DATA MANAGEMENT STRATEGY IN SUPPORT OF CEOP SCIENCE OBJECTIVES

(Session 2.2)

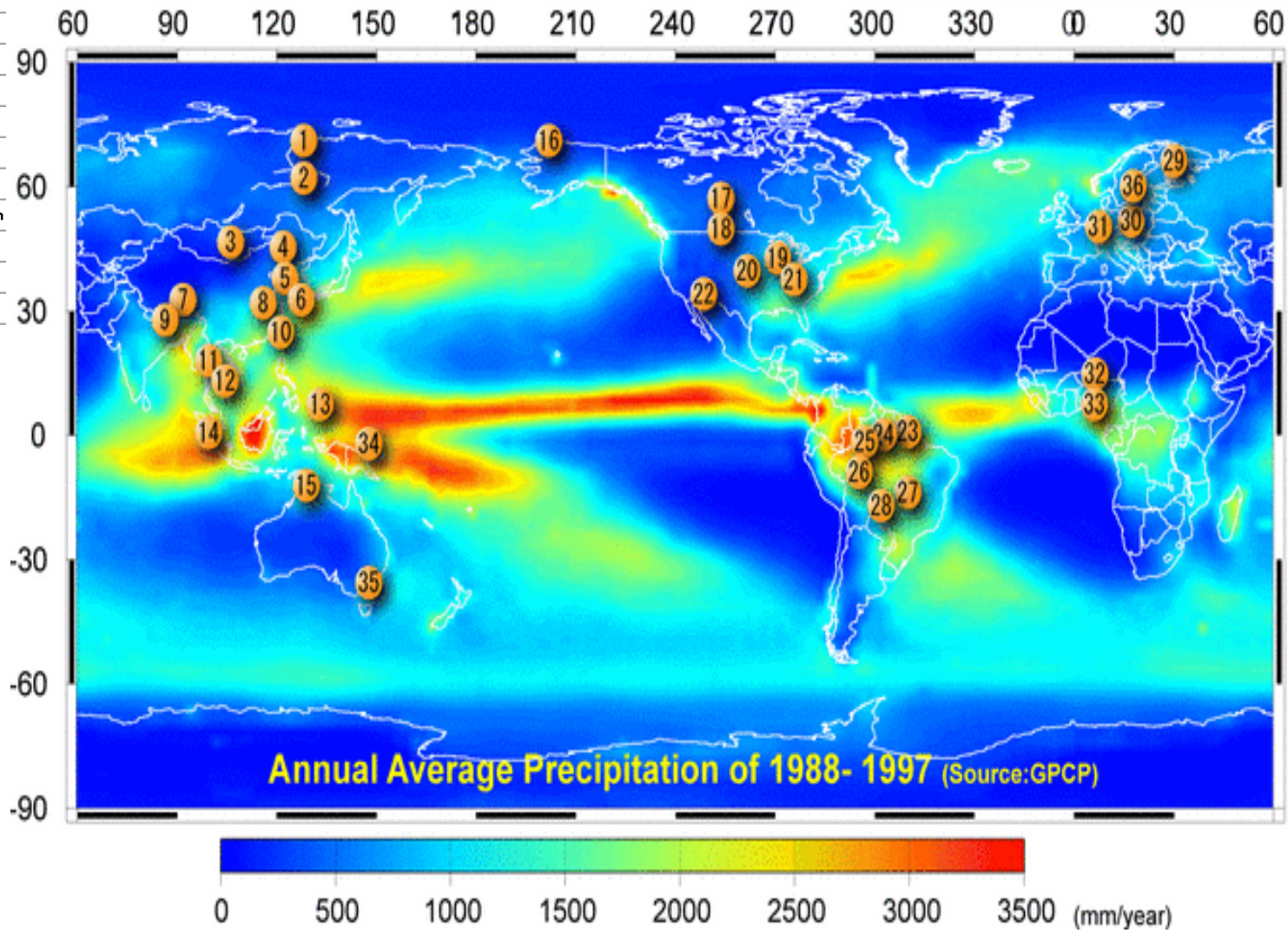
CEOP/IGWCO Workshop
Tokyo, Japan
28 February – 4 March 2005

SESSION 2.2 AGENDA

- Some Research Activities at BALTEX CEOP Reference Sites (Isemer)
- Concept of Climate Retrieving and Analysis System for Equatorial Island Reference Site (Darmawan)
- Seasonal and Diurnal Variations of the Exchange of Water Vapor and CO2 in semi-arid area at Tongyu, China (Liu)
- SHARE-Asia Project Meteoclimatic Research in Himalaya and Karakorum (Tartari)
- Estimating LAI from On-site Measurements of Radiation at NOAA-GAPP Reference Sites (Loehrer)
- Science Overview of the LaPlata River Basin (Mechoso)

REFERENCE SITE LOCATIONS

1	Eastern Siberian Tundra
2	Eastern Siberian Taiga
3	Mongolia
4	Inner Mongolia
5	Korean Peninsula
6	Korean Haenam
7	Tibet
8	Yangtze River
9	Himalayas
10	Northern South China Sea - Southern Japan
11	Chao-Phraya River
12	North-East Thailand
13	Western Pacific Ocean
14	Equatorial Island
15	ARM Tropical Western Pacific (Darwin)
16	ARM North Slope of Alaska (Barrow)
34	ARM Tropical Western Pacific (Manus)
17	BERMS (Old Black Spruce)
18	Ft. Peck
19	Bondville
20	ARM Southern Great Plains
21	Oak Ridge
22	Mt. Bigelow
23	Caxiuana
24	Santarem
25	Manaus
26	Rondonia
27	Brasilia
28	Pantanal
29	Sodankyla
30	Lindenberg
31	Cabauw
36	Norunda
32	Niamey
33	Oueme
35	Tumbarumba



REFERENCE SITE DESCRIPTION

1D Site:

Near surface + surface + sub-surface (Atmospheric sounding* is highly desirable)

2.5D Site:

A few 1D sites + surface heterogeneity with an area of at least 100km^2

3D Site:

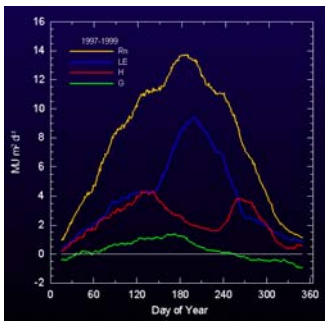
1D sites network (+3D system) or 2.5D site + 3D atmosphere** with an area of about 10^4 km^2

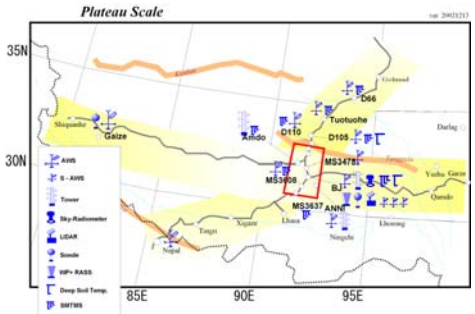
The terminology in summarizing these sites is used in the following manner:

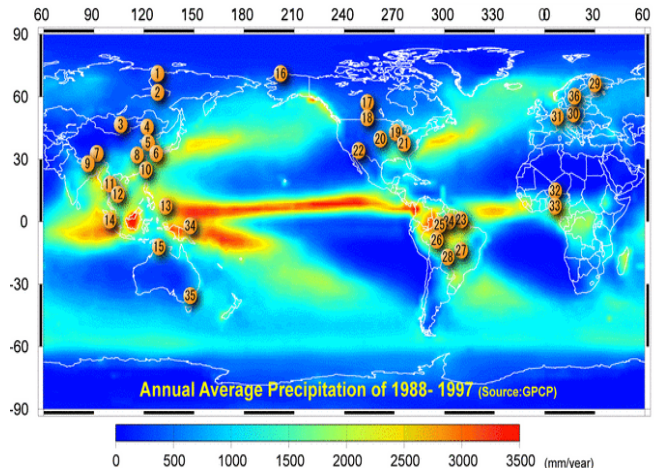
- **Sub-surface (0 to -1m)**: Soil moisture and temperature profile, heat conduction and soil characteristics;
- **Surface (0 to +2m)**: Four-component radiation, PAR, surface temperature, surface soil moisture, precipitation, vegetation type characteristics, snow;
- **Near surface(+2 to +10m)**: Temperature, specific humidity and wind speed profiles, surface pressure, momentum, latent and sensible heat fluxes;

* Atmospheric soundings: Radiosonde, wind profile, LIDAR microwave rain radar

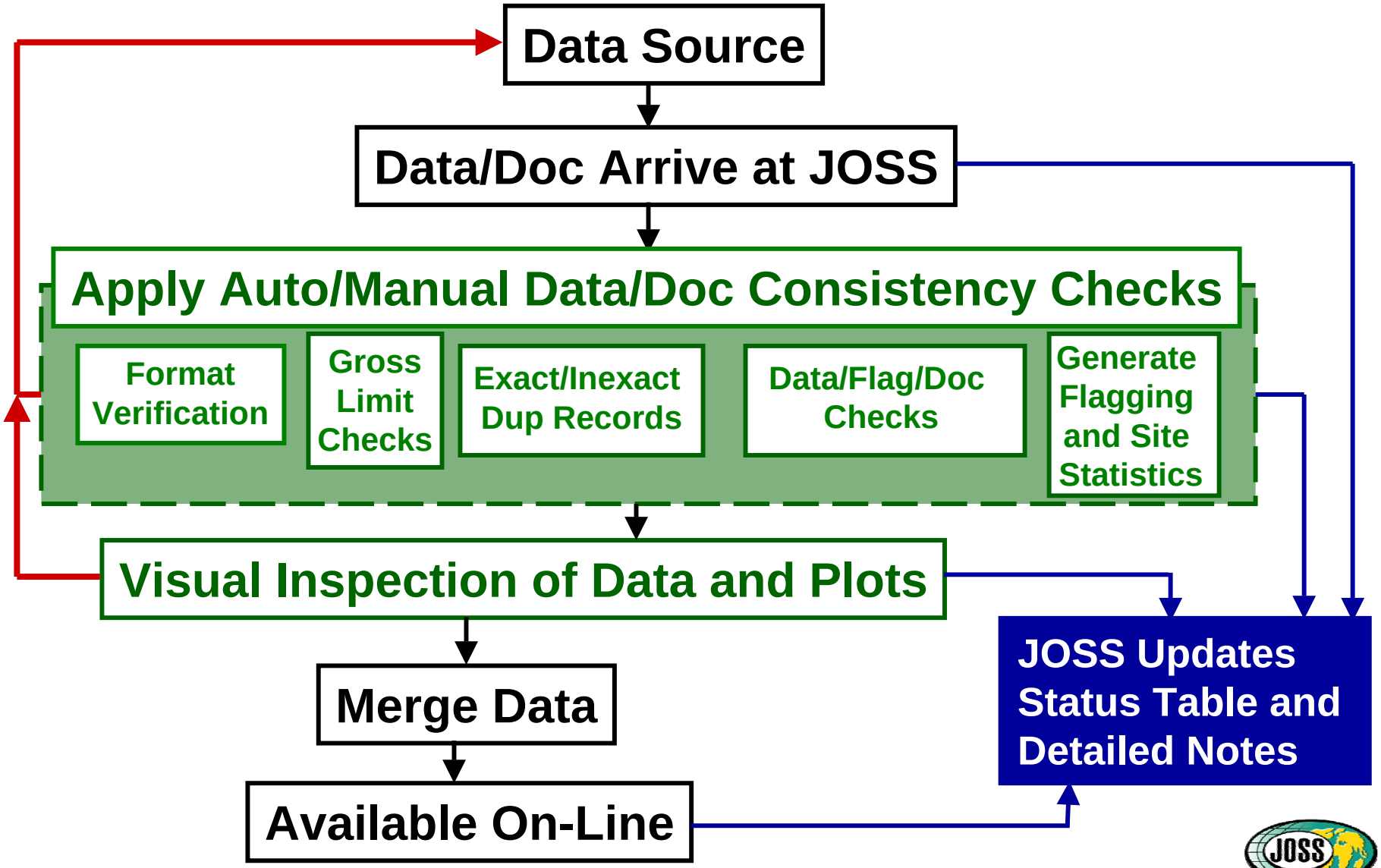
** 3D atmosphere: 3D Doppler radar, cloud radar, aerosonde aircraft.







