**Abstract**

Satellite geodesy plays an important role for Earth observation and it provides numerous applications in different scientific disciplines. This dissertation presents three applications of satellite geodesy in environmental and climate change. In this dissertation, 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). The following are brief introductions of these three studies. In the first study, I use the 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 product to estimate recent freshwater flux from Greenland. The data shows that Arctic freshwater flux started to increase rapidly since the mid-late 1990s, coincident with the decrease of Labrador Sea Water formation, a key component of the deep southward return flow of the Atlantic Meridional Overturning Circulation. This study suggests that recent freshening of the high-latitude region weaken the formation of Labrador Sea Water and hence possibly slow down the Atlantic Meridional Overturning Circulation. 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, utilization and storage can greatly reduced CO2 emitted from power plants, which is a promising way to mitigate anthropogenic warming. From 2007 to 2011, ~24 million tons of CO2 have been sequestered in the field, causing up to 10 MPa pressure buildup at reservoir depth and surface uplift up to 10 cm. This study suggests that surface displacement observed by InSAR is a good indicator of reservoir pressure change and continuous monitoring surface displacement at enhanced oil recovery sites helps to assess risks associated with fluid injection.

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