Object-Based Image Classification of Floating Ice Used as Habitat for Harbor Seals in a Tidewater Glacier Fjord in Alaska

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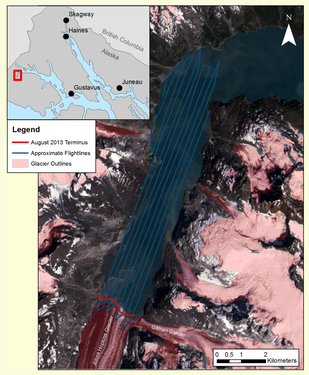
Objectives

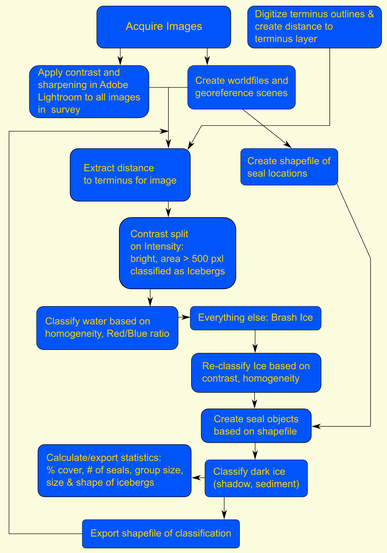
- Develop object-based approach to classify floating ice habitat used by Harbor Seals
- Automate, optimize classification routines for portability to other areas/surveys
- Examine relationship between Harbor Seal population and floating ice availability
- Provide a permanent record of spatial distribution of harbor seals and glacial ice
- Assess potential effects of changes to glaciers on Harbor Seal populations in tidewater glacier fjords in times of warming climate

Study Area



- Johns Hopkins Inlet (JHI) is a tidewater inlet off the West Arm of Glacier Bay in SE Alaska
- Two tidewater glaciers calve into JHI (Johns Hopkins, Gilman); several smaller glaciers also contribute seasonal melt
- Johns Hopkins Glacier (250 km^2) has advanced over 2 km since the mid-20th century
- >1000 seals counted annually in JHI, though numbers are declining
- Surveys twice annually (June/August), 2007-2013, corresponding to pupping/molting seasons

Processing and Classification Workflow



Classification Results

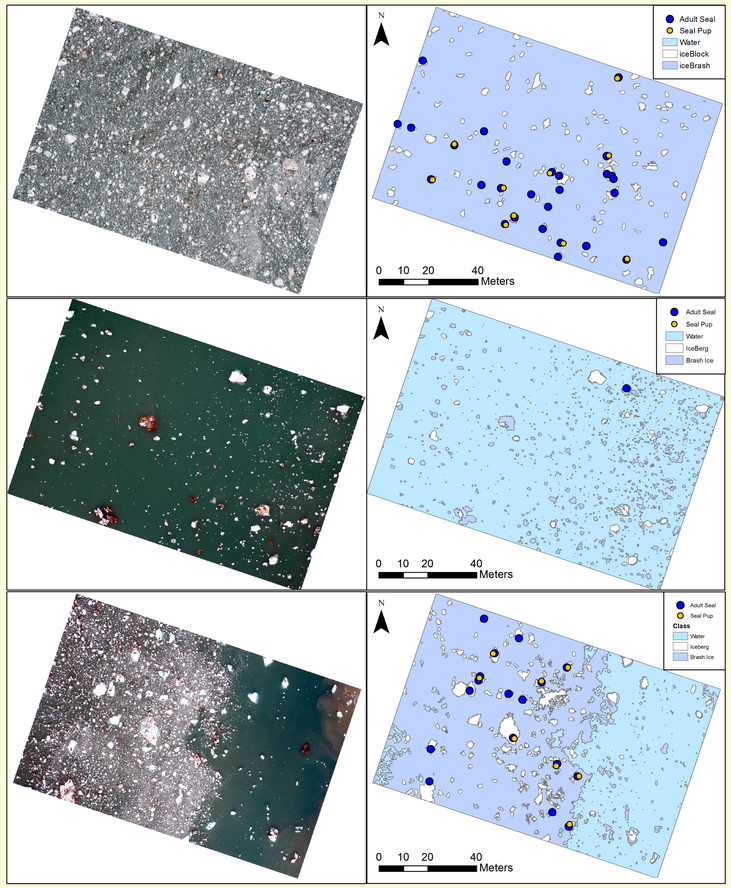
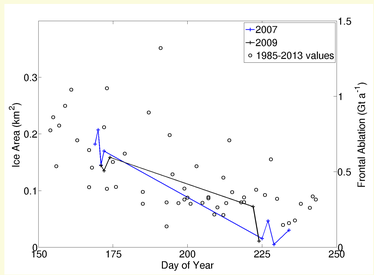