Reference Site EOP-3 Data Flow



CEOP DATA MANAGEMENT WWW PAGE

http://www.joss.ucar.edu/ghp/ceopdm/

In-Situ Reference Site Data Sets and Information

Data Sets

- CEOP EOP-3 Reference Site Data Sets
- CEOP EOP-1 Reference Site Data Sets
- NASA/GMAO CEOP EOP-1 Reference Site Data Sets in GrADS Format
- Sample Reference Site Data Sets
- CEOP In-Situ Data Source Agency Links
- Baseline Surface Radiation Network (BSRN)
- GEWEX Land Processes Database Map Server

Information

- CEOP Reference Site Data Set Procedures Report (Approved by the SSC 29 July 2003)
- CEOP Reference Site Station Characteristics
- CEOP Reference Site Map
- Reference Site Data Management Update (GEWEX SSG Meeting, 20-24 January 2003)
- CEOP Reference Site Rawinsonde Station Questionnaire
  - Responses

Satellite Data and Information

Data Sets

- EOP-1 Satellite Data Sets
- NASA/GMAO GRADS/DODS ISCCP Surface T and Cloud Amount for CEOP EOP1

Information

- CEOP Satellite Data Source Agency Links

Model Output and Information

Data Policies

- Final DRAFT CEOP Reference Sites Data Release Guidelines

- BALTEX
- CAMP
- CATCH
- GAPP
- LBA
- MAGS

Data Standards Information

- Assistance for Land-surface Modelling activities (ALMA)
- Atmospheric Model Intercomparison Project (AMIP)
- ISO/TC 211

Documents

- CEOP Implementation Plan
- Report from the 2nd CEOP Implementation Planning Meeting (DRAFT - 8 July 2003)
- WESP Major Activities Plan (1 June 2003)
- CEOP Reference Site Station Characteristics Questionnaire
- Establishment of a Global Hydrological Observation Network for Climate" GCOS/GTOS/HWRP Meeting Report (June 2000)

Other Links

- CEOP Home Page
- WCRP Home Page
- GEWEX Home Page
- CLIVAR Home Page
- CLiC Home Page
- ACSYS Home Page
- Global Modeling and Assimilation Office (NASA/GSFC)
- Land Information System (NASA/GSFC)
- Model Parameter Estimation Experiment (MOPEX)
- NASA/Goddard Institute for Space Studies (GISS) Data

CEOP EOP-3 Reference Site Data Sets

To order individual data sets click on the appropriate "X" below

Data sets that cover the complete EOP-3 period are signified by the full moon icon: .

Last Updated 25 February 2005.

CSE	Reference Site Name	Surface Meteorological and Radiation	Meteorological Tower	Soil Temperature and Soil Moisture	Flux	Soundings (Raw Format)
BALTEX	Cabauw	X (01 Oct 2004)	X (01 Oct 2004)	X (01 Oct 2004)	X (23 Apr 2004)	X (19 Oct 2004)
	Lindenberg	X (07 May 2004)	X (07 May 2004)	X (07 May 2004)	X (07 May 2004)	X (30 Sep 2004)
	Norunda					
	Sodanklya	X (22 Oct 2004)				
CAMP	Chao-Phraya River	X (30 Sep 2004)	X (30 Sep 2004)	X (23 Sep 2004)	X (23 Sep 2004)	
	Equatorial Island	X (05 Mar 2004)				X (02 Mar 2004)
	Himalayas	X (23 Apr 2004)		X (23 Apr 2004)	X (23 Apr 2004)	
	Korean Haenam	X (23 Sep 2004)		X (23 Sep 2004)		
	Korean Peninsula					
	Mongolia	X (23 Jan 2004)		Reprocessing (25 Feb) NEW	X (23 Jan 2004)	
	Northeast Thailand	X (19 Sep 2004)	X (30 Sep 2004)	X (19 Sep 2004)	X (30 Sep 2004)	
	Northern South China Sea					X (02 Mar 2004)

CEOP Metadata Design Meeting

University of Tokyo, 1-2 November 2004

Metadata design for integrating CEOP satellite imagery, reference site data and simulation result data

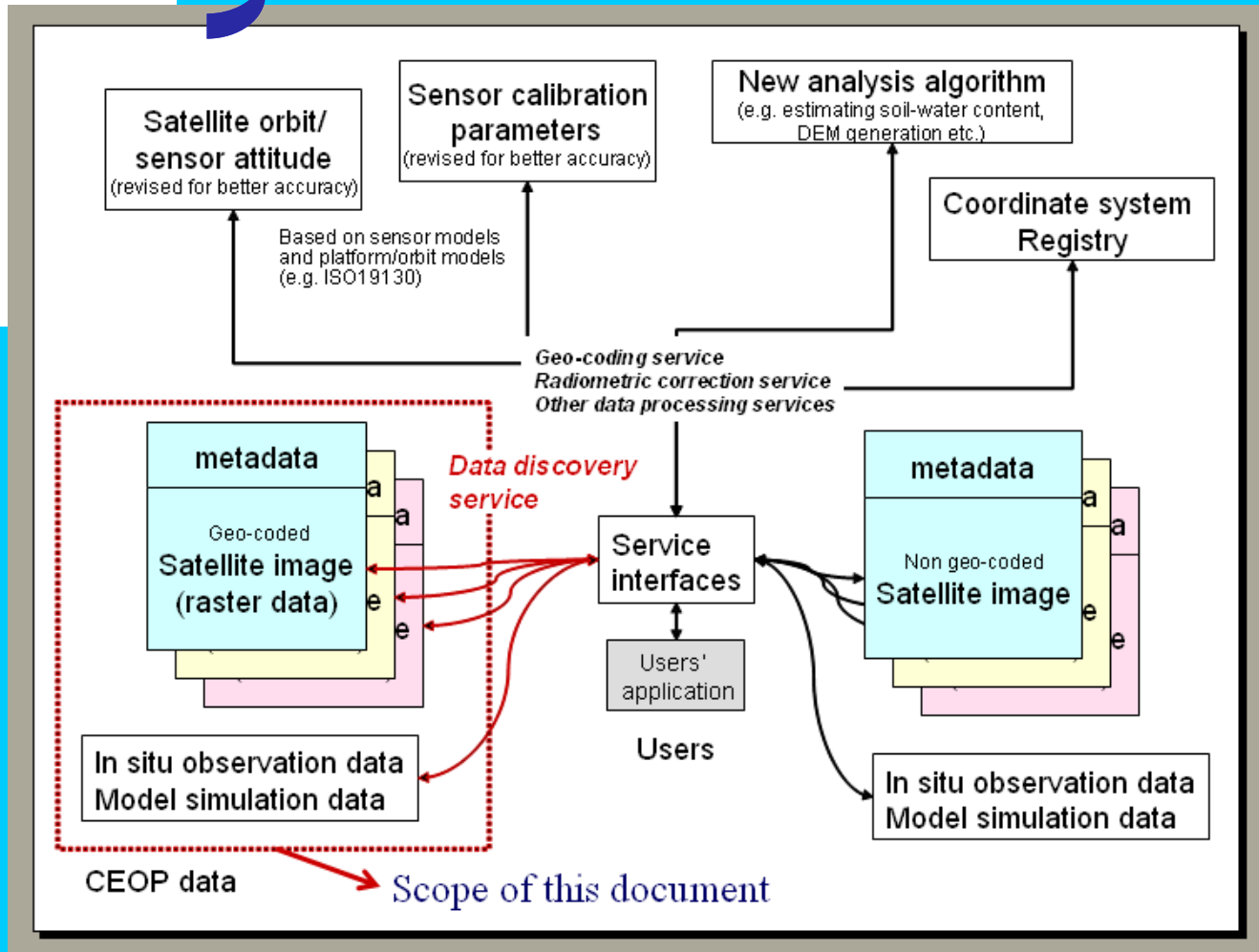
Version 1.0

Shibasaki Group
For "Koike global water informatics" project

October 30, 2004

Center for Spatial Information Science
The University of Tokyo
4-6-1 Komaba, Meguro-ku, Tokyo 153-8505, Japan
Tel: +81-3-5452-6412
Fax: +81-3-5452-6414
http://shiba.iis.u-tokyo.ac.jp

- Based on ISO 19115 Metadata Standards
- Design for *Finding* and *Integrating* data



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Some Research Activities

at

BALTEX CEOP Reference Sites

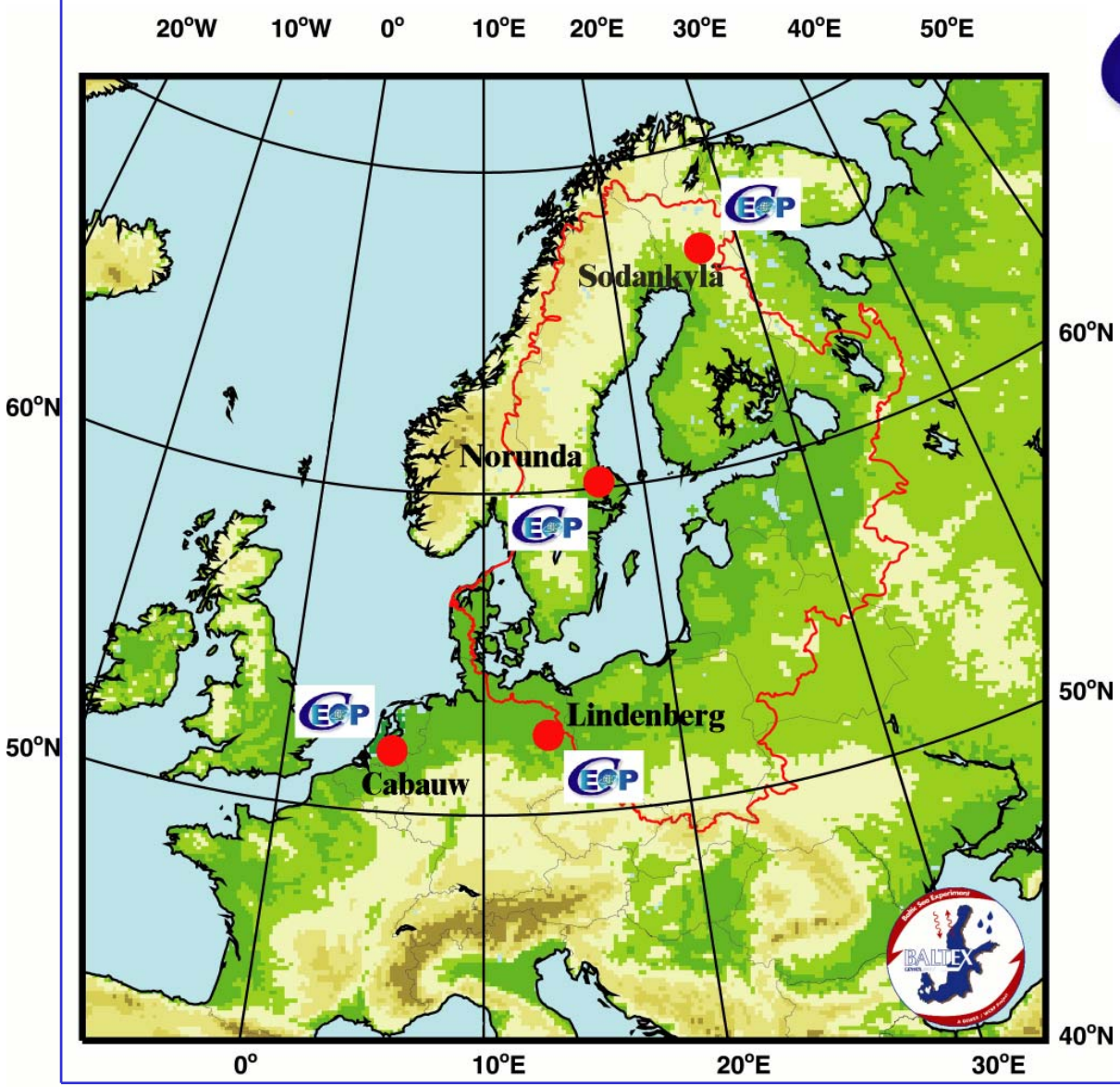
Hans-Jörg Isemer
(International BALTEX Secretariat; GKSS; Germany)

for

Frank Beyrich (DWD, Germany)
Fred Bosveld (KNMI, The Netherlands)
Anders Lindroth (Lund University, Sweden)
Tarja Savunen (FMI, Finland)

