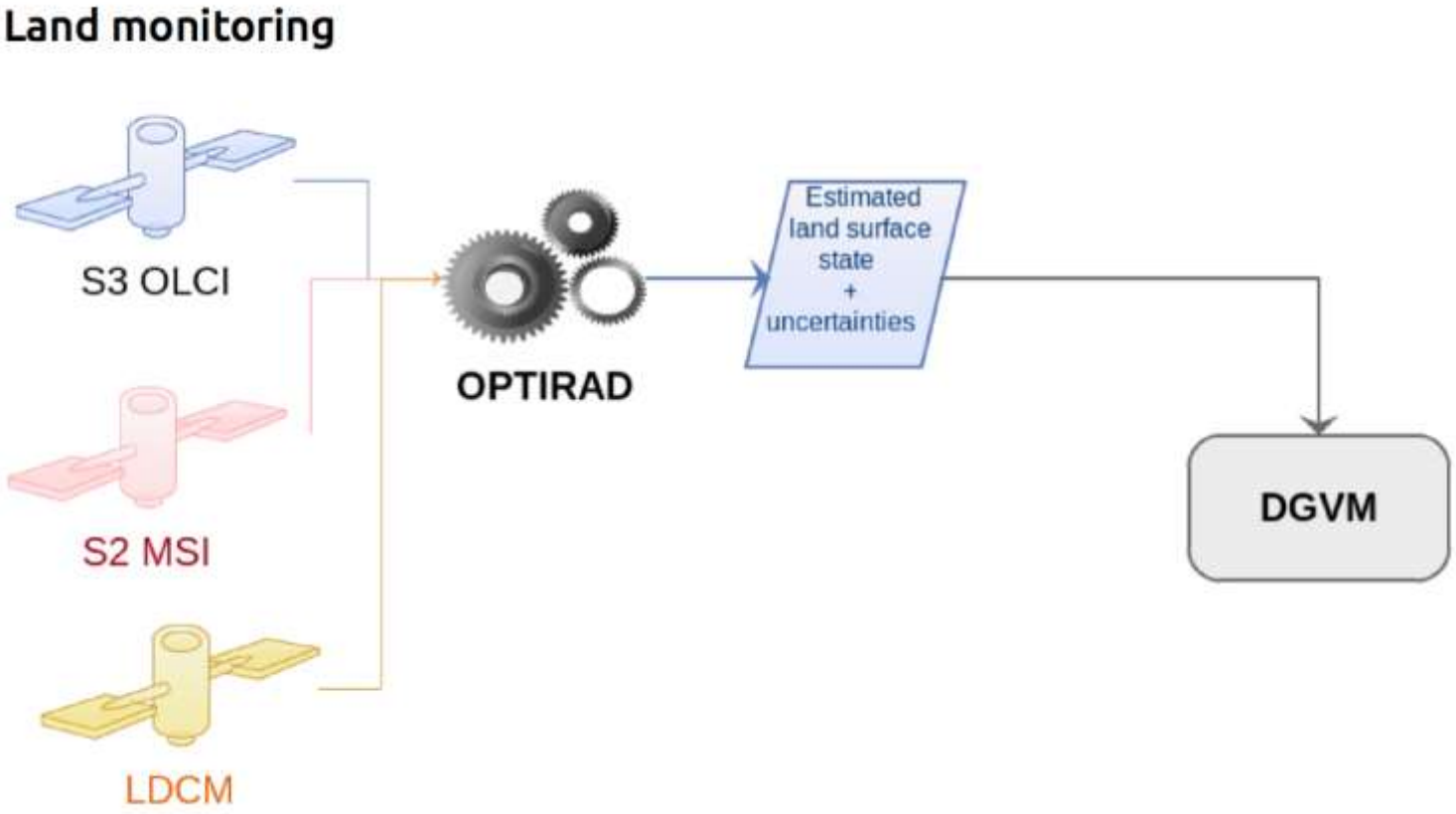
# OPTIRAD Components



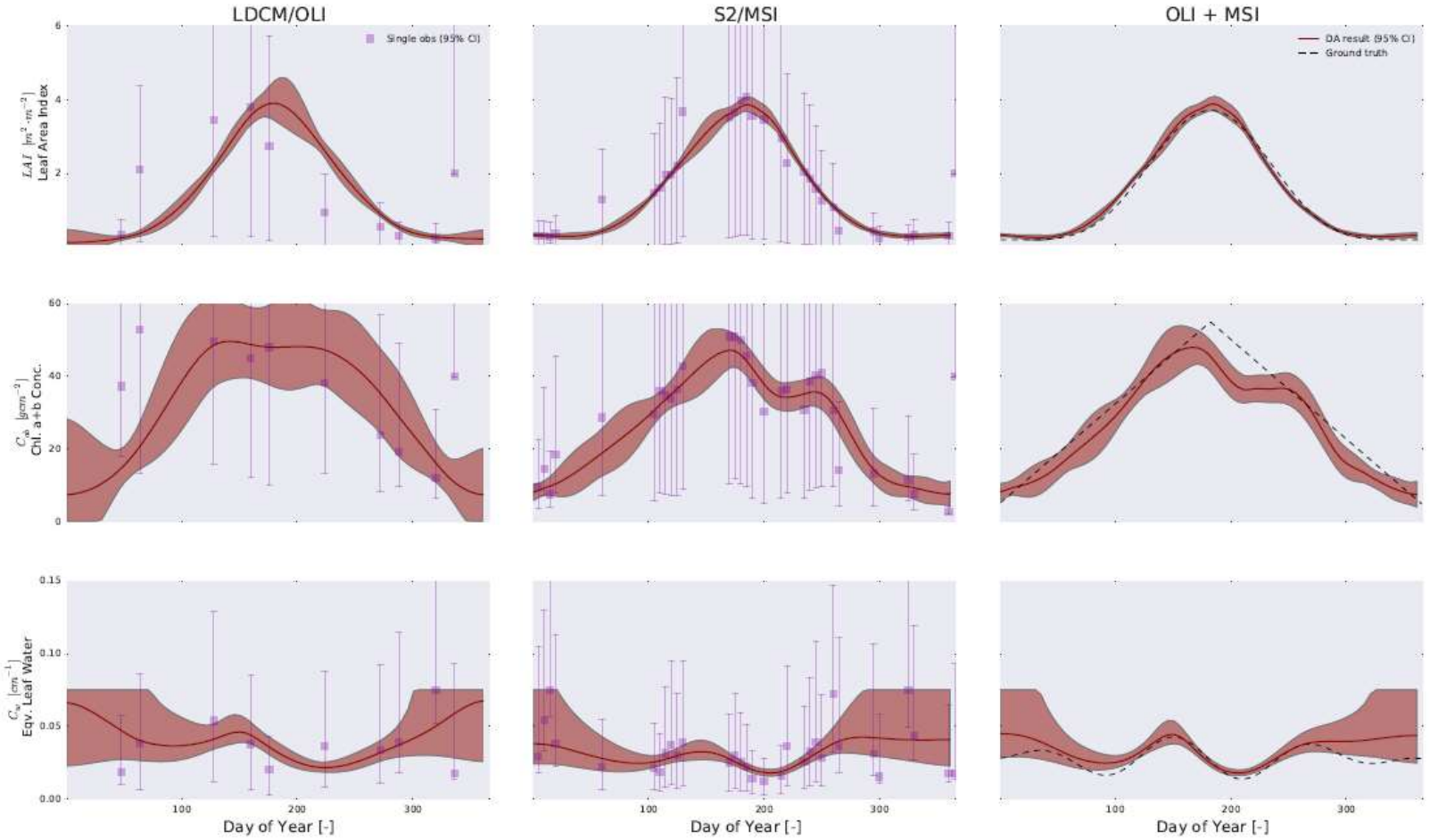
# Use Cases

- Virtual constellation for and surface monitoring
- Satellite constellation performance simulation
- Inter sensor comparisons /validation
- Improved post-processing / inversion of global products

