INTERACT

International Network for Terrestrial Research and Monitoring in the Arctic

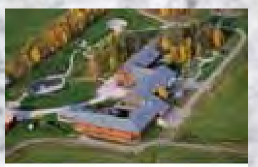
www.eu-interact.org

InGOS 2nd periodic project meeting

14 – 16 October 2014, Firenze, Italy

By Elmer Topp-Jørgensen, Aarhus University and Anders Lindroth, Lund University





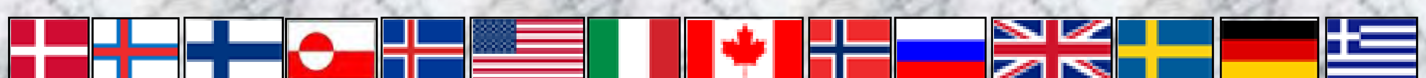

INTERACT is a project of SCANNET

Four years funding of INTERACT (2011-2014)

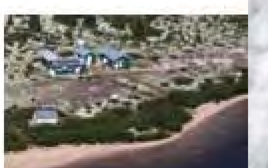
(under EU's FP7 Infrastructure Programme (I3))

Application submitted for four more years

(under EU's Horizon 2020 - INFRAIA)



INTERACT Stations



Start (2011):

33 stations

32 partners

14 countries

Today (2014):

69 stations

50 partners

19 countries

INTERACT partner station

INTERACT Observer Station

About INTERACT






One-stop shop to a network of >70 terrestrial field stations

Platform for circumarctic research or monitoring projects/programmes

Aim - To build capacity for research and monitoring in the Arctic

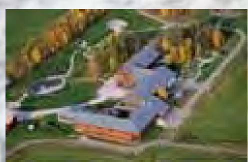
- identifying, understanding, predicting and responding to diverse environmental changes throughout the wide environmental and land-use envelopes of the Arctic.

International collaboration

Strengthen ties to international programmes and networks to improve coordination and contribute to circumarctic understanding of processes, identification of changes and adaptation.

INTERACT partners hosts and participate in international initiatives related to terrestrial research and monitoring - e.g. ABC, IASC, ISAC, SAON, CBMP, AMAP, GLORIA, IPA/CALM, ITEX, ICOS, InGOS, ANAEE, INCREASE, LifeWatch and SIOS.

About INTERACT


INTERACT work packages

WP1 Coordination (Terry V. Callaghan and Margareta Johansson)

WP2 Station Managers' Forum

WP3 International Cooperation

WP4 Transnational Acces

Joint Research Activities
WP5 Virtual instrumentation
WP6 Feedback mechanisms
WP7 Data management

WP8 Outreach






Improved management and service provisions

INTERACT infrastructure overview
INTERACT Station Catalogue

Improved management and service provisioning
INTERACT Management practices handbook

Research and monitoring
Transnational Access
INTERACT research and monitoring report and metadata repository

INTERACT Station Catalogue

Help researchers identify suitable infrastructure(s)

SAMOYLOV

STATION NAME AND OWNER

The Russian-German Research Station Samoylov is owned and run by the Lena Delta Reserve (Russia) and the Alfred Wegener Institute for Polar and Marine Research (Germany).

LOCATION

Samoylov Research Station is located at the southern coast of Samoylov Island in the southern part of the Lena River Delta, Northeast Siberia, close to the Laptev Sea (72°22' N, 126°28' E). The Lena River Delta is the largest delta system in the Arctic and Samoylov Island is part of the Lena Delta Reserve, the largest protected area in Russia. The nearest settlement is Tiksi, located about 115 km to the southeast, and home to c. 5000 inhabitants.

BIODIVERSITY AND NATURAL ENVIRONMENT

Samoylov Island is situated in the youngest part of the Lena Delta in the zone of continuous permafrost. It covers an area of about 5 km² and is dominated by wet polygonal tundra, characterised by low-centered ice-wedge polygons. The regional arctic-continental climate allows maximum thaw depths of about 0.5 m.

Hydrophytic sedges such as *Carex aquatilis*, *Carex chordorrhiza*, and *Carex rariflora*, as well as mosses (e.g. *Drepanocladus revolvens*, *Meesia triquetra*, and *Aulacomnium turgidum*) dominate the vegetation in the wet polygon centers and on their edges. Mesophytic dwarf shrubs such as *Dryas octopetala* and *Salix glauca*, forbs (*Astragalus frigidus*), and mosses (*Hylocomium splendens*, *Timmia austriaca*) dominate the polygon rims.

HISTORY AND FACILITIES

The station was originally built as a logistics base for the Lena Delta Reserve. After its extension in 2005, it became an official Russian-German research station (in 2006). Altogether, the station can accommodate ten people during winter time and up to 16 people in the summer when tents can also be used. The station also includes working space, laboratories, cold storage in a permafrost cellar (Russian – lednik), and a separate sauna. Long-term experimental plots – including automatic climate and soil stations as well as devices for trace gas flux measurements – can easily be reached by a twenty minutes walk from the station. In 2011, the construction of a new Russian station (owned by the Siberian Branch of the Russian Academy of Sciences) was initiated and it is expected to open in the spring of 2013, to replace the existing Samoylov Station.

