Estimating Carbon Fluxes with Quantum Enabled Annealing Algorithms

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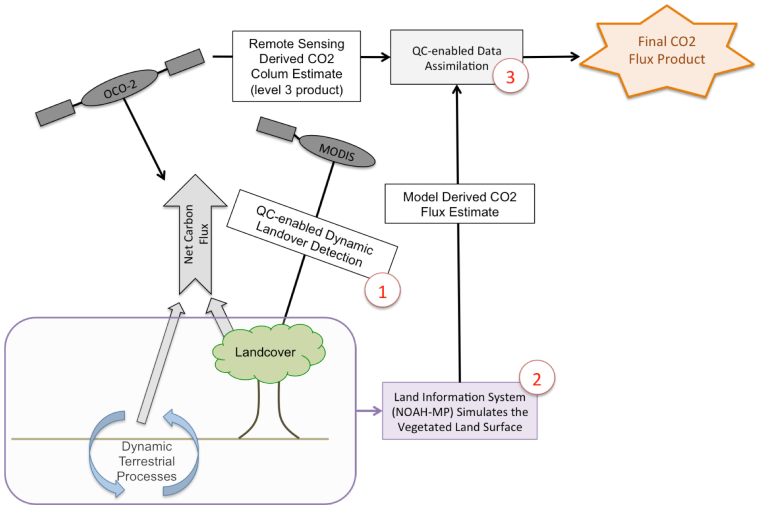
Objective

- Develop algorithms to extract CO_2 fluxes from OCO-2 data using quantum enabled annealing and to calculate Net Carbon Uptake for two ground truth sites
  - Satellite image registration of OCO-2 datasets for selected sites
  - Perform variational data assimilation (VarDA)
  - Assimilate CO_2 flux into Land Information System (LIS) hydrological model
- Evaluate the potential for quantum annealing computing (QAC) to be a disruptive technology to advance Earth science
- Improve NASA's understanding of the range of applications of quantum computing
- Supports the data analytics focus as a potential tool to be harmonized within atmospheric and climate science investigation frameworks



Carbon flux estimates from OCO-2 and LIS

Accomplishments

- First remote implementation of a hybrid FFBP neural net regression and characterization for complex non-linear multi-variable turbulent data set and satellite data set
- Validated CO2 flux inference on classical computer and D-Wave QAC using identical input data
- Produced new global monthly estimates of Solar Induced Fluorescence (SIF), including latent heat flux, sensible heat flux, and gross primary production
- Implemented machine learning training strategy to learn from three independent datasets
- Successfully completed deep neural net training and predictions of seasonal, semi annual CO2 flux for 2015 and 2016

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TRL_{in} = 2 $TRL_{current}$ = 4