and many collaborators

BALTEX Reference Sites for CEOP



Sodankylä (FMI)
67.4N/26.7E
T. Savunen

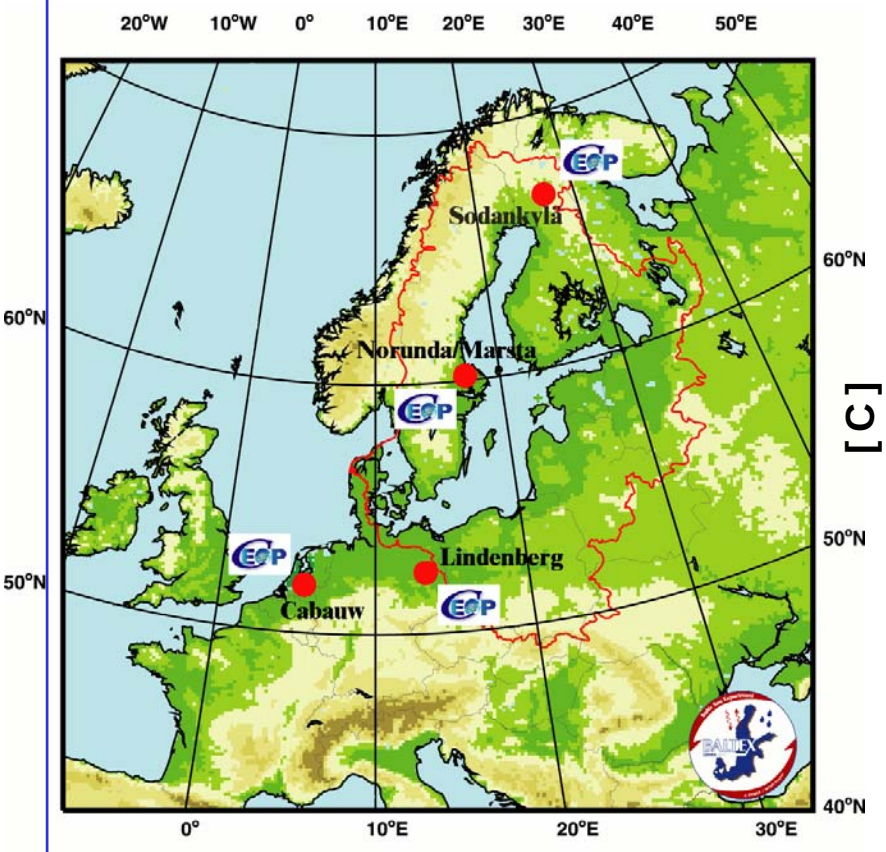
Norunda
(Lund University)
60.1N/17.5E
A. Lindroth

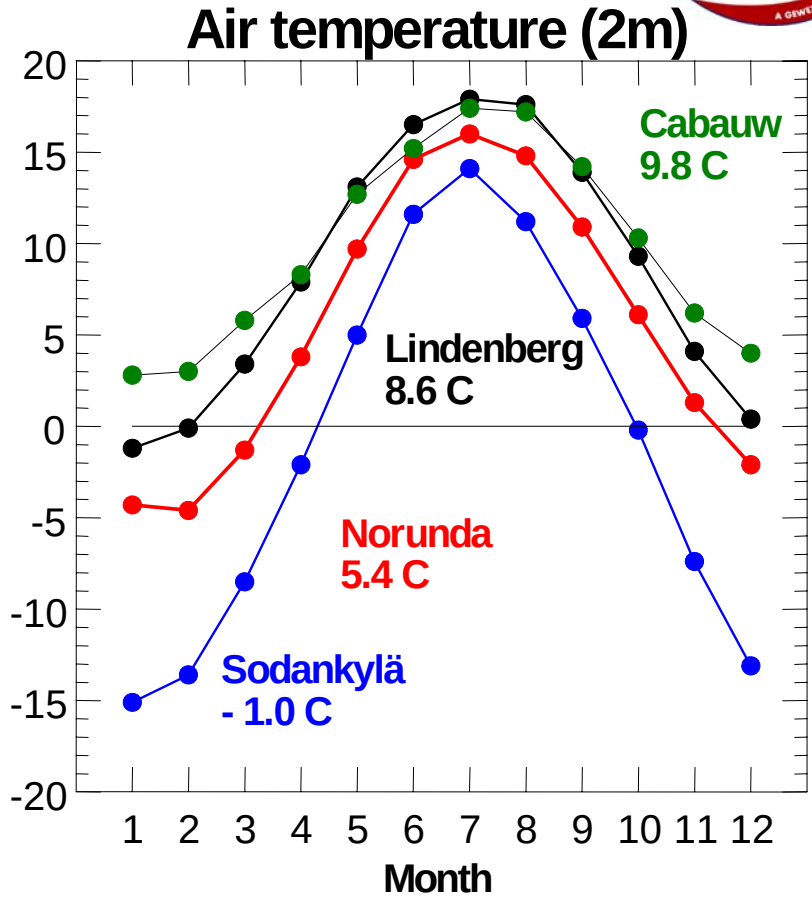
Lindenberg (DWD)
52.2N/14.1E
F. Beyrich

Cabauw (KNMI)
52.1N/5.2E
F. Bosveld

Hans-Jörg Isemer, IBS, *isemer@gkss.de*

BALTEX Reference Sites for CEOP





Hans-Jörg Isemer, IBS, *isemer@gkss.de*

Sodankylä, FMI, Finland

The Surface Energy Budget

The Stable ABL

The Structure of Turbulence

Arctic Wind Energy

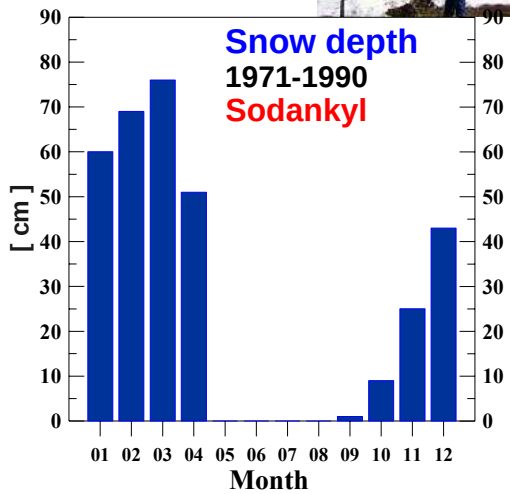
Icing

Ice-free Sensors

Model Validation / Verification

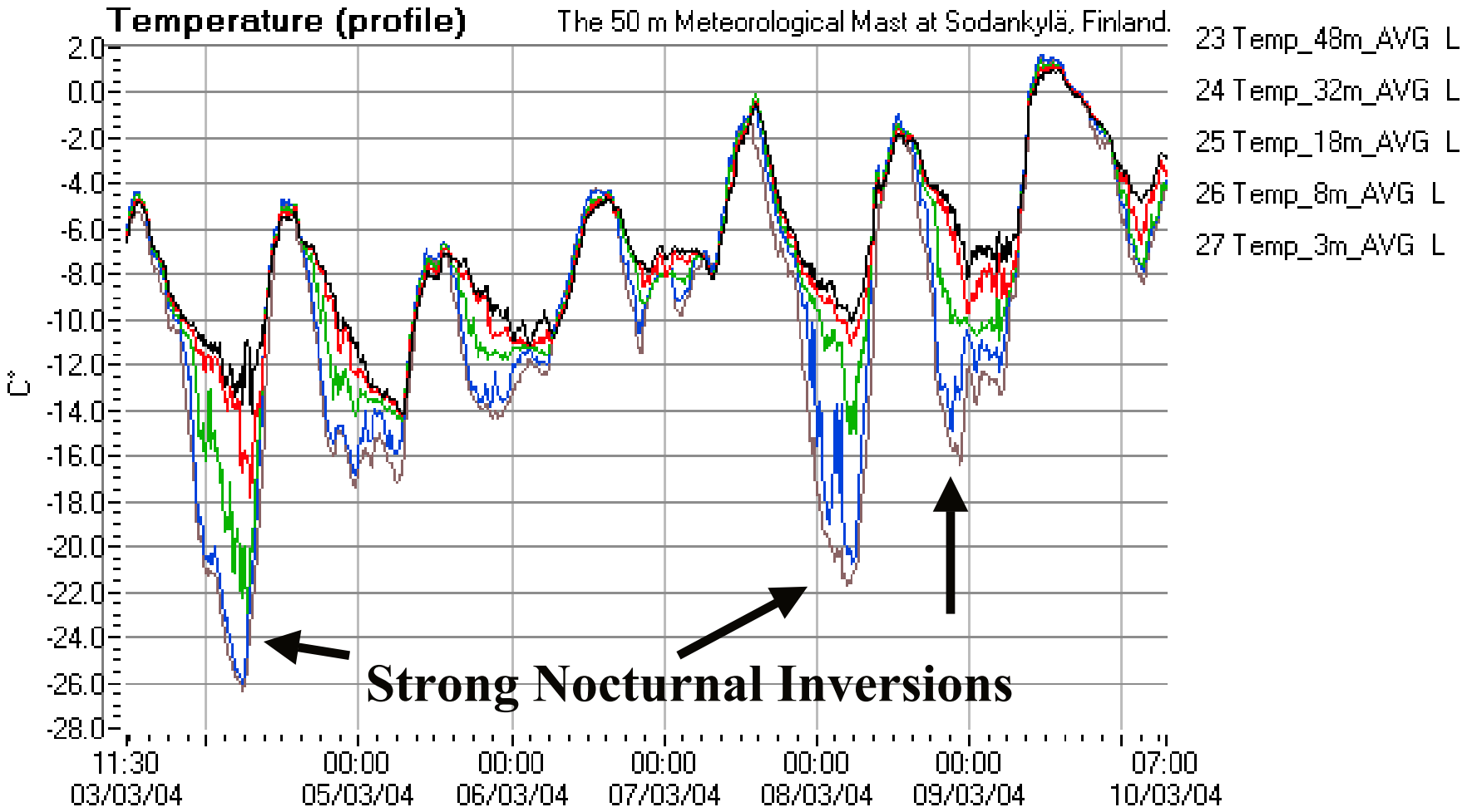
Tarja Savunen, Ivan Mammarella,
Bengt Tammelin, Erik Gregow
and many others

Finnish Meteorological Institute



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Sodankylä



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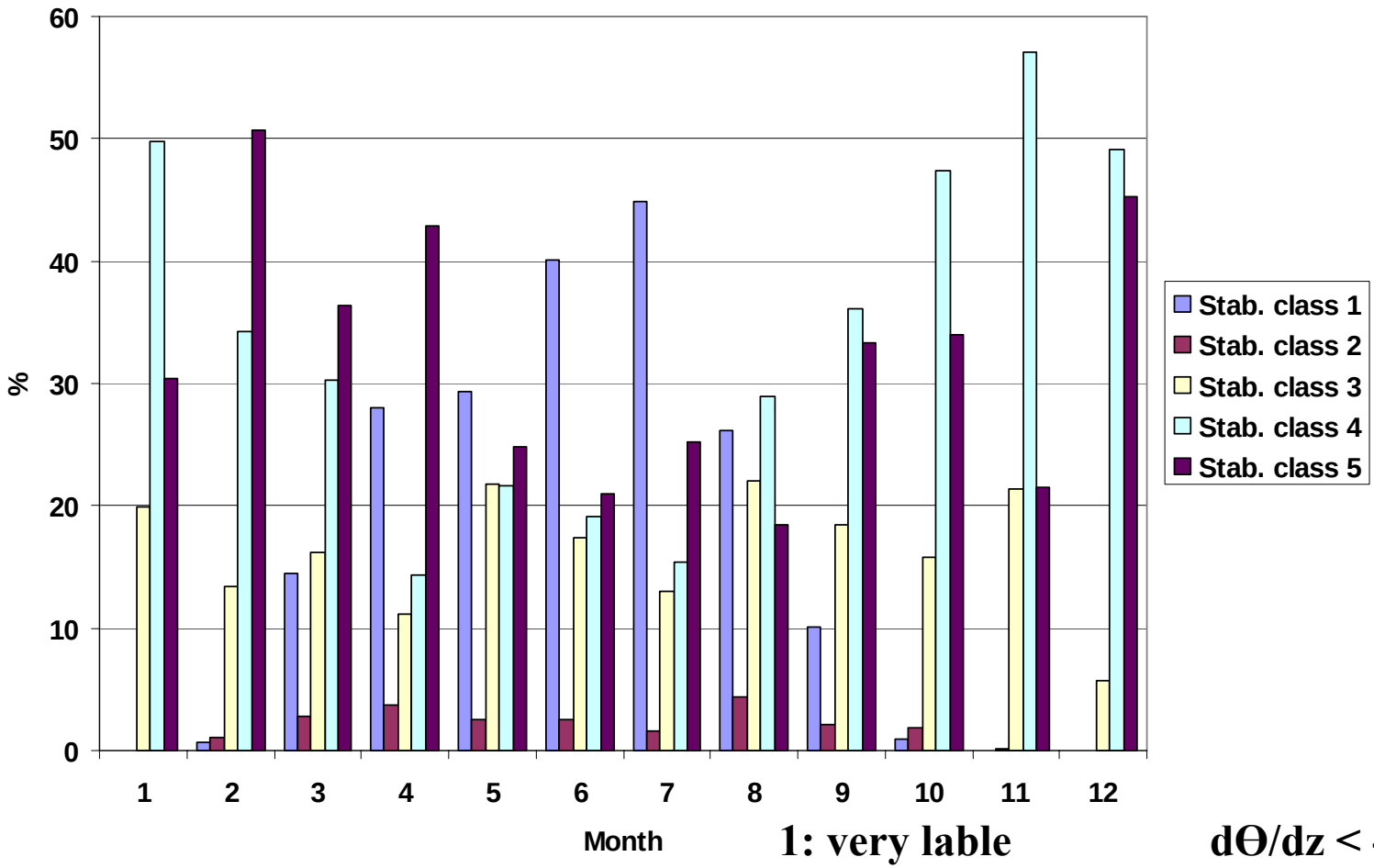
FINNISH METEOROLOGICAL INSTITUTE