GENERAL RESEARCH AND DATABASES

The Lena Delta is a key area for studies of the dynamics and development of permafrost in the Siberian Arctic. The research focuses on the ecosystem-atmosphere interactions on various spatial and temporal scales in order to assess and predict climate and environmental changes in the Lena River Delta region. The main objectives are to study the community, structure, and dynamics of microbial populations involved in the methane cycle as well as the processes controlling exchange of methane, carbon dioxide, and energy on different scales. Other important long-term studies focus on climate and permafrost monitoring, paleo-environmental reconstruction, river hydrology, geomorphology, permafrost dynamics, arctic coastal dynamics, and hydrobiology (e.g. zooplankton dynamics). For more information see Hubberten, H.-W. et al. 2003 (published 2006): Polarforschung 73, 111-116. Data and results from Samoylov can be found in the PANGAEA database (www.pangaea.de).

HUMAN DIMENSION

The human influence on the Lena Delta is minimal due to its status as a nature reserve with three rangers living in the reserve throughout most of the year. However, there is some subsistence fishing in the summer, and occasionally river cruise ships pass by.

ACCESS

The Russian-German Research Station Samoylov can be reached from Tiksi (connected by regular air service to Moscow and Yakutsk) by helicopter in about 45 minutes and by river boat in about 12 hours. Winter transport is also possible by truck or tank on the ice of the Lena River.

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INTERACT
Station Catalogue

Help researchers identify suitable infrastructure(s)

Category	Sub-Category	Samoylov Research Station
Website		www.awi.de/en/infrastructure/stations/samoylov_station
Country		Russia
Opening year		1998
Operational period		(April-May), June-August, (September-November)
Permitting issues categories	Permits required for access to the station	Yes
	Permits required for studies	Yes
	Contact (permit issues)	waldemar.schneider@awi.de
Facility owner and manager	Name of the facility owner	Lena Delta Reserve (Russia) and Alfred Wegener Institute for Polar and Marine Research (Germany)
	Owner status	Private
	Institution responsible for managing the station	Alfred Wegener Institute for Polar and Marine Research
	Contact (access to station)	moritz.langer@awi.de
	Website (institution)	www.awi.de
Other institutions	Name	AWI, LDR, PIY
	Country	Germany, Russia
Location	Geographical coordinates	72°22'N, 126°28'E
	Altitude of station	12 m a.s.l.
	Min. altitude within study area	0 m a.s.l.
	Max. altitude within study area	50 m a.s.l.
	Nearest town/settlement	Tiksi (5000 inhabitants)
	Distance to nearest town/settlement	120 km
	Map	Aerial image, satellite image, Google Earth with low resolution
Climate	Climate zone	Low Arctic
	Permafrost	Continuous
	Years measured	1998-2010 (with gaps)
	Mean annual temperature	-13.6 °C
	Mean temperature in February	-33.2 °C
	Mean temperature in July	9.3 °C
	Mean annual wind speed	4.35 m/s
	Max. wind speed	17.7 m/s
	Dominant wind direction	NE
	Total annual precipitation	319 mm
	Precipitation type	Rain, snow
	Ice break up	Lena River backwater, May
Station facilities	Area under roof	103 m²
	Scientific laboratories	25 m²
	Logistic	12 m² (storage)
	Number of rooms (beds)	4 sleeping rooms (10 beds), 1 living room, 2 labs, 1 kitchen
	Number of staff on station (peak/off season)	1/0
	Max. number of visitors at a time	13
	Showers	–
	Laundry facilities	–
	Power supply (type)	6 kVA diesel generator and 400 W wind generator (under reconstruction)
	Power supply	6-12 hours diesel, 24 hours wind
Scientific equipment	Specific device	–
	Scientific services offered	–
Medical facilities	Medical facilities	–
	Medical suite	–
	No. of staff with basic medical training or doctor	1-2
	Distance to hospital (estimated time)	120 km (1 hour by helicopter)
	Compulsory safety equipment	–
	Recommended safety equipment	–
Landing facilities	Airstrip (Length × Width)	–
	Airstrip surface	–
	Helipad	No helipad, just tundra
	Ship landing facilities	–
Vehicles at station	Sea transportation	Zodiac (rubber boot)
	Land transportation	Quad with hanger
Transport and freight	Transport to station	Commercial flight to Tiksi, then by helicopter or boat
	Number of ship visits per year (period)	No regular intervals
	Number of flight visits per year (period)	Once every two weeks (May – October)

Features within study area
- ○ Ice cap or glacier
- ○ Permanent snowpatche
- ● Mountain
- ● Valley
- ● Shoreline
- ● Tundra
- ○ Tree line
- ● Other (Ice-rich per polygons, thermok

