Data fusion for MODIS, Landsat and Sentinel sea surface temperatures (SST)

Overview

Will be automating detection of warm water outflow from many ice shelves around Antarctica. It will include visible and thermal infrared imagery from MODIS, Landsat, and Sentinel, and will include ice shelf surface morphology measurements from Icesat-2. It would be great to integrate improved visualization code, especially if we can get imagery from MODIS WorldView visualized. Cloud detection for Icesat-2 and thermal infrared will be important and code development/data fusion for Level-2/Level-3 imagery will be pertinent. The automated-detection across multiple sensors will also be a place where this group can do some interesting work together.

Objectives

* Improved download with cropping functionality and metadata access
* Data fusion for Level 2 and Level 3 imagery, and field data

Landsat Outline

Download

Gap fill Landsat 7

Atmospheric correction

* Align MOD07\_L2 to Landsat, subset and smooth – maybe align isn’t the right word (get MOD07\_L2 onto Landsat grid without losing data, currently using nearest neighbor)
* Find values from LUT using MOD07\_L2 for each Landsat pixel (currently using a mean for the surface because has edge issues)
* Apply LUT values and conversion from radiance to temperatures

Non-ocean masking for Landsat

* Start with cloud mask provided by QA bands
* Conduct Random Forest classification using multiple bands to determine land/ice/cloud (improves cloud mask)

Apply mask to extract SSTs

Multi-platform Fusion Outline

Apply sea ice mask if needed (might not need to do)

Align MODIS, Landsat, Sentinel SST and subset

Reliably extract data from all three for comparison

Automate detection of polynyas/outflow

* ML ice shelf front detection – in literature
* Use either feature detection to find basal channels or input location of basal channel
* Search block along ice front for largest open water area at/near ice front, if multiple-collect info on all and distance from basal channel outlet
* Create polygons for each
* Determine the probability of good retrieval based on surface variation, probability of cloud, distance from outlet

Challenges:

Download – way too much data and takes forever

Alignment of Level 2/3 data without losing or biasing data

Assigning proper water vapor values to small open water areas (<4 km)

Classification with Random Forest that isn’t too computationally expensive – streamline classif.

Automation