Sodankylä: Annual Cycle of Stability Classes

Pasquill-stability

32-3 m



1: very lable $d\Theta/dz < -7^\circ C/km$

2: lable $-7^\circ C < d\Theta/dz < -5^\circ C$

3: neutral $-5^\circ C < d\Theta/dz < 5^\circ C$

4: stable $5^\circ C < d\Theta/dz < 25^\circ C$

5: very stable $d\Theta/dz > 25^\circ C/km$

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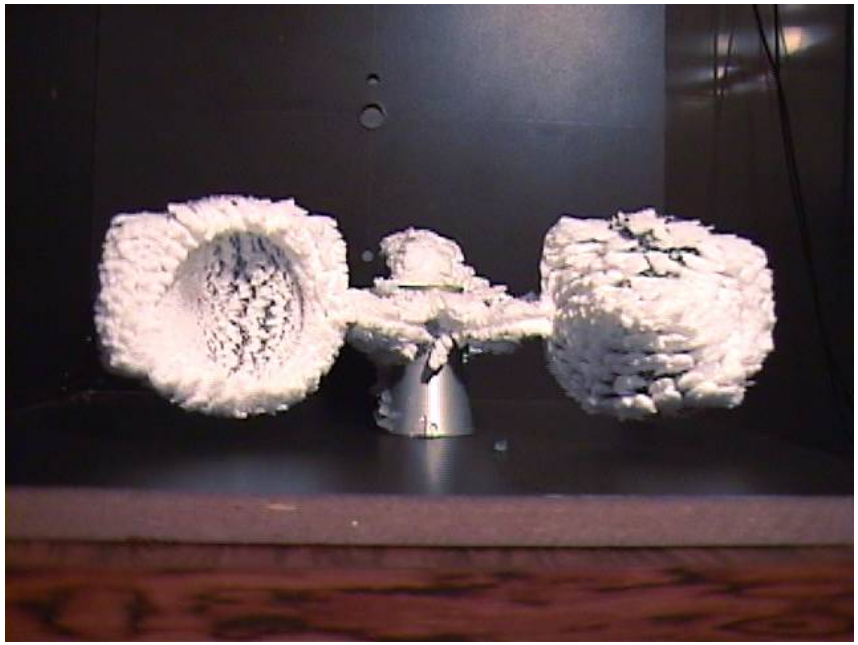
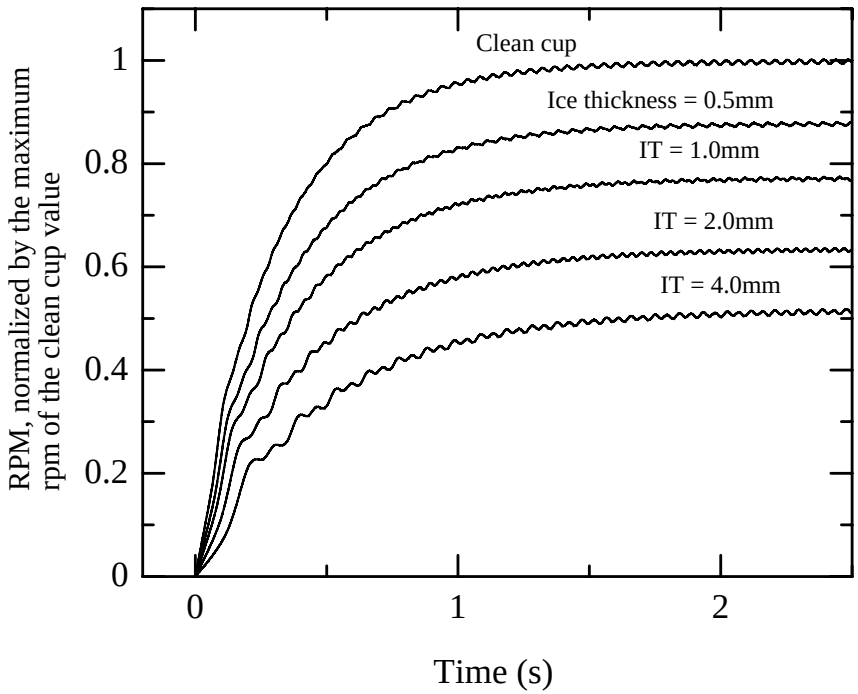
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Sodankylä/Luosto: Icing Test Site

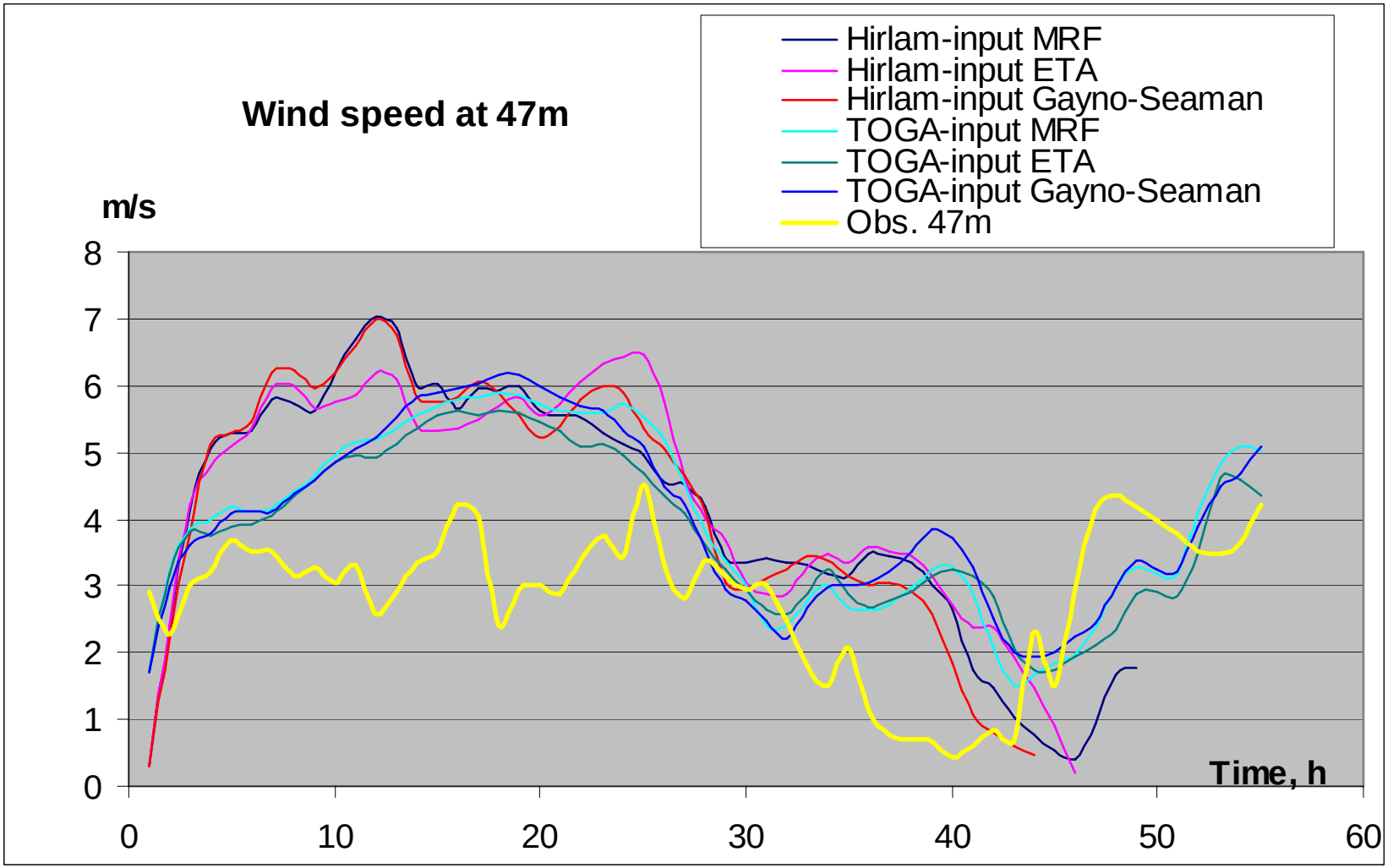
ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE

Sodankylä, FMI:
Impact of icing upon cups on the accuracy and response of a anemometer