Main science discipl
- ○ Anthropology, Sociology,
- ○ Astrophysics
- ○ Atmospheric chemistry and physics
- ● Isotopic chemistry
- ● Climatology, Climate Change
- ○ Environmental sciences, Pollution
- ○ Geodesy
- ● Geology, Sedimentology
- ● Geophysics
- ○ Glaciology
- ● Geocryology, Geomorphology
- ● Soil science
- ○ Human biology, Medicine
- ● Mapping, GIS
- ● Marine biology
- ○ Oceanography, Fishery
- ○ Microbiology
- ● Hydrology
- ● Terrestrial biology, Ecology
- ● Paleolimnology
- ○ Paleoecology
- ● Limnology

Workshop facilities
- ○ Metal workshop
- ○ Wood workshop
- ○ Plexiglas workshop
- ○ Staff available to assist with constructions

Communication
- ● Telephone
- ● Satellite phone
- ● VHF
- ● E-mail (via satellite)
- ○ Internet
- ● Computer (only one computer for the e-mail system)
- ● Printer
- ○ Scanner
- ○ Fax

Research Station Samoylov

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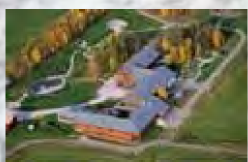



INTERACT Transnational Access

Plus North American TA

Period: 2011-2014

Number of researchers: 544
Number of research days: 7385

INTERACT
Metadata repository

Help researchers identify relevant projects and datasets
Help stations and researchers identify geographical gaps





Research and monitoring projects since 2000

Monitored parameter groups

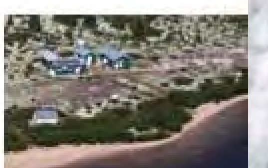
- GHG exchange (CO2, CH4, N2O)
- Energy balance (radiation, heatflux, energy budget)

Best practices for monitoring selected parameters

- Describing and providing links til relevant methodologies of international scientific organisations, networks and programmes.

