IASOA Atmosphere-Surface Exchanges (Flux) Working Group  
November 8, 2017

Attendees: Sara Morris, Gabriela Schaepman, Allison McComiskey, Chris Fairall, David Cook, Taneil Uttal

Introduction of group members: overview of how IASOA can “work for you”, example of creating a flux product file useful to research in both observations and modeling communities (standardize files), if/when to submit these types of files to archives like Fluxnet or Ameriflux (or NCEI for NOAA datasets)

Presentation: How vegetation drives shortwave energy fluxes in a changing tundra landscape – from observations to 3D radiation modeling (Schaepman):

- Overview of Siberian tundra research site
  - Kytalyk: a NE Siberian tundra research site (similar to Barrow vegetation, but more continental environment)
  - 10m a.s.l., 71N 147E
  - INTERACT site: international network for terrestrial research and monitoring in the Arctic
  - Measurements: CO2 and CH4 fluxes, meteo-tower, eddy covariance, SW/LW radiation, heat fluxes, met measurements
  - Need to discuss calibration schedule of these instruments and standardize instrumentation

- Research questions:
  - 1) What are drivers of vegetation change? How are vegetation traits changing?
  - 2) Assessment and prediction of biodiversity – from plot to landscape to pan-Arctic scale
  - 3) How do changes in biodiversity feedback to ecosystem functioning, permafrost, and climate?

- Research methods
  - Experimental, observations, physical modeling, and integration

- Vegetation Feedbacks to Climate through Energy Fluxes
  - How energy fluxes are different across different site
  - How do above-ground radiation and soil fluxes vary with vegetation type
  - How does shrub density influence albedo and transmittance
  - How does patchiness of vegetation types influence SW radiation at landscape scale

- Assess energy fluxes (SW/LW)
  - Comparison of SW and LW fluxes against soil temp
  - Comparison of albedo and heat fluxes (impact of sedges vs shrubs)

- Phenological Camera capturing changes in surface layer

- Assess energy fluxes both above and below ground in areas of sedges vs shrubs
  - Snow melt occurs are different timing depending on sedge or shrub area

- Discussion of results
  - Shrubs absorb more SW radiation and transmit more to the ground surface
  - Shading of sedges mostly by litter
  - Heat flux below sedges much higher than below dwarf shrubs
  - Processes at very local scale, posing challenges to land surface models that do not model processes at these scales
- 3D Radiative Transfer Modeling – DART model
  o Discrete anisotropic radiative transfer
  o Can manipulate plant area to assess impact on SW radiation
    ▪ Branches are important absorbers
    ▪ Increasing shrub density does not decrease albedo
    ▪ Albedo insensitive to total plant area
  o Drivers of SW radiation at landscape scale
    ▪ Hydrologic changes in Arctic landscape might be important
- Can we predict ecosystem responses to environmental change based on traits of species?
  o Permafrost thawing and soil fertilization impacts

Discussion of Schaepman Presentation:

- How are we collaborating internationally with regard to Arctic flux measurements/parameters?
  o IASC, MOSAiC, T-MOSAiC (terrestrial MOSAiC)
- Are there measurement protocols?
  o Not currently
  o Can assess previous Arctic sites (Tiksi, Eureka) and how their Fluxtower are set up
    ▪ Datagrams
- Arctic Council activities (SAON)?
- Link to satellite data community?

Action Items:

- Discussion of where to submit/archive flux product files (NCEI, Ameriflux, Fluxnet, etc.), IASOA initiative?? (Uttal, ALL)
- Evaluate other models (beside DART) to analyze (Uttal, Schaepman)
- Literature review of energy flux methods (Uttal, Morris, Persson)