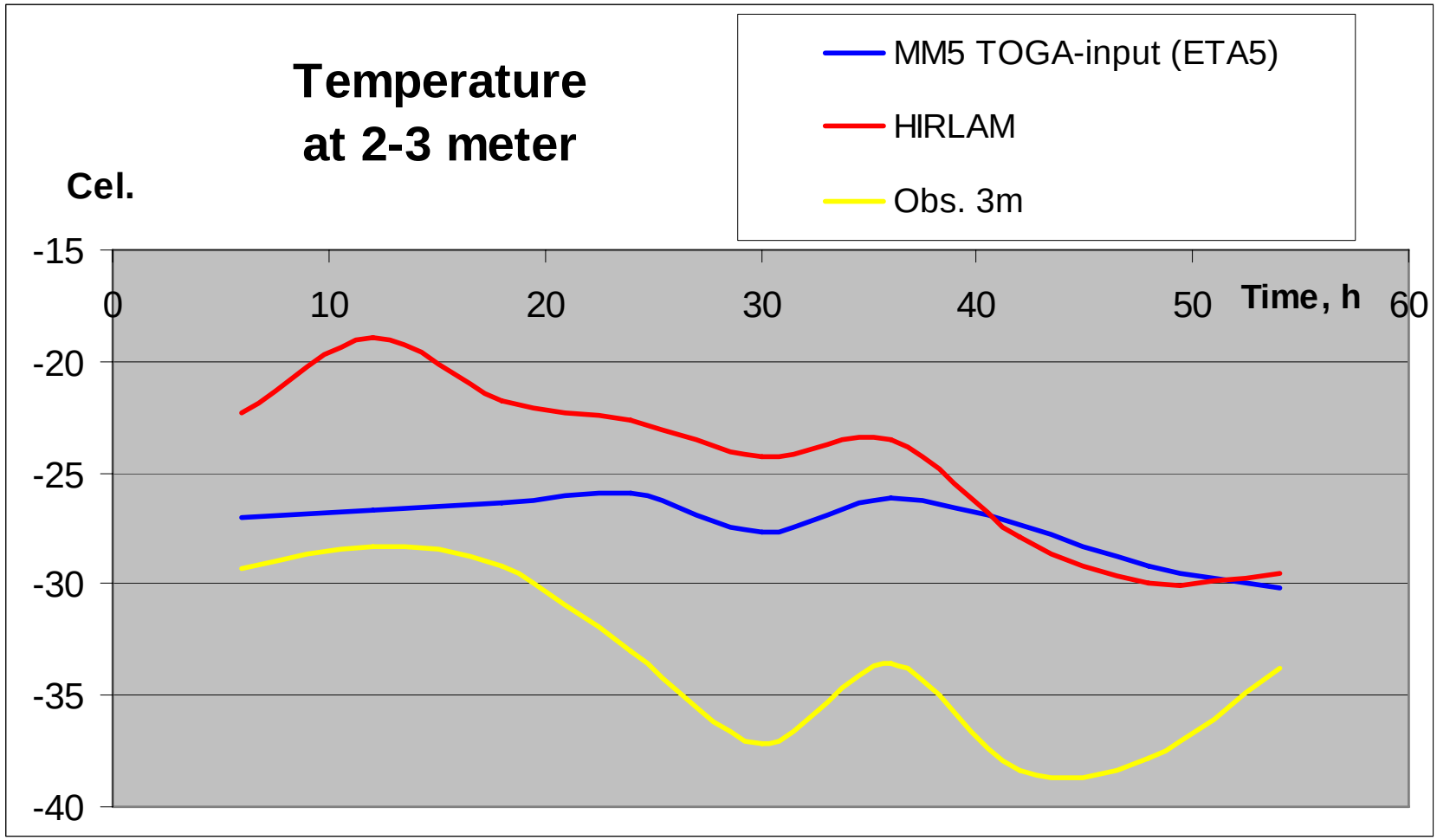


MM5-simulations vs Sodankylä mast observations



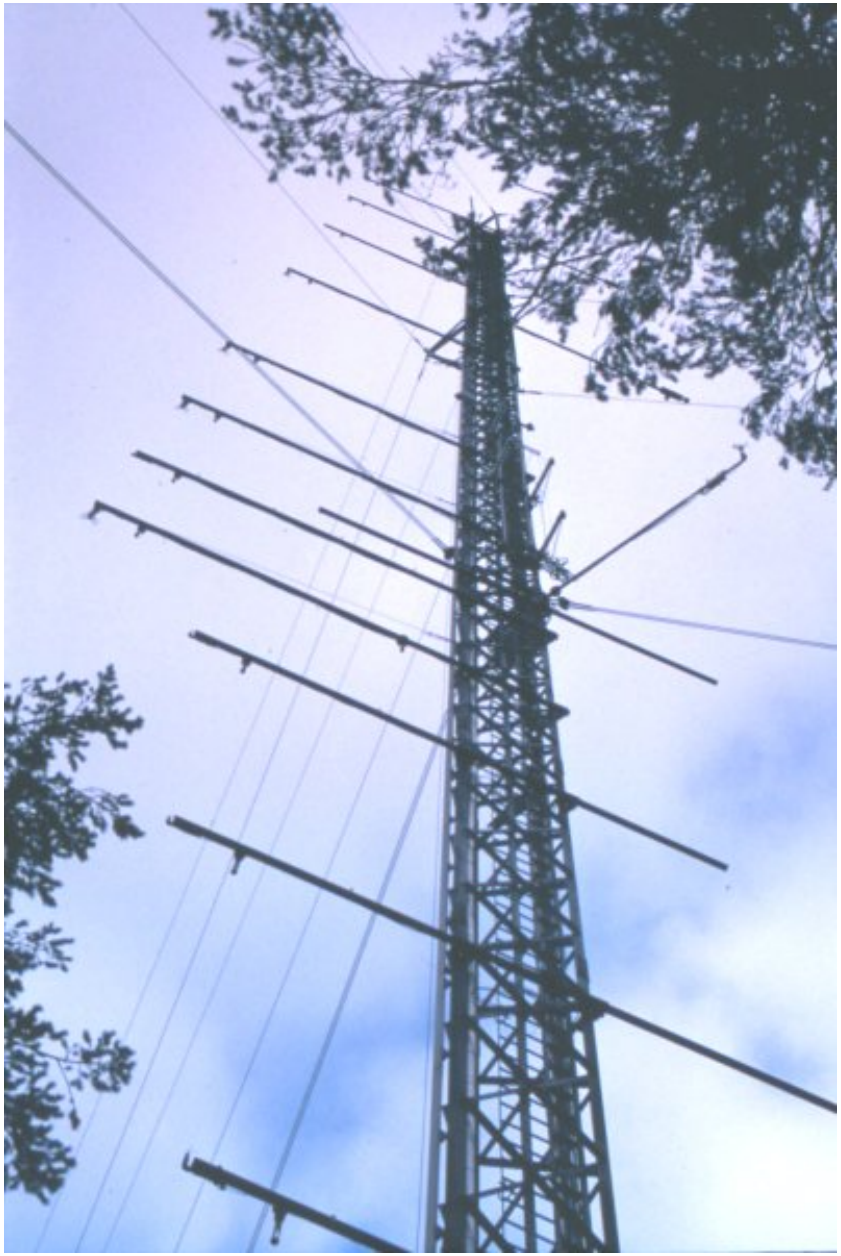
Max bias; 2,5 m/s

MM5 vs HIRLAM observations from Sodankylä mast.
Temperature at 2-3 meters.



Norunda:

*Focus on long-term **observations** of energy fluxes in a mixed pine/spruce forest in Central Sweden*



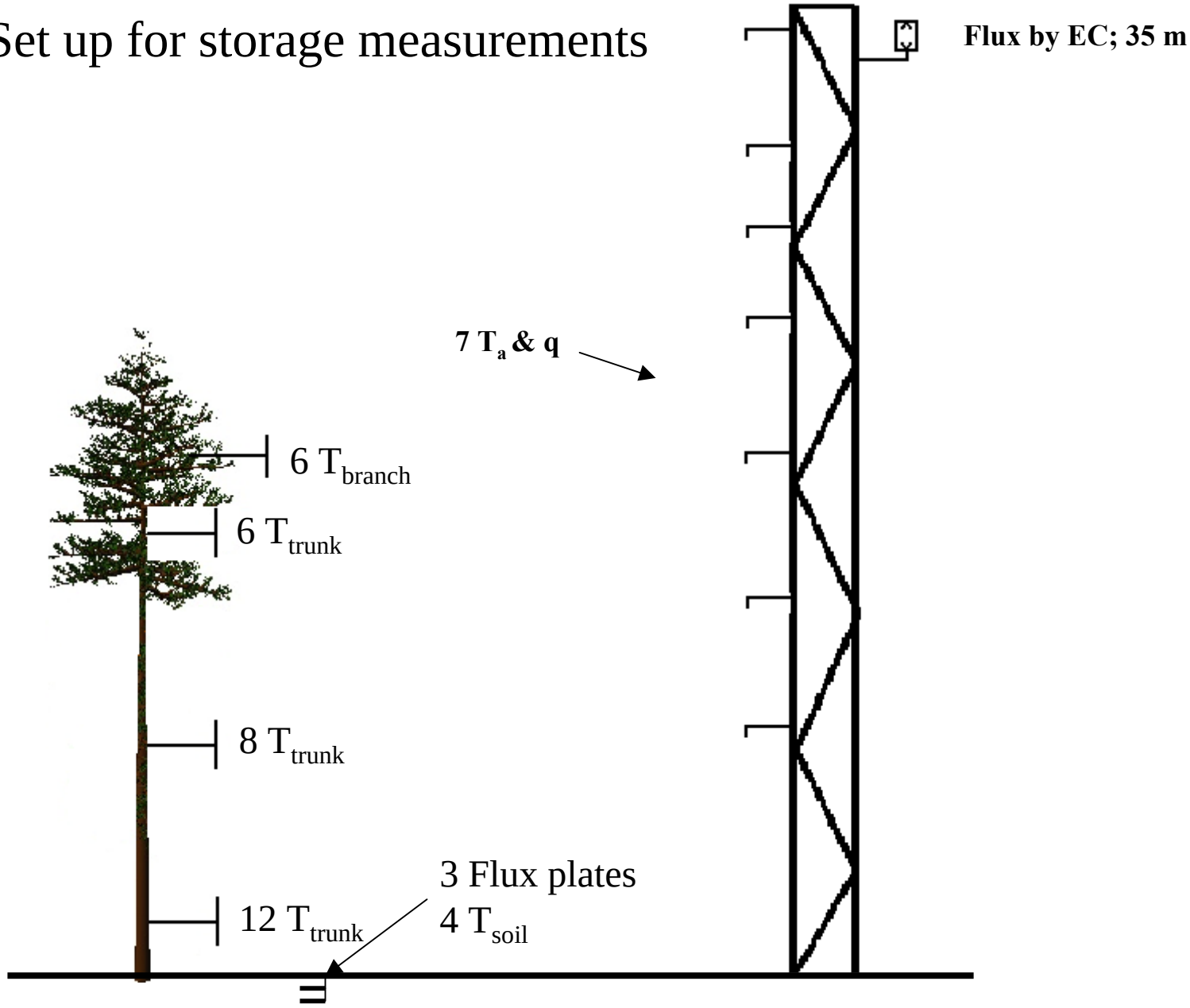
The **Norunda** site

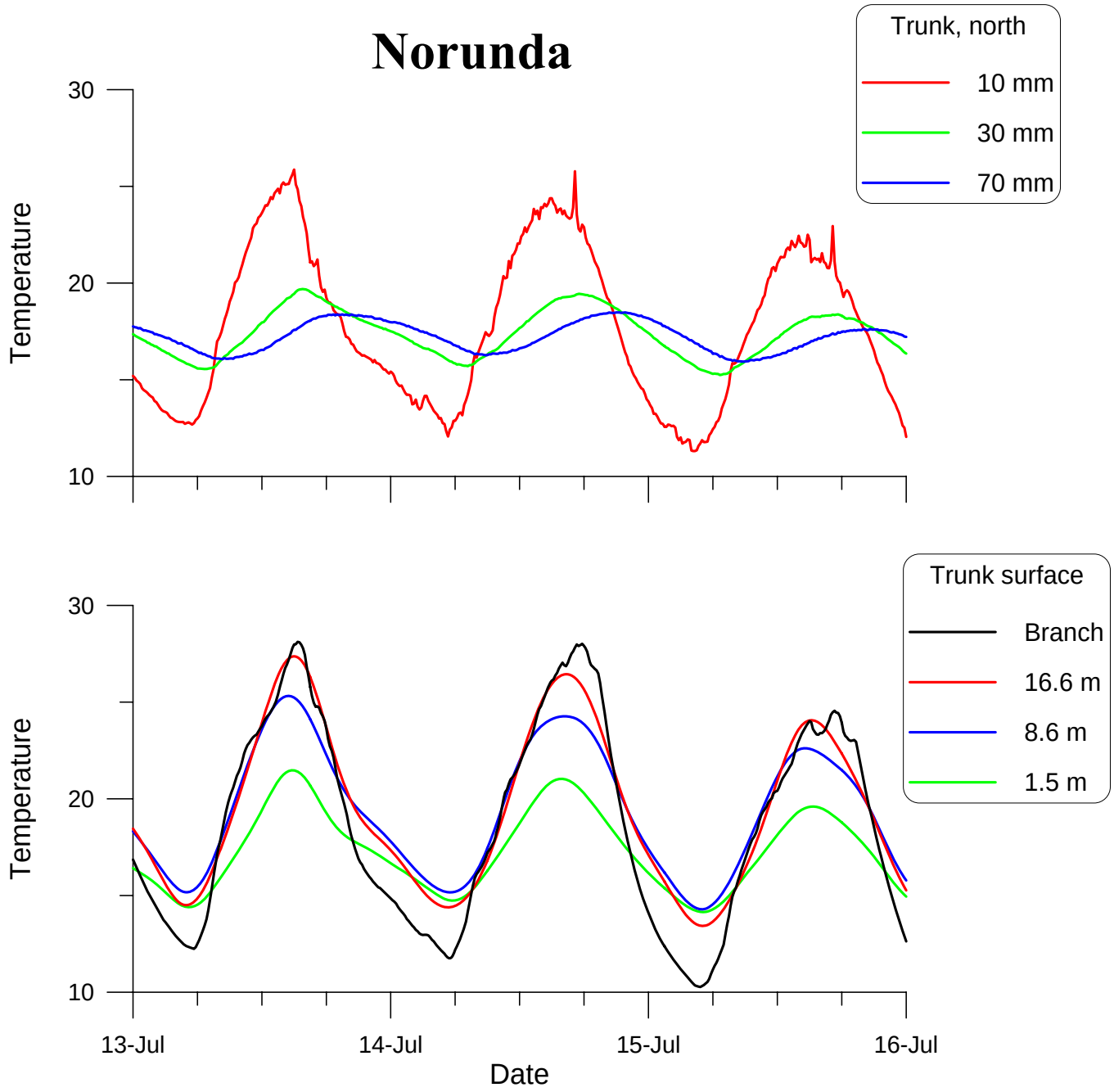
- Location; 60°5’ N, 17°29’ E, alt. 45 m
- ca. 100 years old stand on glacial till soil
- LAI about 4-5
- Twelve levels of u, T, CO_2 and H_2O above ground
- Three levels of flux measurements above canopy
- Two levels of radiation measurements above canopy
- Biomass & soil temperatures

Norunda:

Surface Energy Balance of Boreal Forests: Dependency on Season, Weather and Soil Moisture