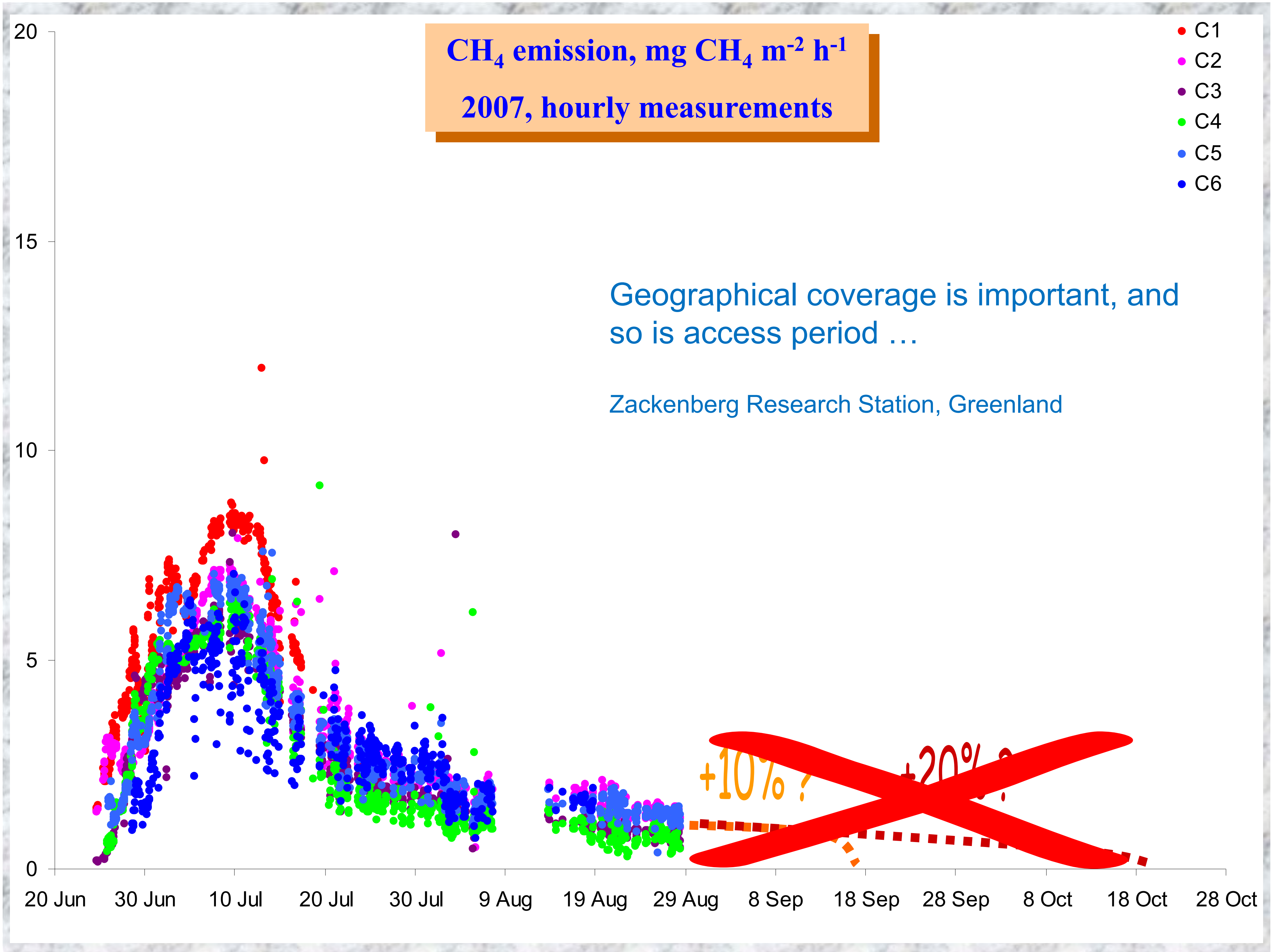
INTERACT

- GHG flux and energy balance



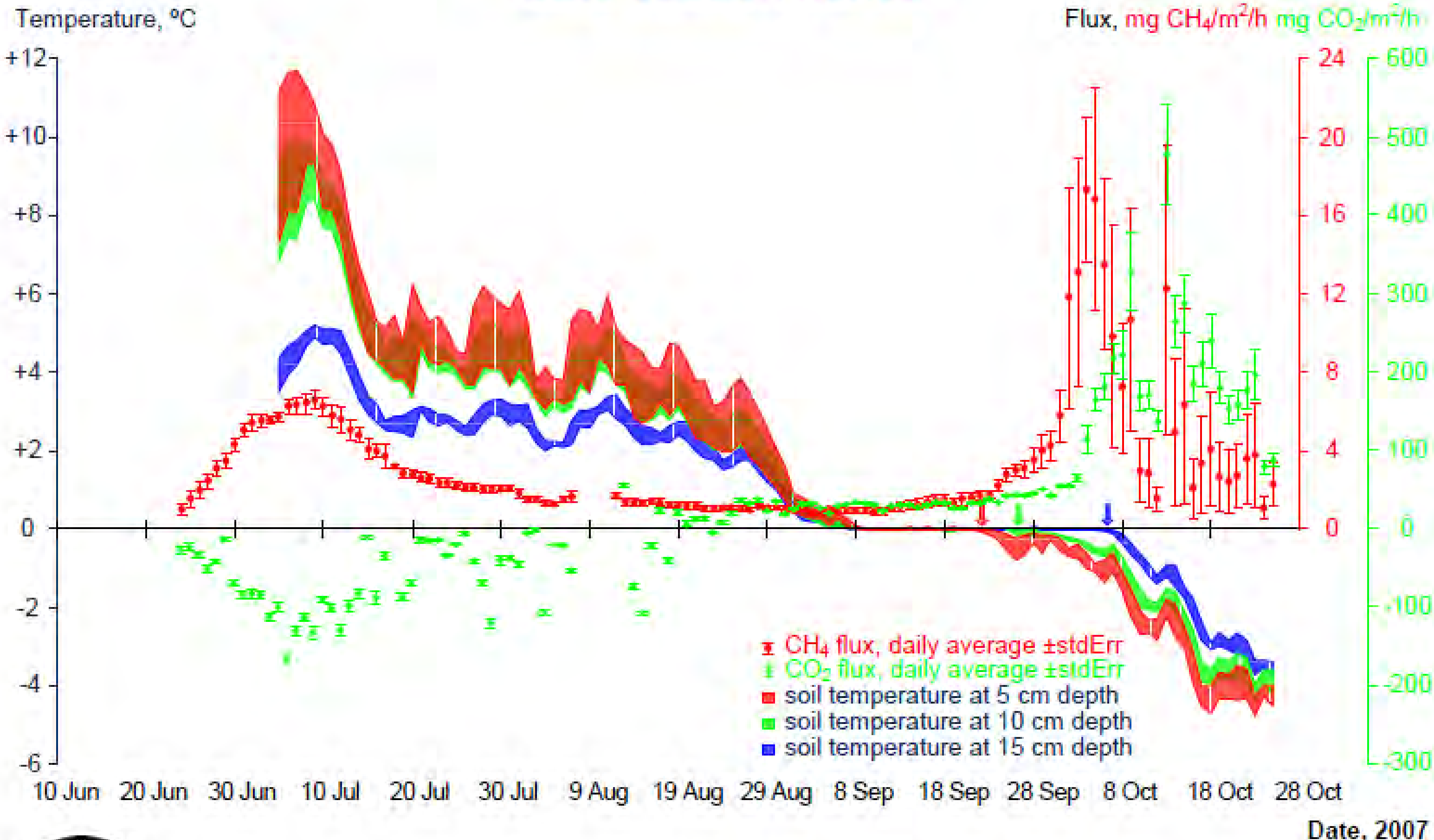
Stations measuring GHG fluxes and energy balance

Parameter	Number of stations measuring (of 33 stations)
CO_2	10
CH_4	8
N_2O	2
Net Radiation	16
Sensible heat flux	11
Latent heat flux	10
Soil heat flux	10



CH_4 emission, mg CH_4 m^{-2} h^{-1}
2007, hourly measurements
C1
C2
C3
C4
C5
C6
Geographical coverage is important, and so is access period …
Zackenberg Research Station, Greenland
+10% ?
+20% ?
20
15
10
5
0
20 Jun
30 Jun
10 Jul
20 Jul
30 Jul
9 Aug
19 Aug
29 Aug
8 Sep
18 Sep
28 Sep
8 Oct
18 Oct
28 Oct

Late season fluxes



Adapted from Mastepanov et al, *Nature*, 2008

INTERACT JRA – Climate feedbacks






WP 6: Improved measurements of terrestrial biospheric feedbacks to climate

- to use the site infrastructures to improve monitoring and facilitate research into key feedback mechanisms from northern terrestrial ecosystems in a changing climate
- 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.

