**Abstract**

Satellite geodesy plays an important role in Earth observation. This dissertation presents three applications of satellite geodesy in environmental and climate change. Three satellite geodesy techniques are used: high-precision Global Positioning System (GPS), the Gravity Recovery and Climate Experiment (GRACE) and Interferometric Synthetic Aperture Radar (InSAR).

In the first study, I use coastal uplift observed by GPS to study the annual changes in mass loss of the Greenland ice sheet. The data show both spatial and temporal variations of coastal ice mass loss and suggest that a combination of warm atmospheric and oceanic condition drove these variations.

In the second study, I use GRACE monthly gravity change estimates to constrain recent freshwater flux from Greenland. The data show that Arctic freshwater flux started to increase rapidly in the mid-late 1990s, coincident with a decrease in the formation of dense Labrador Sea Water, a key component of the deep southward return flow of the Atlantic Meridional Overturning Circulation (AMOC). Recent freshening of the polar oceans may be reducing formation of Labrador Sea Water and hence may be weakening the AMOC.

In the third study, I use InSAR to monitor ground deformation caused by CO2 injection at an enhanced oil recovery site in west Texas. Carbon capture and storage can reduce CO2 emitted from power plants, and is a promising way to mitigate anthropogenic warming. From 2007 to 2011, ~24 million tons of CO2 were sequestered in this field, causing up to 10 MPa pressure buildup in a reservoir at depth, and surface uplift up to 10 cm. This study suggests that surface displacement observed by InSAR is a cost-effective way to estimate reservoir pressure change and monitor the fate of injected fluids at waste disposal and CO2 injection sites.

**Keywords:** Global Positioning System, Gravity Recovery and Climate Experiment, Interferometric Synthetic Aperture Radar, Greenland ice mass loss, Labrador Sea, AMOC, carbon sequestration