Norunda: Set up for storage measurements




Norunda
Trunk, north
10 mm
30 mm
70 mm
Temperature
30
20
10
Trunk surface
Branch
16.6 m
8.6 m
1.5 m
Temperature
30
20
10
13-Jul
14-Jul
15-Jul
16-Jul
Date

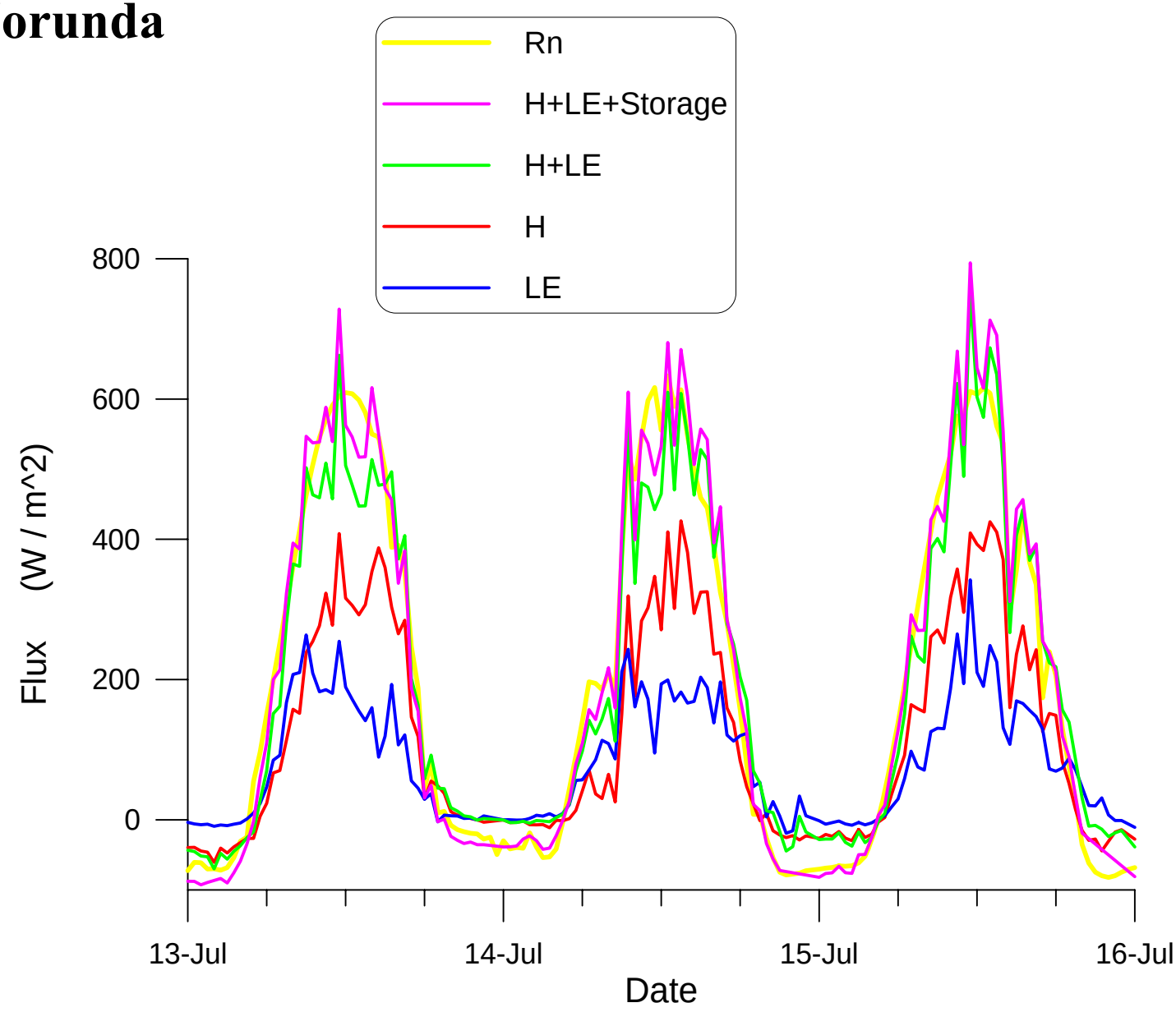
Norunda

Surface Energy Balance of Boreal Forests: Dependency on Season, Weather and Soil Moisture

Some conclusions

- Storage in biomass and stand air is highly significant in the surface energy balance
- Inclusion of storage improves closure significantly and particularly during night-time
- The good closure at night is strong evidence that EC measurements are valid also during stable night-time conditions

Norunda


Rn
H+LE+Storage
H+LE
H
LE
800
600
400
200
0
Flux (W / m^2)
13-Jul
14-Jul
15-Jul
16-Jul
Date

Cabauw, KNMI, The Netherlands

The Surface Energy Budget

Clouds (CliwaNet)

Stable Boundary Layer Classifications (Contribution to GABLS)

Hydrology Programme

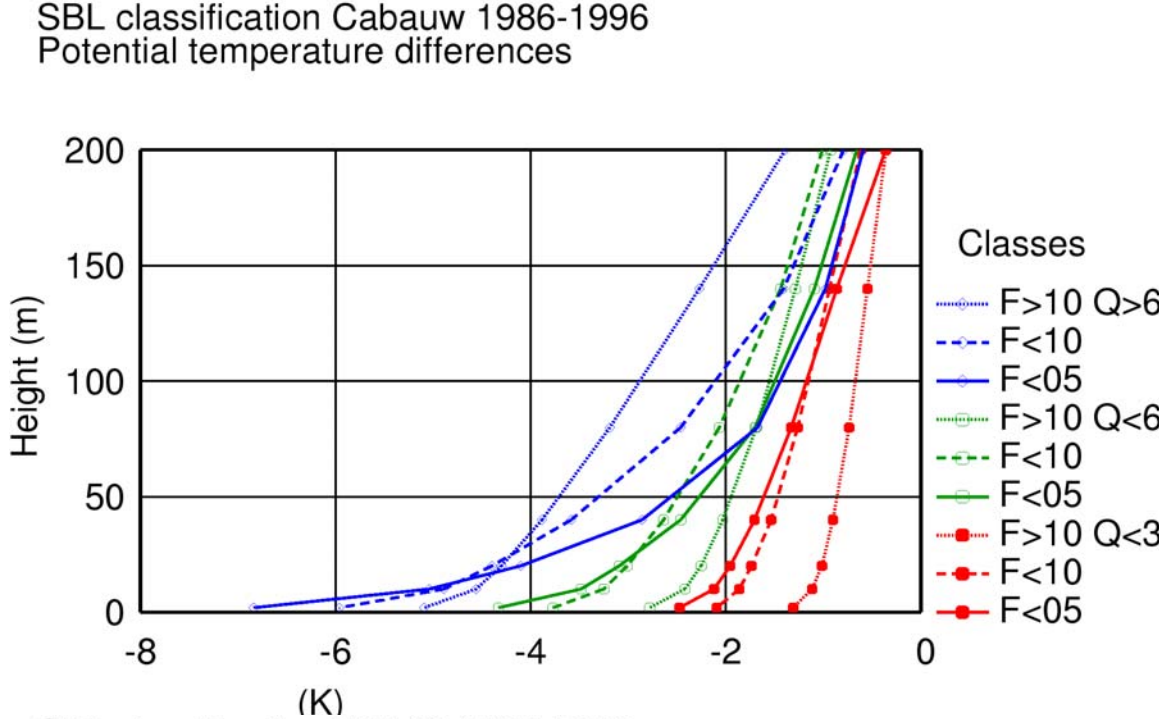
Grassland landscape with ditches

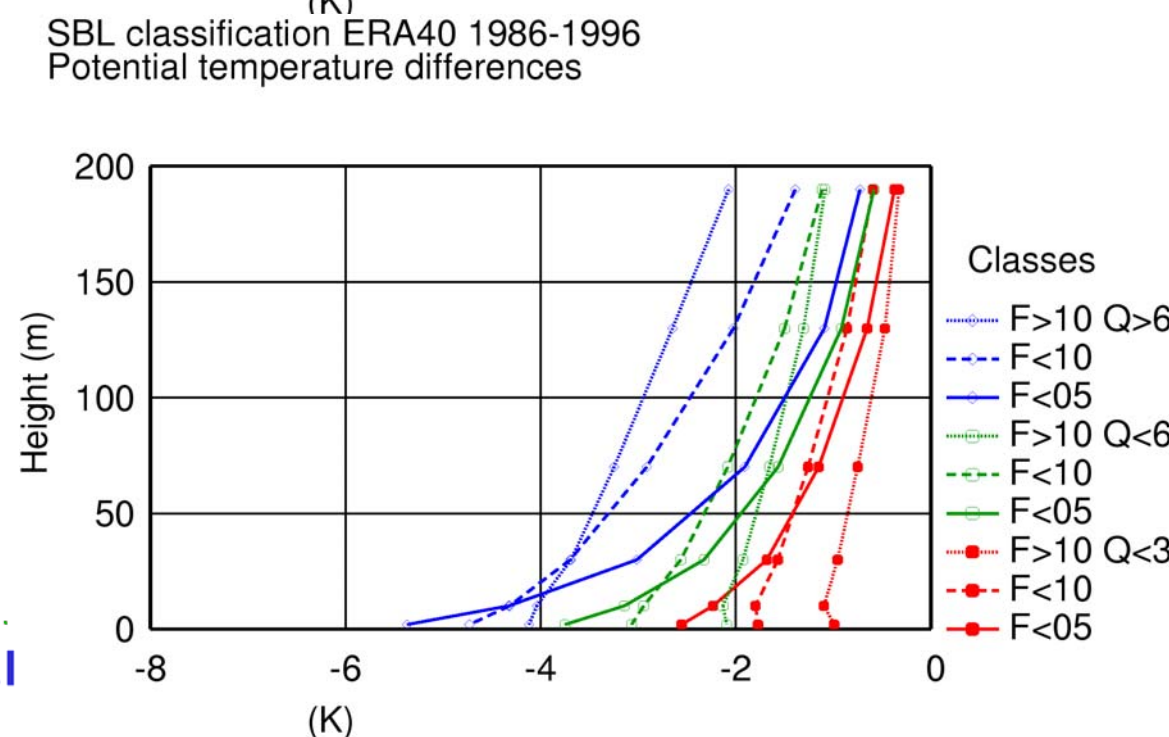
Potential temperature

Relative to 200m potential temperature at sunset

Observed potential temperature profiles are quite well reproduced by the model (ERA40).

But for the most extreme classes with low wind and high cooling the model overestimate surface temperature by approximately 2 K.