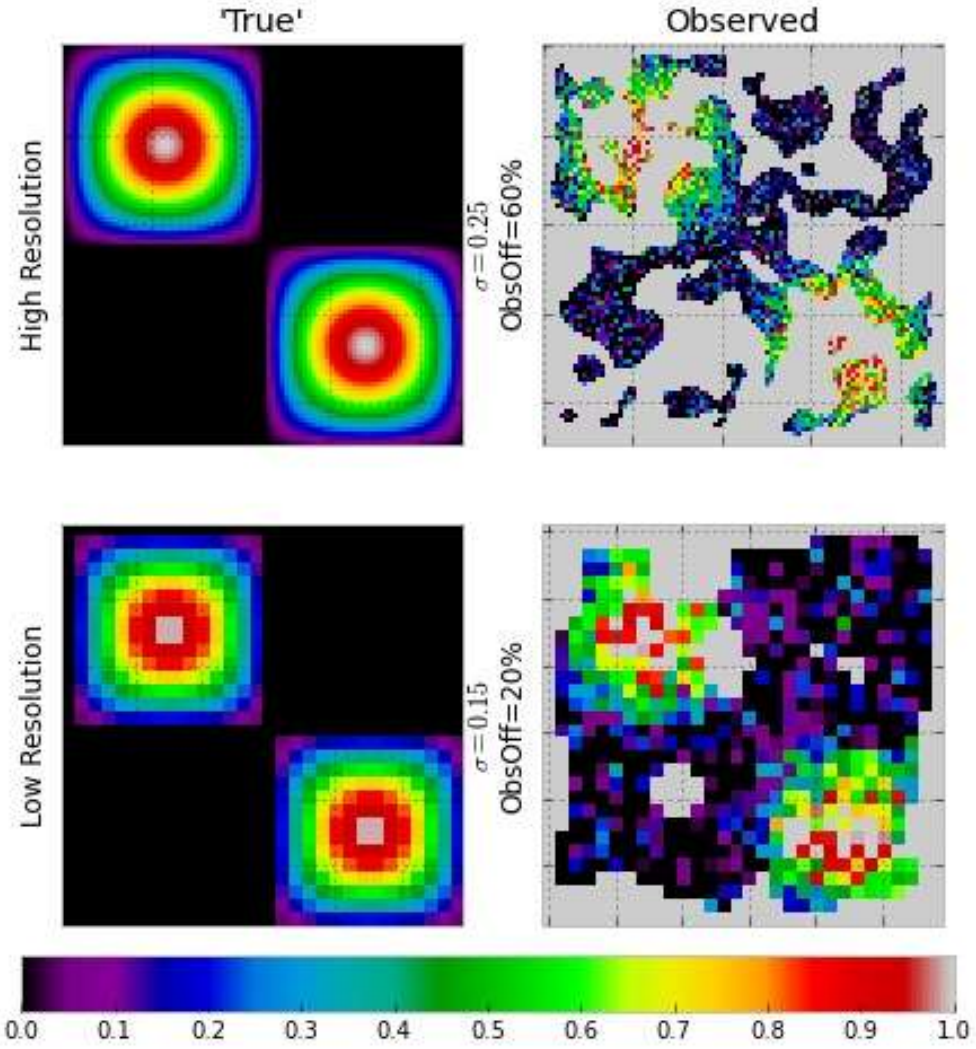
# Virtual constellation for and surface monitoring