10 set of sensors installed at 4 sites

Abisko (Sweden)
Nuuk (Greenland)
Zackenberg (Greenland)
Svalbard

WP Lead: Torben R. Christensen
Lund University, Sweden

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

Christian Stiegler [(1)], Anders Lindroth [(1)], Magnus Lund [(1,2)], Torben R. Christensen [(1,2)]
[(1)] Department of Physical Geography and Ecosystem Science, Lund University, Lund, Sweden
[(2)] Department of Bioscience, Aarhus University, Roskilde, Denmark

Study areas and measurement setup

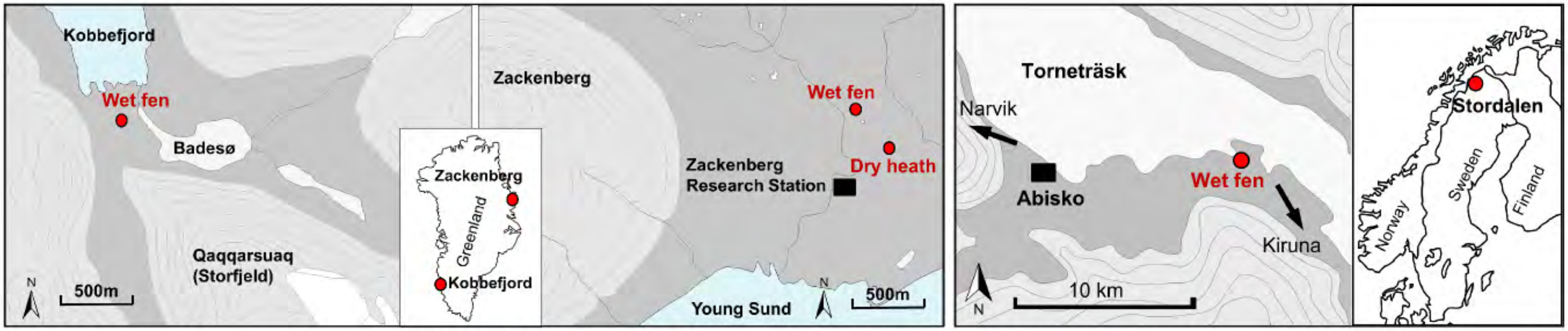


Fig. 1: Map and location of the study sites in Kobbefjord (left), Zackenberg (middle) and Stordalen (right).

Fig. 2: Measurement setup in Kobbefjord, Zackenberg and Stordalen. (Foto: Christian Stiegler, Magnus Lund, Niklas Rakos)

Measured parameters

Instrumentation	Study site			
	Stordalen	Kobbefjord	Zackenberg	
	wet fen	wet fen	wet fen	dry heath
Sonic anemometer	x	x	x	x
Net radiation	x	x	x	x
CO_2 gas analyser		x	x	x
Soil heat flux	x	x	x	x
Snow depth	x	x	x	x
Snow and pack temp.	x	x	x	x
Soil moisture	x	x	x	x
Air temperature, humidity		x	x	x
Precipitation		x	x	x
NDVI	x	x	x	
Air pressure		x	x	x
Ground water level	x	x	x	
PAR			x	x
Webcam	x		x	x

Tab. 1: Summary of available sensors and measured meteorological parameters at the study sites.

Data collection and processing

- Micro-meteorological measurements were performed during the period 1 Jul. - 31 Aug. 2012 at the wet fen sites in Zackenberg and Kobbefjord. Data from the wet fen site in Stordalen and the dry heath site in Zackenberg show the period 1 Jul. - 31 Aug. 2013.
- Turbulent fluxes were sampled at a rate of 10 Hz and calculated for 30-minute intervals using the EddyPro 4.2 software package. Standard flux corrections and quality tests were applied.
- Climatic variables, ground heat fluxes and radiation components were measured every 10-s and averaged to 30-minute intervals. No gap-filling was applied.
- Latent heat fluxes (LE) at the Stordalen site were calculated as a residual to the surface energy budget. At the other sites LE was both measured and calculated as a residual.

Results:
Surface energy balance components

- The mean diurnal trend in measured net radiation (Rn), sensible heat fluxes (H) and latent heat fluxes (LE) shows a midday peak at all study sites.

- Latent heat fluxes show a pronounced difference between measured (LE) and calculated ($LE_{res.}$) due to lack of energy balance closure.