KNMI

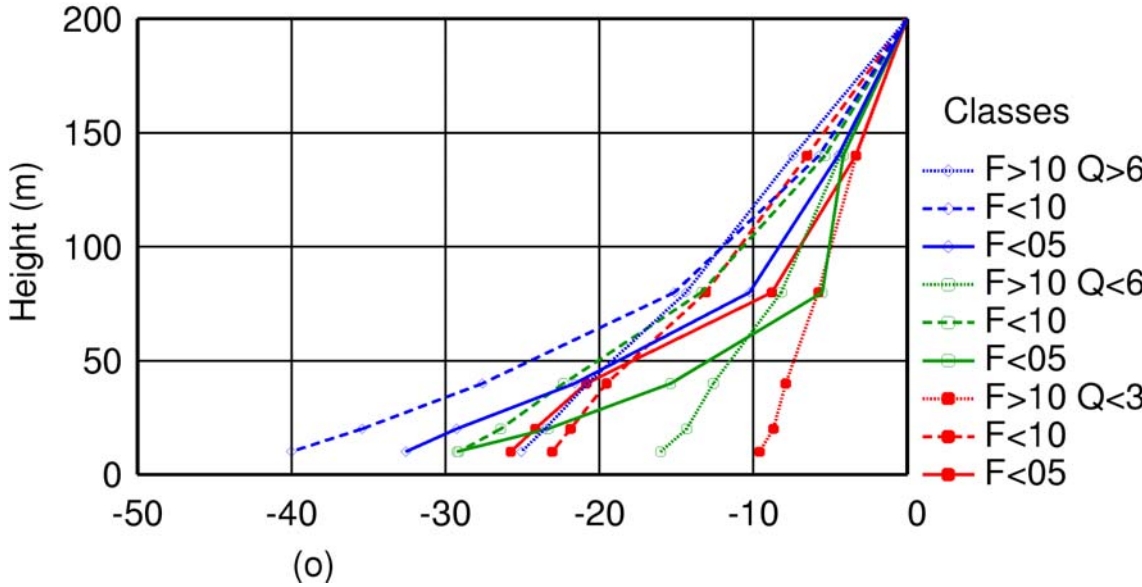
Wind direction

Relative to 200m wind direction

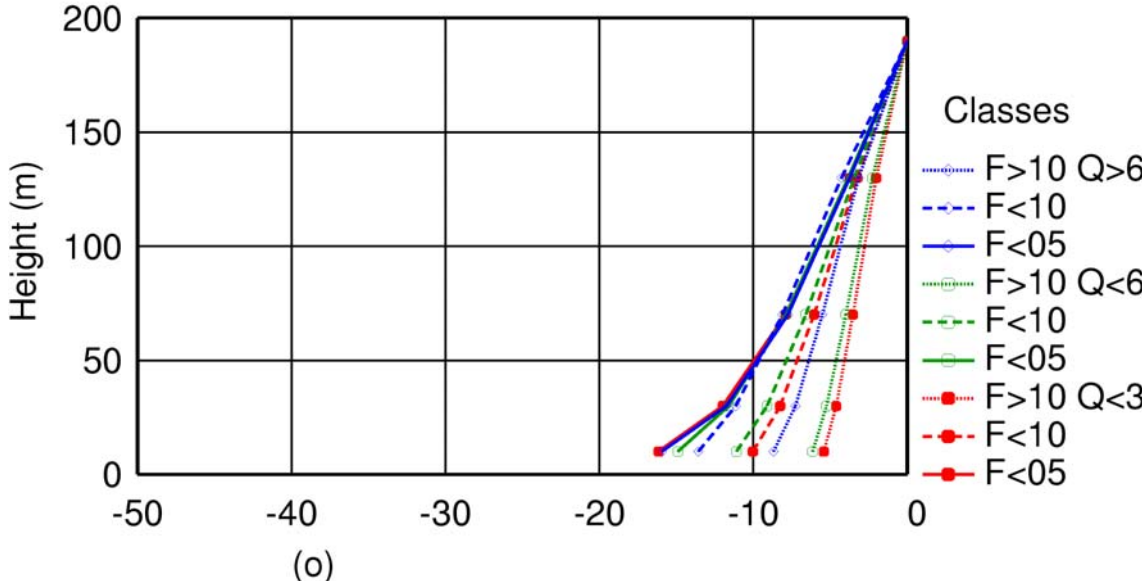
Observed large wind veering with height is not reproduced by the model (ERA40)

KNMI

SBL classification Cabauw 1986-1996
Wind direction differences



SBL classification ERA40 1986-1996
Wind direction difference



Water budget observations

Goal:

Monitoring of the water budget at the local (0.5 km^2) and regional catchment (30 km^2) scale

Observations:

- Rain amount (gauges, rain radar)
- Evapo-transpiration (turbulence,scintillometry)
- Soilwater storage (water table, TDR)
- Discharge and water supply

CABAUW is now a BSRN Station

CEOP Reference Site Lindenberg - Status Report

The Surface Energy Budget

Regional Heterogeneity

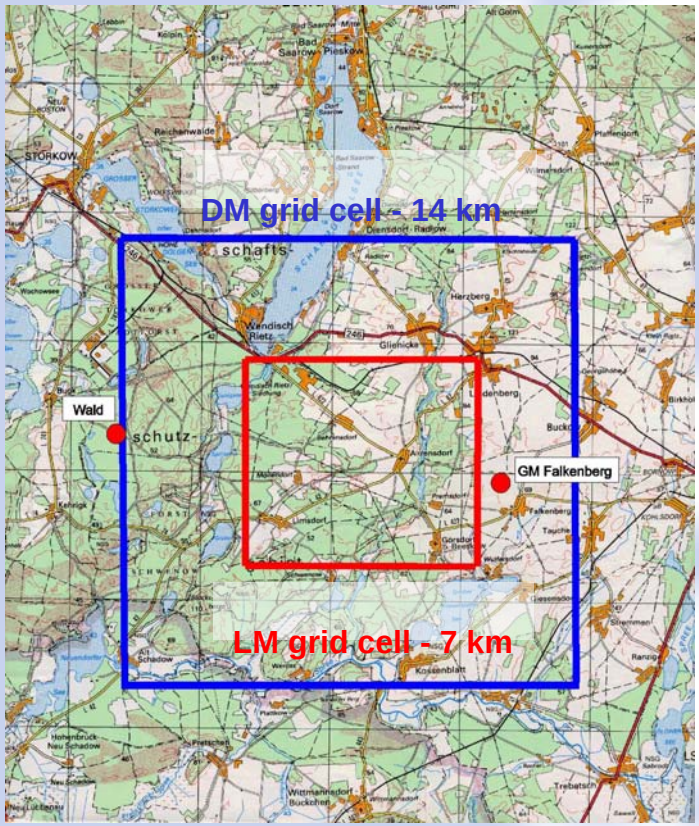
The Stable ABL (GABLS)

Humidity Structure of the ABL

Model Validation / Verification

Monitoring the Troposheric Column

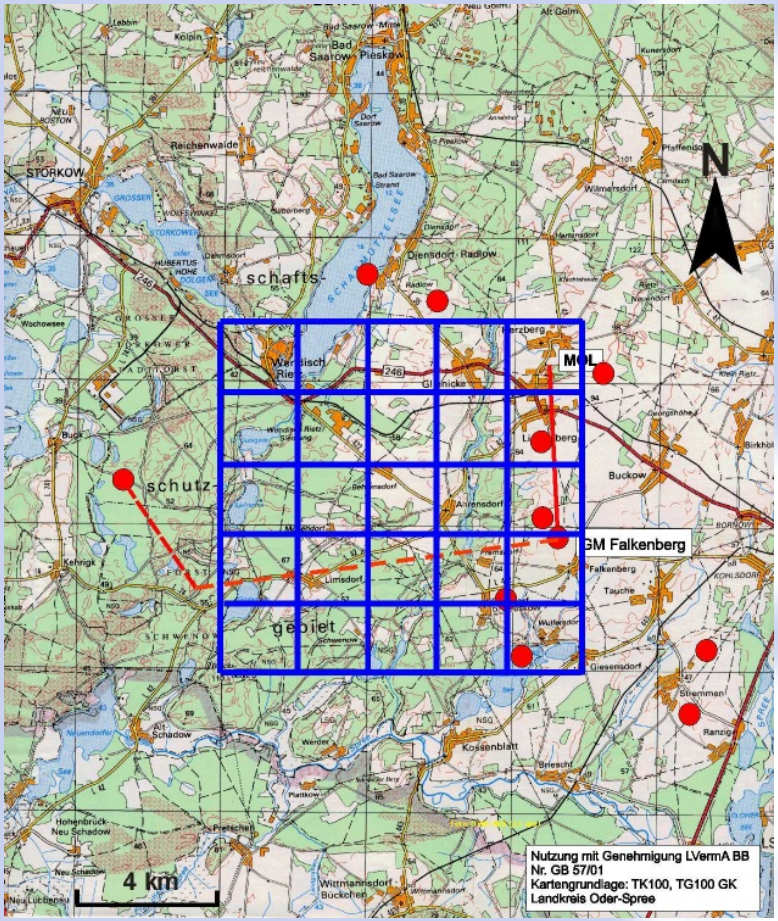
Heterogeneous landscape around Lindenberg



~ 45 % agriculture
~ 43 % forest
~ 7 % water

Boundary layer field site at Falkenberg (standard CEOP dataset) represents grassland / agriculture

Measurements are also performed at a forest site



LITFASS - 2003
Experimental Setup

Flux measurements at different scales

- **13 micrometeorological stations**
- **three large aperture scintillometers**
- **lidar / RASS and lidar / lidar combination at GM Falkenberg**
- **more then 60 flight hours with turbulence sonde Helipod**

LITFASS-2003 Measurement Program - Micrometeorology

Measurements of energy budget components over major land use types

13 Sites

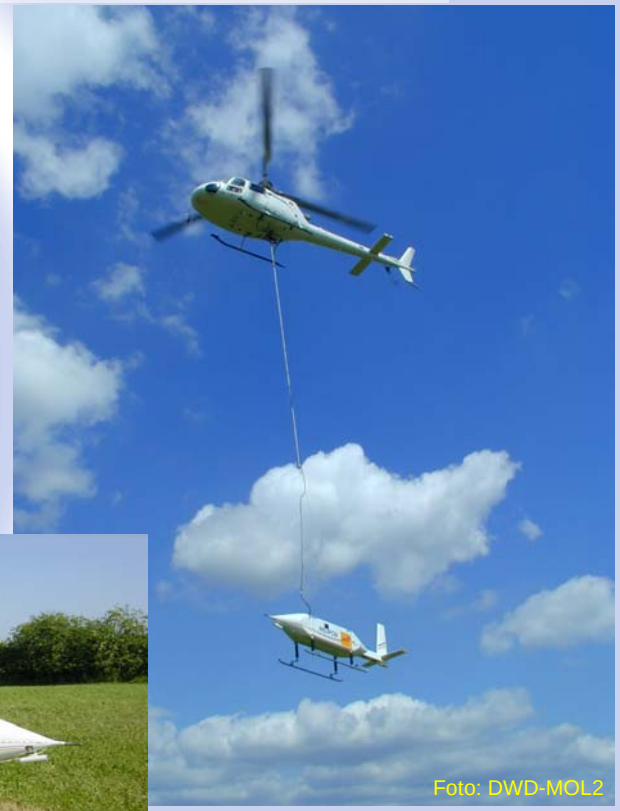
LITFASS-2003 Measurement Program - The Helipod

Helicopter borne turbulence probe Helipod

→ temperature, humidity, wind

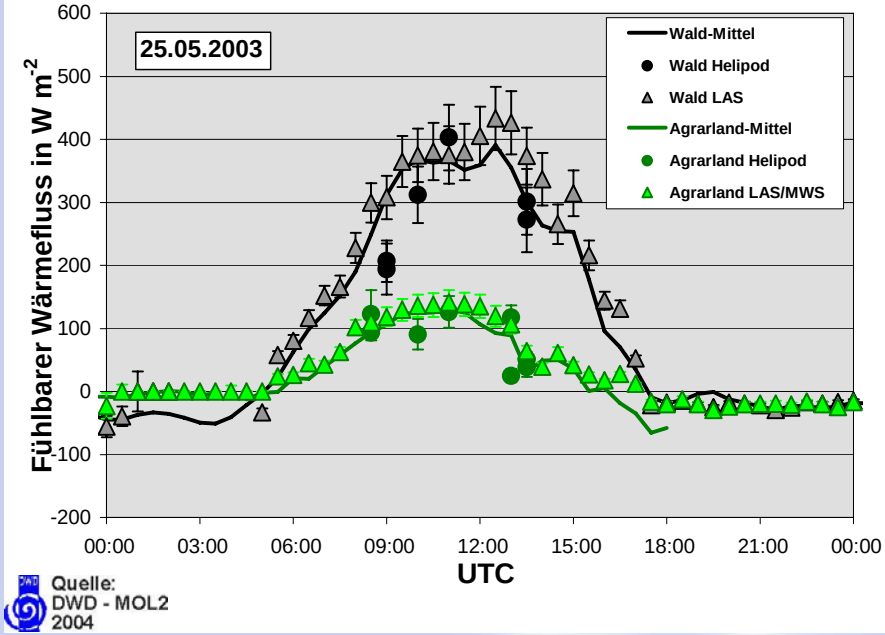
time resolution: 0.01 s

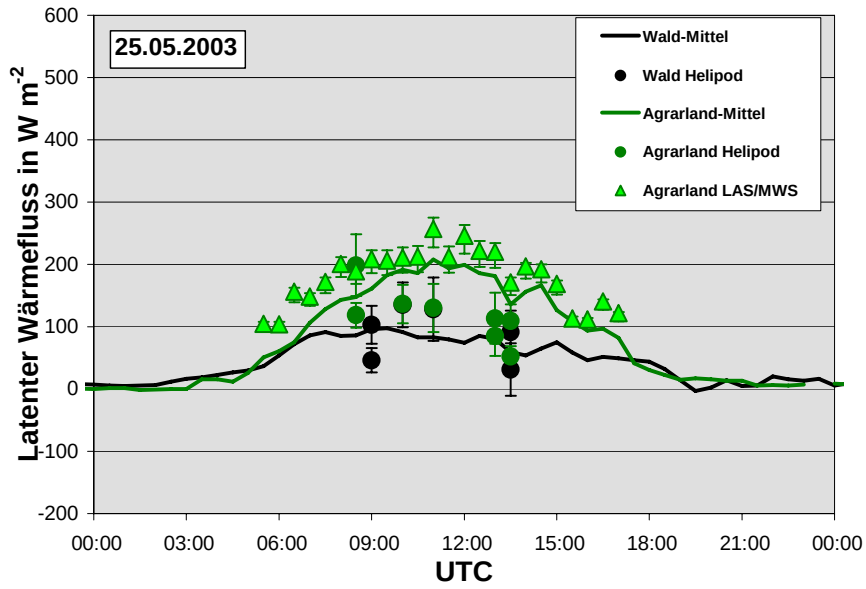
→ turbulent fluxes of momentum, heat, and water vapour over flight legs of ~ 10 km length