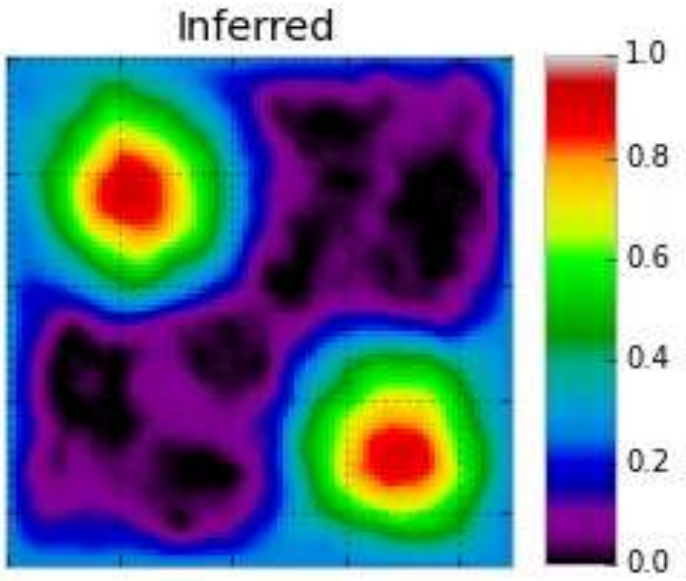


# Synthetic example: Temporal regularization

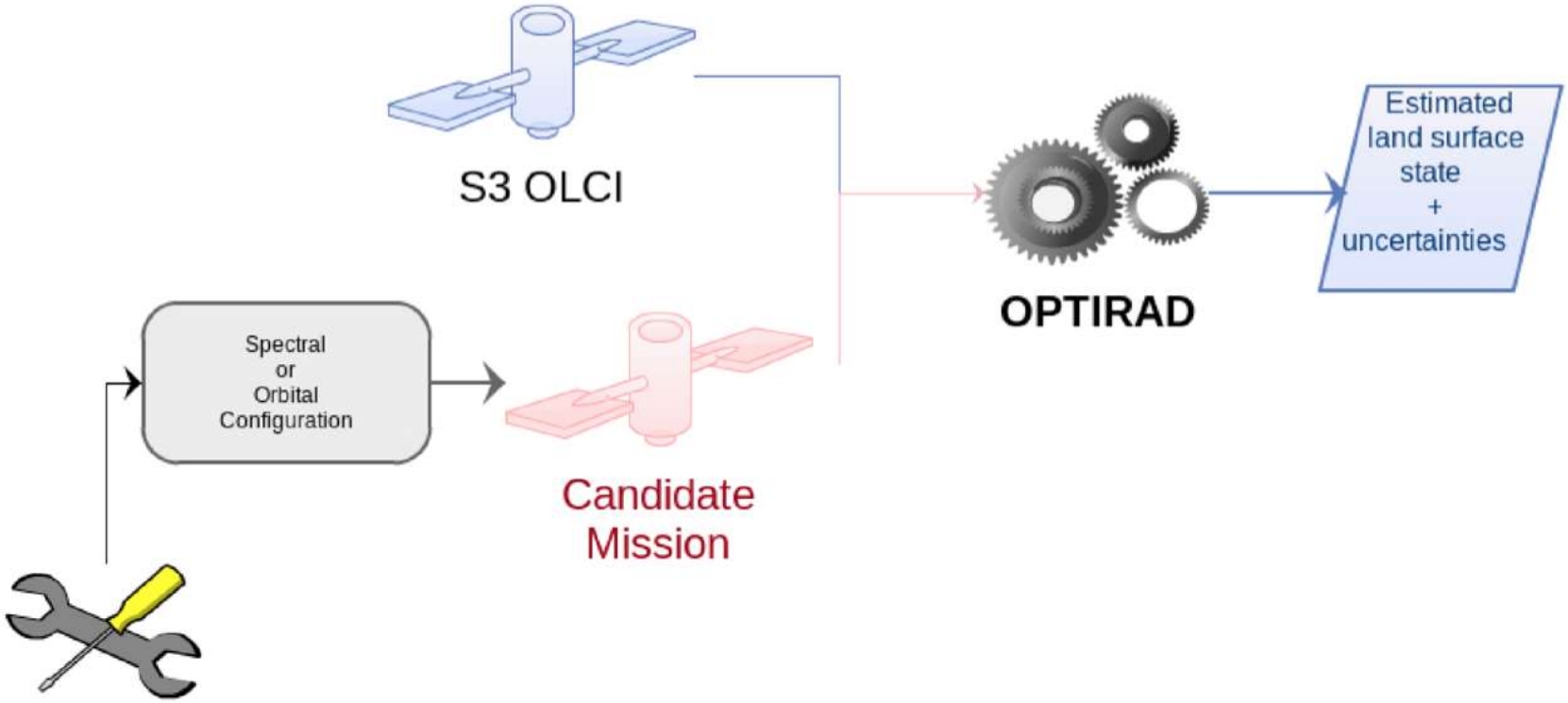


# Synthetic Example: Spatial regularization

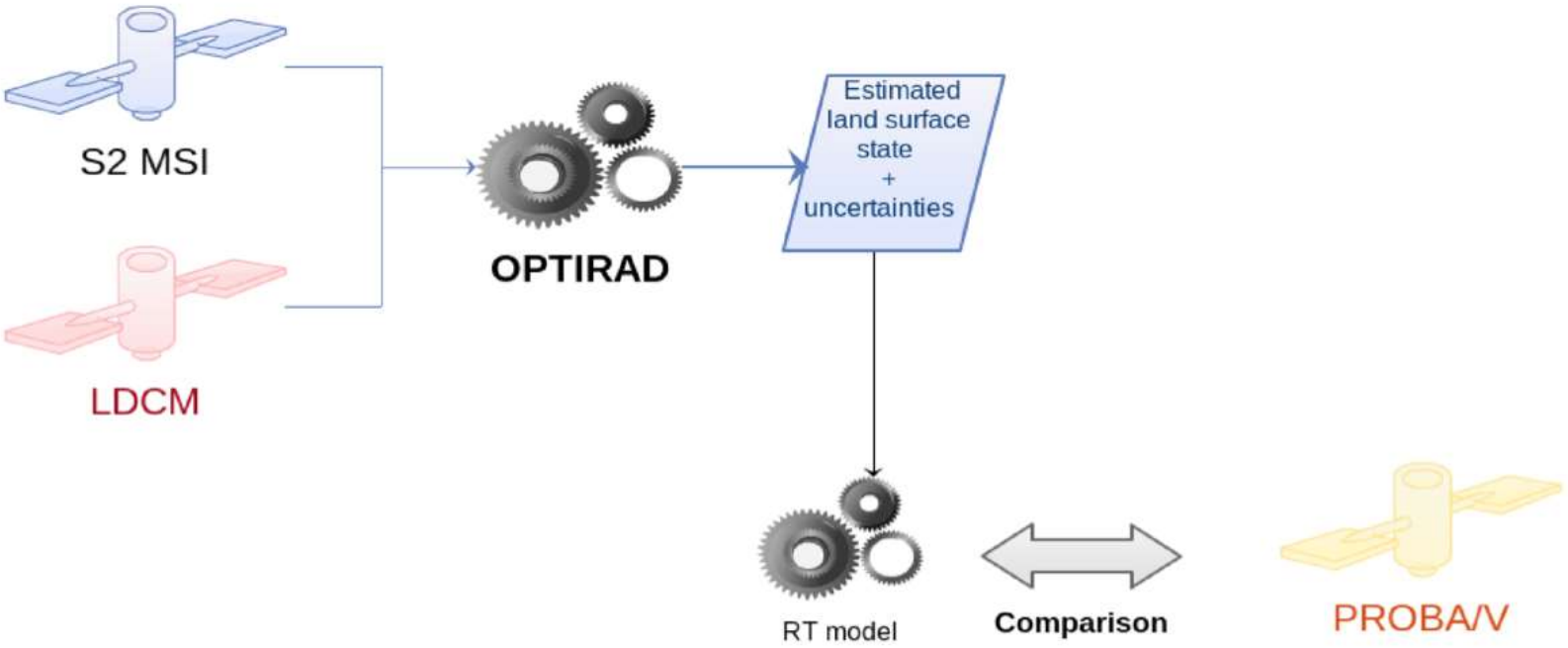


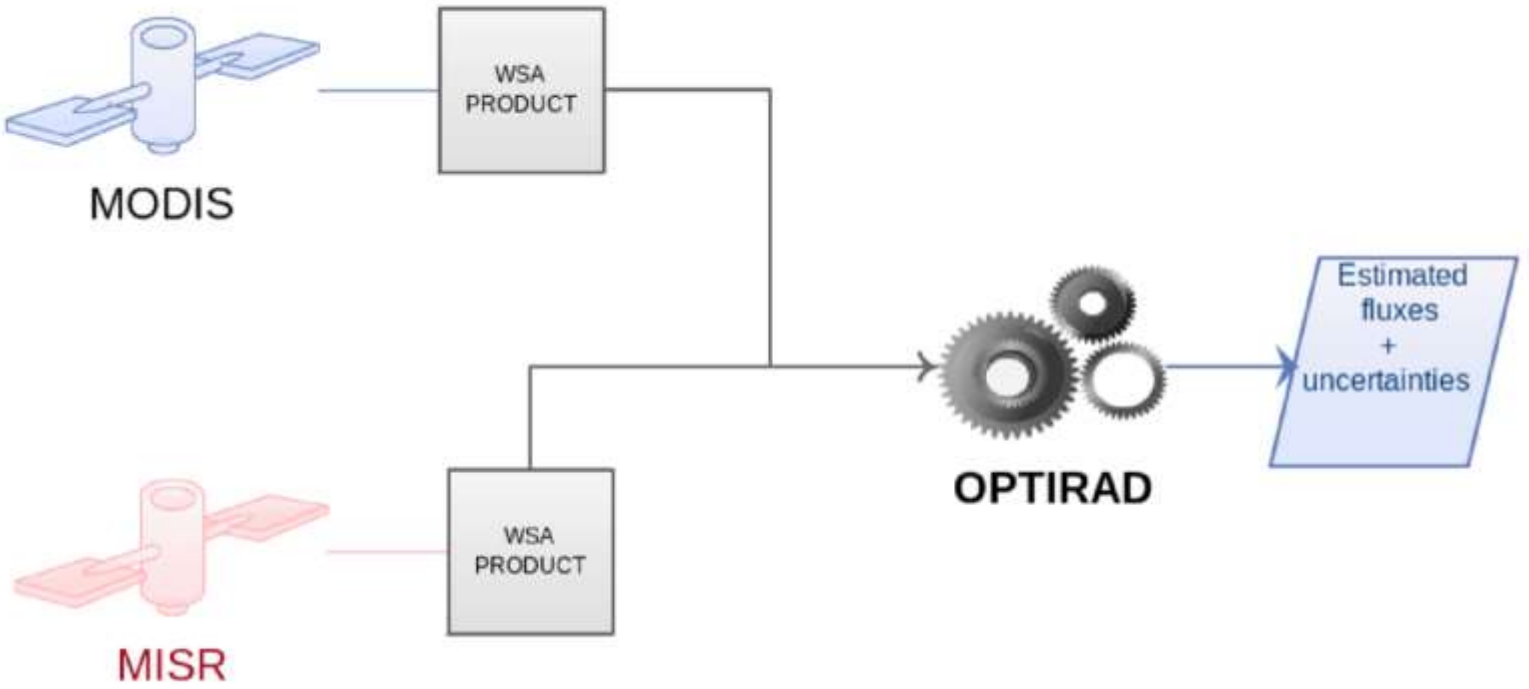
# Satellite constellation performance simulation



# Inter sensor comparisons / validation



# Improved post-processing / inversion of global products



# OPTIRAD Software

- Based on eo-ldas (EO land data assimilation system)
  - https://github.com/jgomezdans/eoldas_ng
  - http://www.esa-da.org/sites/default/files/Deliverables/Interfacing%20EO_D2_V1.pdf
- Written in python and freely available
- Tutorials available in iPython notebooks
- Computing resources also available on CEMS for collaborative experiments
  - http://www.ceda.ac.uk/services/analysis-environments/

# Validation

- Typically, cal/val activities focus on a few dates on a site
- Our typical output for a single pixel is typically made up of several time series showing the evolution of LAI, Cab, etc.
- Campaign data will only allow partial validation
- Need long term (at least over a season) measurements of vegetation parameters for effective validation

# Collaboration Opportunties

- Sharing of OPTIRAD software
  - Support / tutorials
- Access to computing resources
- Joint validation experiments
- Integration of new models