Combination of CP & CSA

D6.6 - Fine-tuned operational system with multi-year data gathering experience in place

Project No.262693 – INTERACT

FP7-INFRASTRUCTURES-2010-1

Start date of project: 2011/01/01 Duration: 48 months
Due date of deliverable: 31/12/2014 Actual Submission date: 15/01/2015

Lead partner for deliverable: ULUND
Author: Torben R. Christensen

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the Consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

Publishable Executive Summary

The main objectives for the work package are 1) to improve monitoring and facilitate research into key climate feedback mechanisms from northern terrestrial ecosystems in a changing climate. These key feedback mechanisms have regional and global consequences and relate to ecosystem energy and greenhouse gas (GHG) exchange as these are affected by changes in snow and other cryospheric components such as permafrost measured at the INTERACT infrastructures 2) to quantify interactions of snow/ice, temperature, moisture and exchanges of energy and CH_4/CO_2 and their intra- and inter- annual variability at multiple sites. The planned improved flux measurements and distributed energy exchange monitoring sites has been running through the years 2012 - 2014 (some started in 2011 and all continue to operate) and we have encountered only a few problems that we have been able to fine-tune during the years. The major ones are:

- We found major faults and inconsistencies between net radiometers and have conducted several dual sensor tests to isolate the problem. These tests combined with close collaboration with the supplier have resulted in all net radiometers being operational and reliable.
- Major problems with power supply for these remote locations have been found. We embarked on a use of fuel-cells but found these were not fully developed yet for the harsh terrain we are operating in during winter when there is little possibility for carrying out maintenance on a routine basis. We have developed the fuel-cells to be better suited and have created combined solutions with small wind mills and solar panels. The power supply at all sites is now also in an operational working order which will help minimise the gaps in data coverage experienced during the first years of operation.

As the planned improved flux measurements and distributed energy exchange monitoring are now up and running at all the test sites, the work in this work package is now focusing on the analyses of the multi-site and multi-year data which is exemplified briefly in the text below.

A comparative approach to assess variation in surface energy fluxes in northern high-latitude ecosystems

An analysis by: Christian Stiegler, Anders Lindroth, Magnus Lund, Torben R. Christensen, Mikhail Mastepanov

The partitioning of energy at the surface is a crucial process which exerts a major control on climatic and hydrologic regimes in northern high-latitude ecosystems. High-latitude ecosystems are also known to be very sensitive to climate change. With concern made to the potential effects of climate warming, knowledge of the terrestrial surface energy balance of arctic and subarctic environments is therefore important but there is a lack of direct measurements and observations.

In this study we assess the variability of arctic and subarctic terrestrial ecosystems in surface energy partitioning and moisture exchange. We use micrometeorological data provided by the INTERACT-WP6. The study areas cover measurements from high-arctic (Zackenberg, Northeast Greenland and Adventdalen, Svalbard), low-arctic (Kobbefjord, West Greenland) and subarctic (Stordalen, Sweden) heath and fen tundra ecosystems. The study period covers the years 2012-2014.

The aim of the work is to: (1) Determine and quantify the controlling factors of the surface energy balance of these arctic and subarctic terrestrial ecosystems; (2) Examine the effects of differences in regional climate, vegetation, topography and substrate on the surface energy budget and evapotranspiration regime; (3) Assess possible changes in land-atmosphere interactions caused by climate change; (4) Discuss the energy balance closure problem.

These analyses will be presented at several international conferences starting with EGU 2015 and will also be disseminated through the publication of original high impact journal articles that also will feed into the PhD thesis by Christian Stiegler. Below are photo examples of different INTERACT stations that already have produced multi-year data sets as shown in D6.5.

Figure 1. INTERACT-installation in a low-arctic fen ecosystem in Kobbefjord, West Greenland (Photo: Christian Stiegler).

Figure 2. INTERACT-installation in a low-arctic heath ecosystem in Kobbefjord, West Greenland (Photo: Christian Stiegler).

Figure 3. INTERACT-installation in a subarctic fen ecosystem in Stordalen, Sweden (Photo: Niklas Rakos).