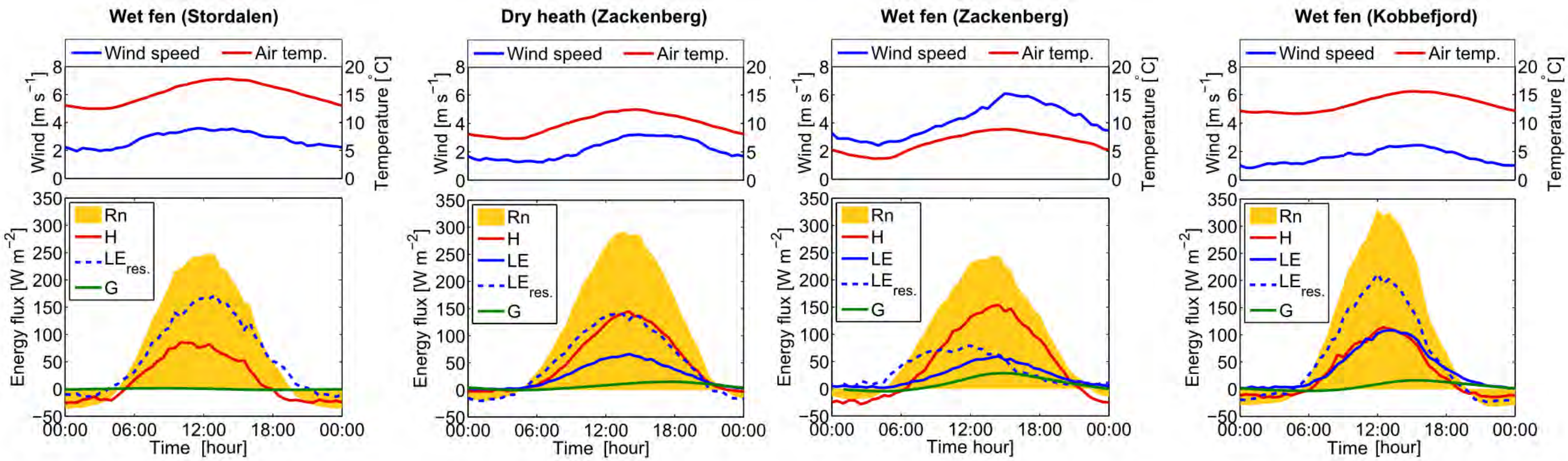
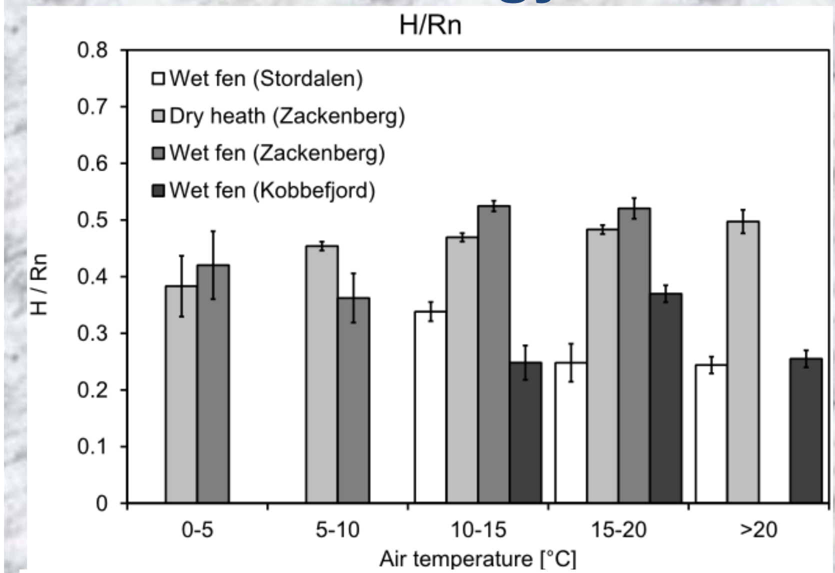
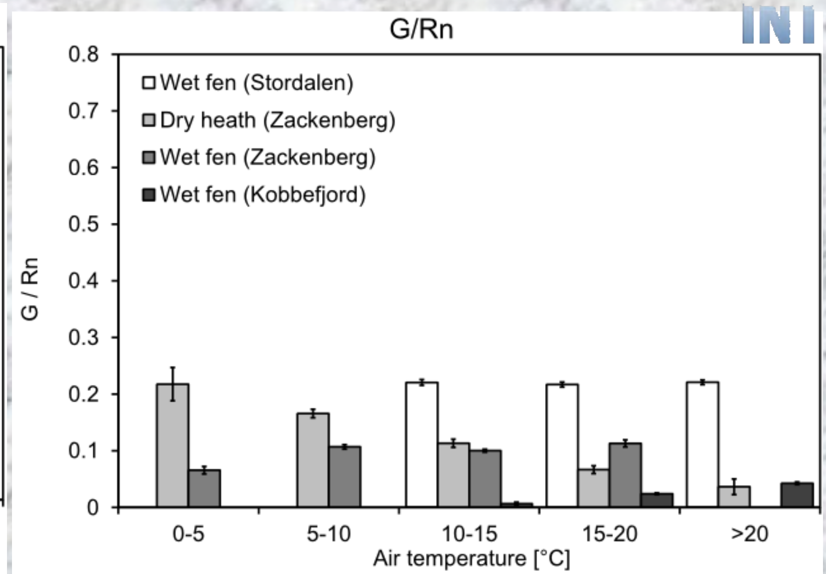