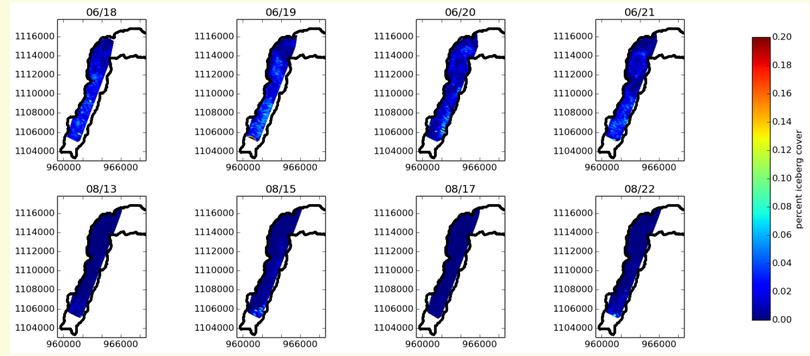
Figure 1 : Right: Classification maps for scenes on the left; from top to bottom, scenes are from 19 June 2007, 19 June 2007, and 20 June 2009.

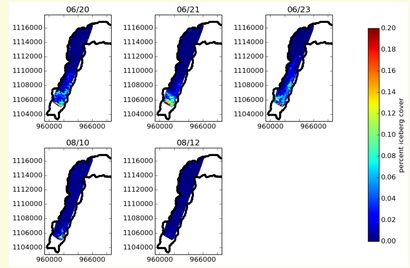
Seasonal Cycles

- McNabb et al. (*In Press*, JGR *Earth Surface*) calculate time series of frontal ablation (sum of submarine melt, calving) for 27 Alaska tidewater glaciers, 1985-2013, using Landsat scenes, an offset tracking algorithm, and estimates of ice thickness
- For Johns Hopkins Glacier, seasonal cycle of frontal ablation (calving) matches well with pattern observed in classified iceberg cover based on 2007, 2009 surveys
- Pupping season occurs simultaneously with highest fjord ice availability



Percent Ice Cover





- Icebergs (here defined to be >0.8 m^2) decrease in area cover and abundance from June-August (pupping/molting season, respectively)
- Earlier in year (June), icebergs (and seals) tend to be distributed throughout the fjord
- Later in year (August), concentration of icebergs (and seals) is higher closer to glacier terminus
- Percent Iceberg cover never exceeds ~20% in either 2007 or 2009 - icebergs are never typically larger than ~100 m^2

Discussion

- Classification works well for most scenes, especially for icebergs
- Seasonal ice coverage derived from classification method agrees with estimates of frontal ablation for Johns Hopkins Glacier from McNabb et al., *Accepted*.
- Icebergs with sediment, shadows can be misclassified; glare can also result in misclassification
- Unlike other tidewater fjords in Alaska, JHI has no moraine sill to retain icebergs

Acknowledgements

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Further Resources

- McNabb, R., R. Hock and M. Huss, Variations in Alaska tidewater glacier frontal ablation, 1985-2013, *J. Geophys. Res.*, Accepted
- For more on Harbor Seal studies in GBNP, visit `http://www.nps.gov/glba/naturescience/seal.htm`
- See Abstract GC23D-0976, AGU Fall Meeting 2013