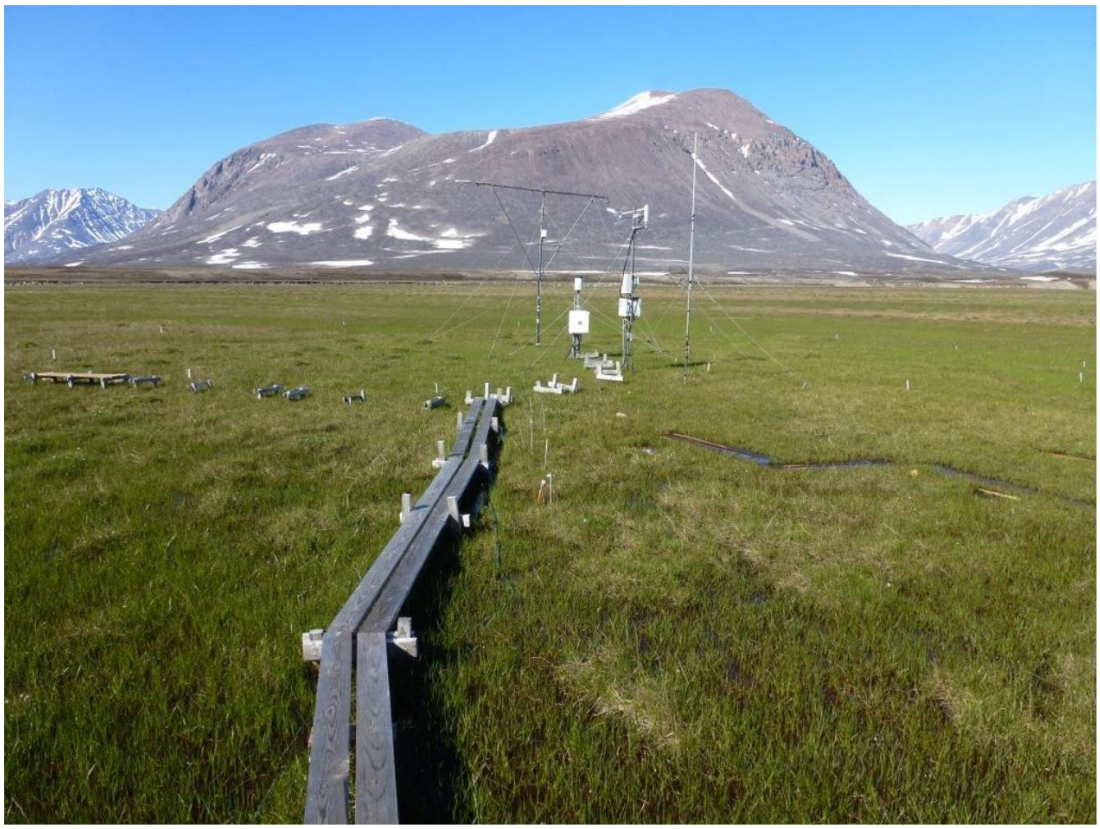

Figure 4. INTERACT-installation in a high-arctic fen ecosystem in the Zackenberg valley, Northeast Greenland (Photo: Magnus Lund).

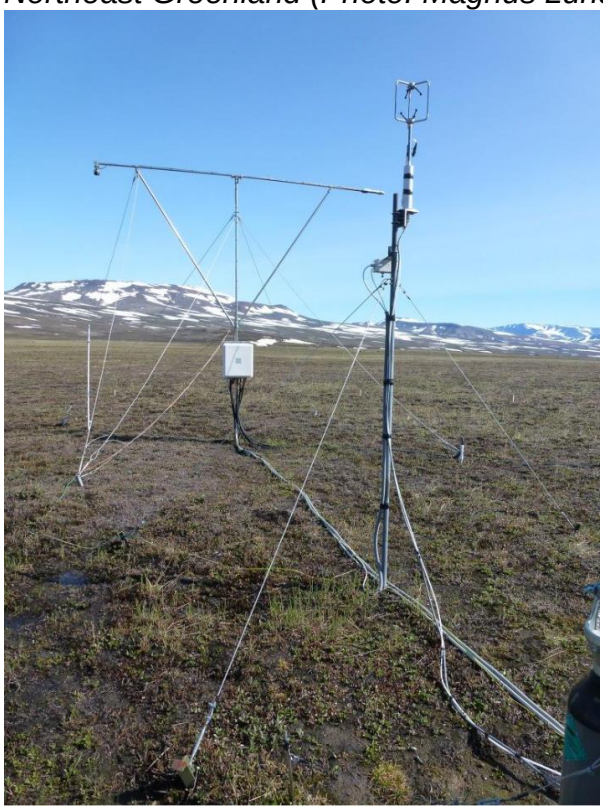

Figure 5. INTERACT-installation in a high-arctic heath ecosystem in the Zackenberg valley, Northeast Greenland (Photo: Magnus Lund).

Figure 5. Mobile INTERACT-installation in a subarctic fen ecosystem in Torneträsk, Sweden (Photo: Christian Stiegler).