Fig. 3: Measured mean diurnal wind speed and air temperature at the study sites during the observation period 1 July - 31 August 2012 (wet fen, Zackenberg and Kobbefjord) and 1 July - 31 August 2013 (wet fen Stordalen, dry heath Zackenberg) and measured mean diurnal net radiation (Rn), sensible heat flux (H), latent heat flux (LE), and ground heat flux (G) at the study sites during the observation period: 1 July - 31 August 2012 (wet fen, Zackenberg and Kobbefjord) and 1 July - 31 August 2013 (wet fen Stordalen, dry heath Zackenberg). $LE_{res.}$ represents the calculated residual to the surface energy budget ($LE_{res.}$=Rn-H-G).

Surface energy flux ratio





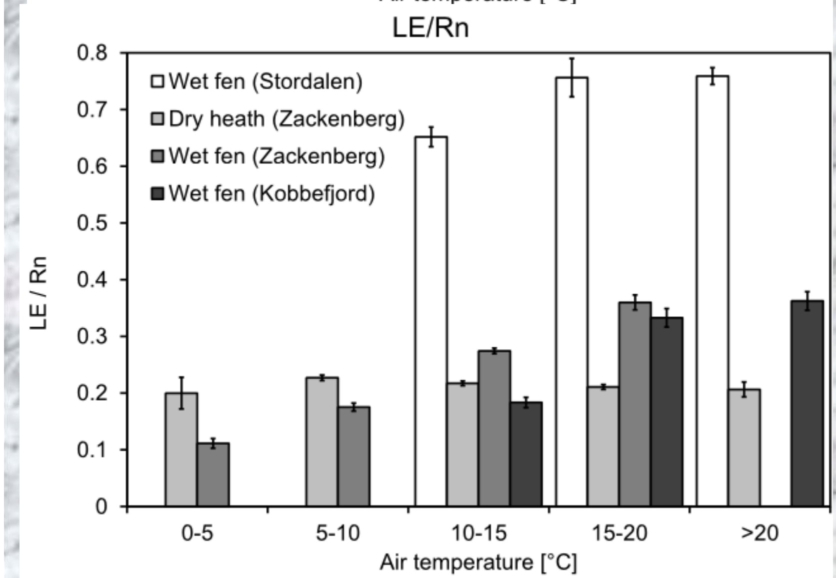
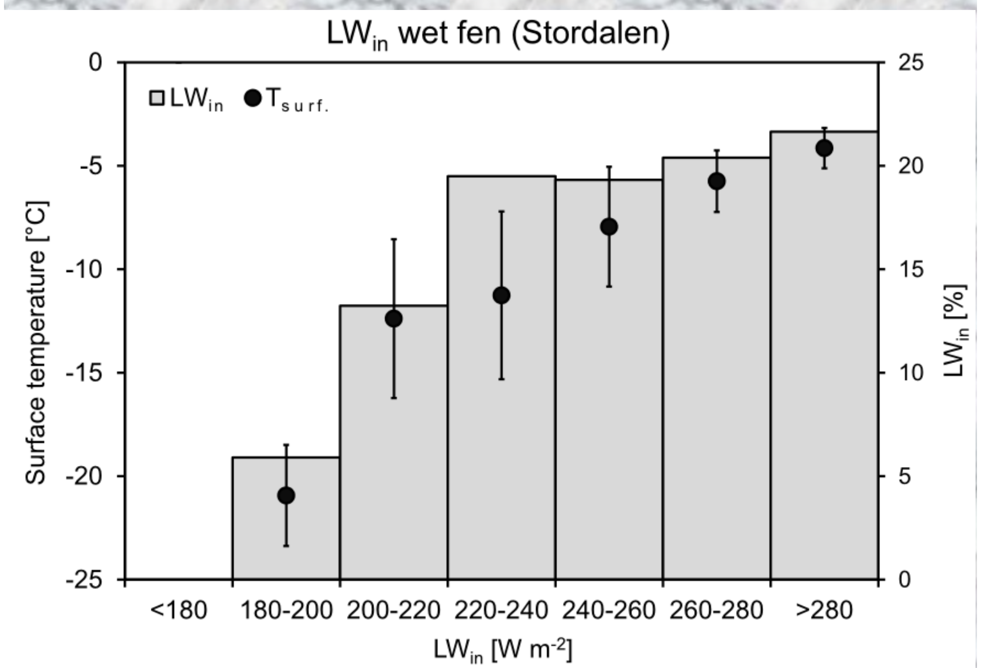


Fig. 4: Ratios of midday (10-14 h, local winter time) sensible heat flux (H), latent heat flux (LE), ground heat flux (G) and net radiation (Rn) based on 30-min flux intervals. The data were grouped into five bins according to 30-min average air temperature. The error bars represent the standard error. Observation period: see Fig. 3.

- Ratios of sensible heat, latent heat and ground heat fluxes to net radiation (H/Rn, LE/Rn, G/Rn) demonstrate the importance of air temperature on the energy partitioning of the tundra.
- The wet fen sites show a strong increase of LE/Rn with increase in air temperatures whereas the dry heath site shows no clear relationship to increasing temperature.
- A decline in G/Rn at the dry heath site in Zackenberg could be explained by the reduction of the temperature gradient due to the increased thaw depth.

Surface temperature during the polar winter

- Incoming long-wave radiation (LW_{in}) in Stordalen and in Zackenberg determines the general magnitude of the surface temperature ($T_{surf.}$) during the observation period in early winter.
- High values of incoming long-wave radiation (LW_{in}), determined by synoptical weather patterns and thus air mass distribution and cloud properties, correspond with increased soil surface temperatures ($T_{surf.}$).



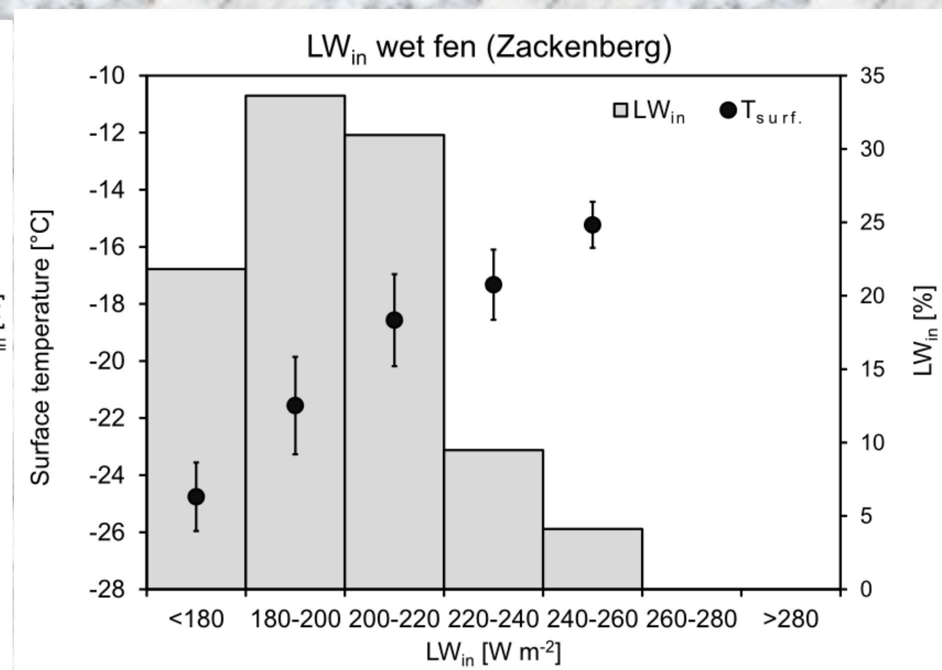


Fig. 5: Surface temperature (T_{surf}.) in dependence to the incoming long-wave radiation (LW_{in}) during the polar winter period 6 - 17 December 2012. The error bars represent the standard deviation. The histogram shows the distribution of incoming long-wave radiation (LW_{in}) in classes of 20 W m^{-2}.

INTERACT JRA – Climate feedbacks



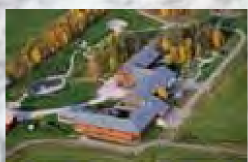




Summary

- The energy balance closure problem is a major limitation for an accurate determination of the surface energy budget.
- Flux partitioning is dependent on air temperature. At all the wet fen sites LE increases with air temperature.
- Incoming long-wave radiation during the polar winter exerts a direct control on soil surface temperatures.

INTERACT II


INTERACT work packages

WP1 Coordination (Margareta Johansson, ULund)

WP2 Science Coordination (Terry V. Callaghan, USheffield)

WP3 Station Managers' Platform (Morten Rasch, UCopenhagen)

WP4 Transnational Access, Virtual Access and Remote Access (Kirsi Latola, UOulu)

<u>Joint Research Activities</u>

WP5 Climate feedbacks/fluxes (Torben R. Christensen, ULund)

WP6 CBMP (Tom Barry, CAFF)

WP7 Red phone - Emergency response (Alexandra Bernadova, UBohemia)

WP8 Facilitating Adaptation (Grete Hovelsrud, NForsk)

INTERACT II

JRA – Climate feedbacks

WP 5 Developing flexible ground, boat-based and airborne sensing of GHG and energy exchanges at INTERACT stations

- aim to increase geographical scale of measurements.

Task 5.1: Evaluate energy exchange platforms installed during INTERACT I

Task 5.2: Explore novel robot technology for surveying hotspot emissions

Task 5.3: Develop flexible and transportable high sensitivity automatic chamber system and apply at high point emission sites

Task 5.4: Test airborne and boat-based remote sensing technology

WP Lead Torben R. Christensen, University of Lund, Sweden

Let’s INTERACT

InGOS 2nd periodic project meeting

14 – 16 October 2014, Firenze, Italy

By Elmer Topp-Jørgensen