27 flights = 65 flight hours

LITFASS-2003: Diurnal cycle of H and LE over farmland / forest from micrometeorological, scintillometer and Helipod measurements

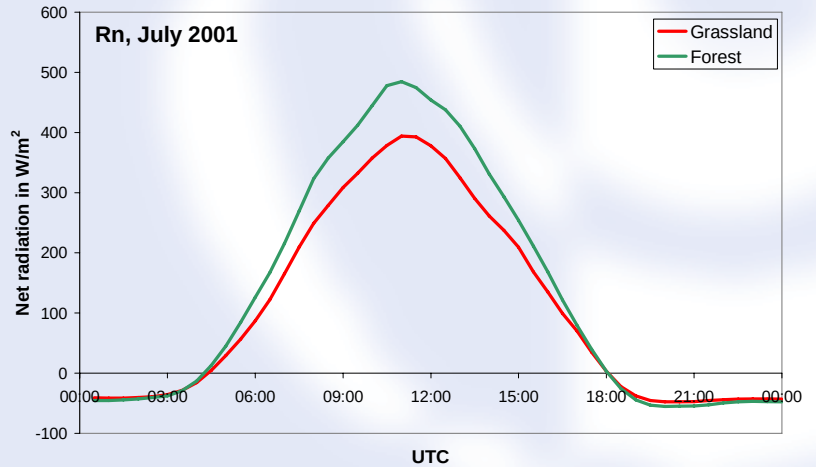


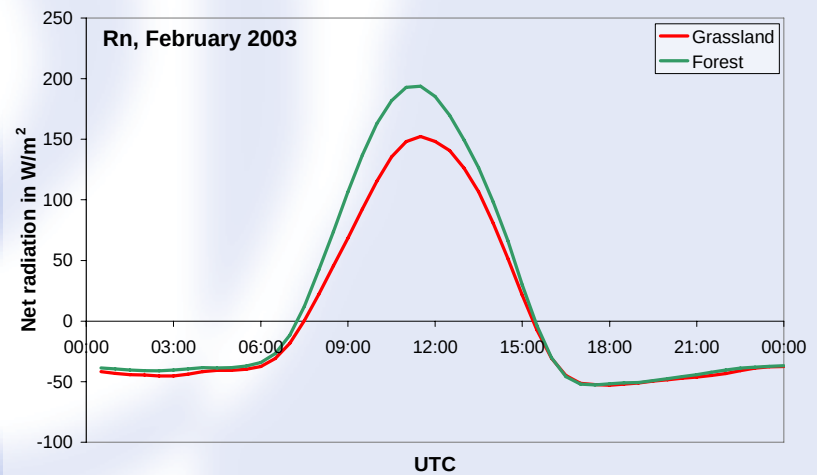


Using data from DWD, GKSS, TUDD, TUBS, UBT, KNMI, WAU, UBern

Differences forest - grassland (III): Net radiation

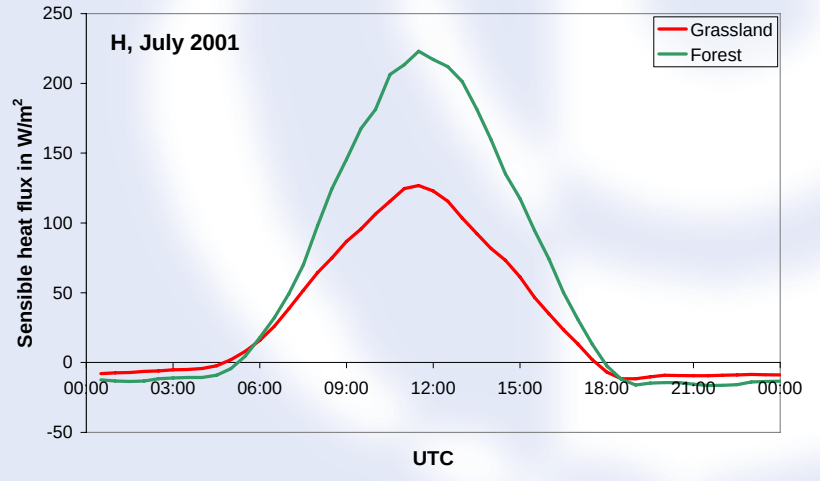
... up to 25 %

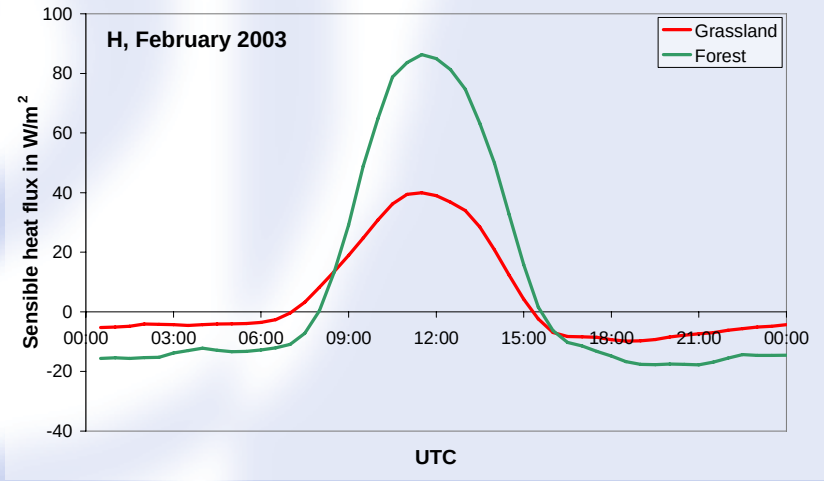




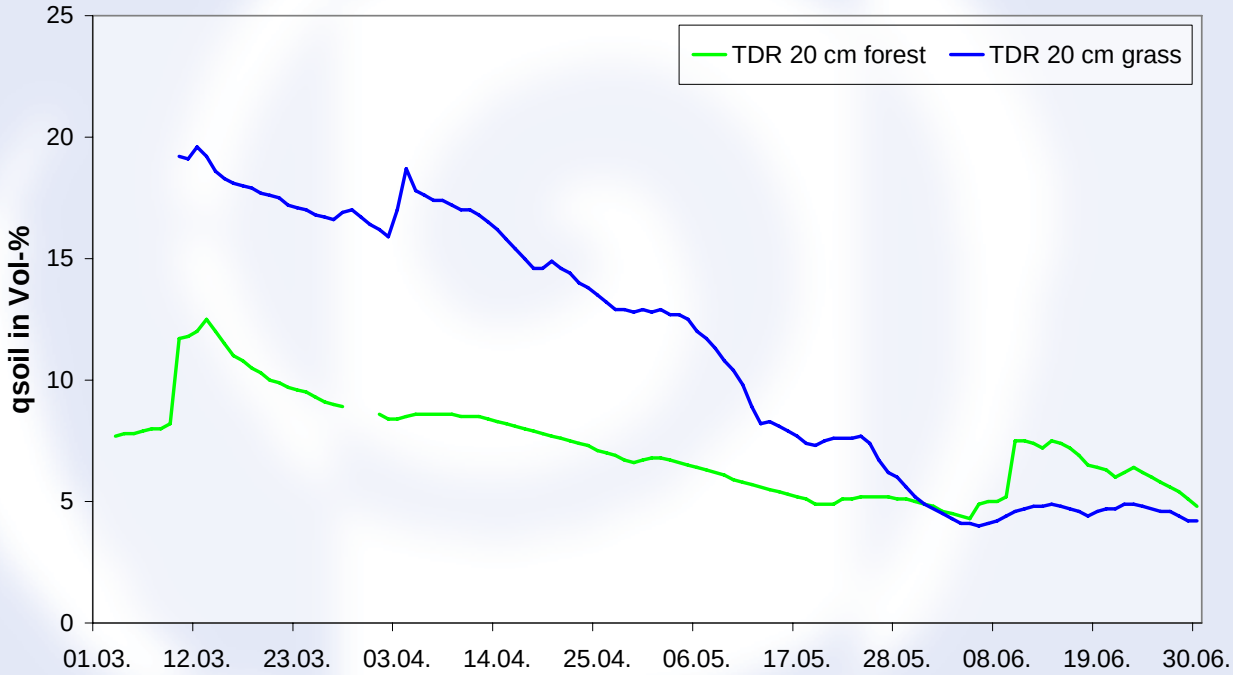
Differences forest - grassland (IV): Sensible heat flux

... up to 100 %



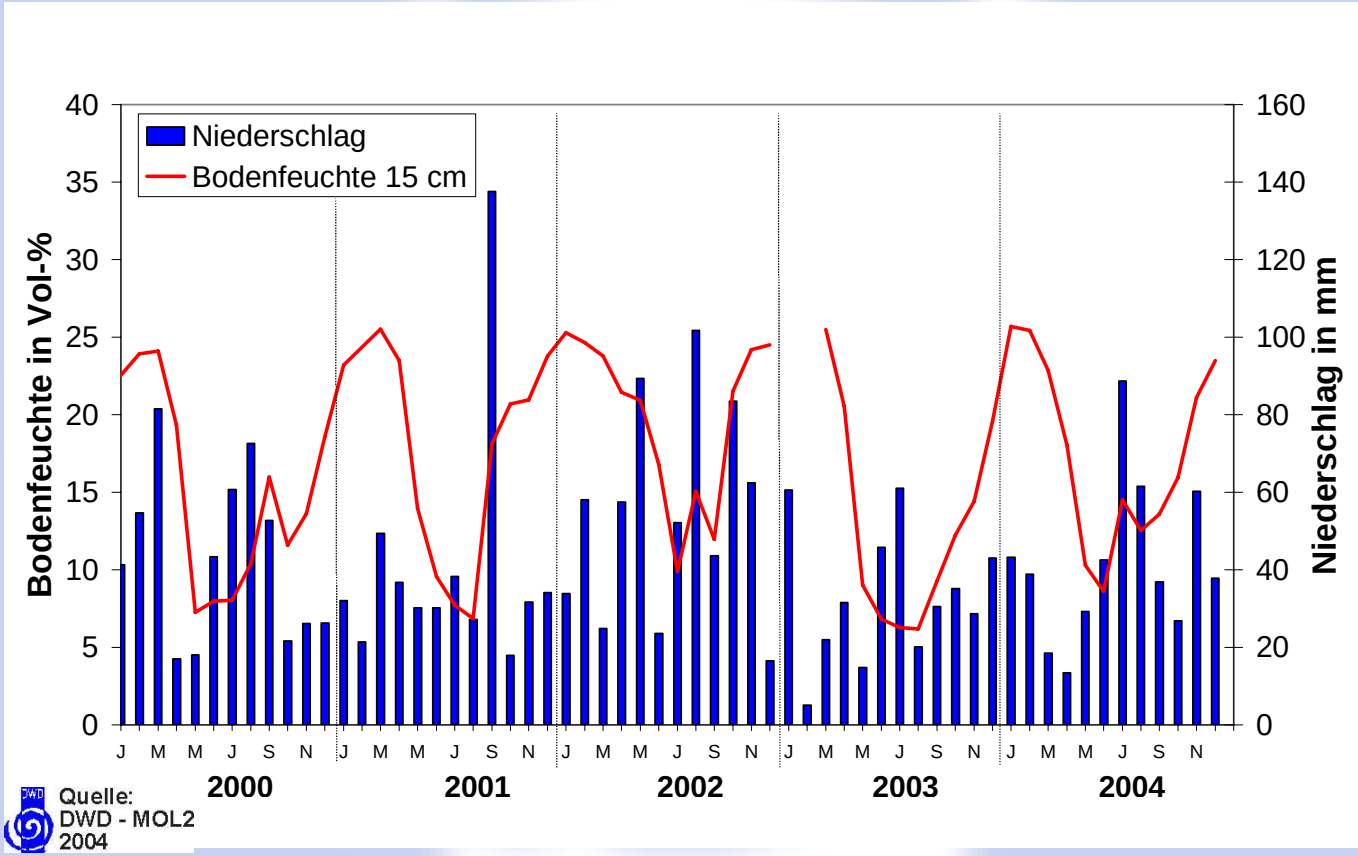


Differences forest - grassland (I): Soil moisture

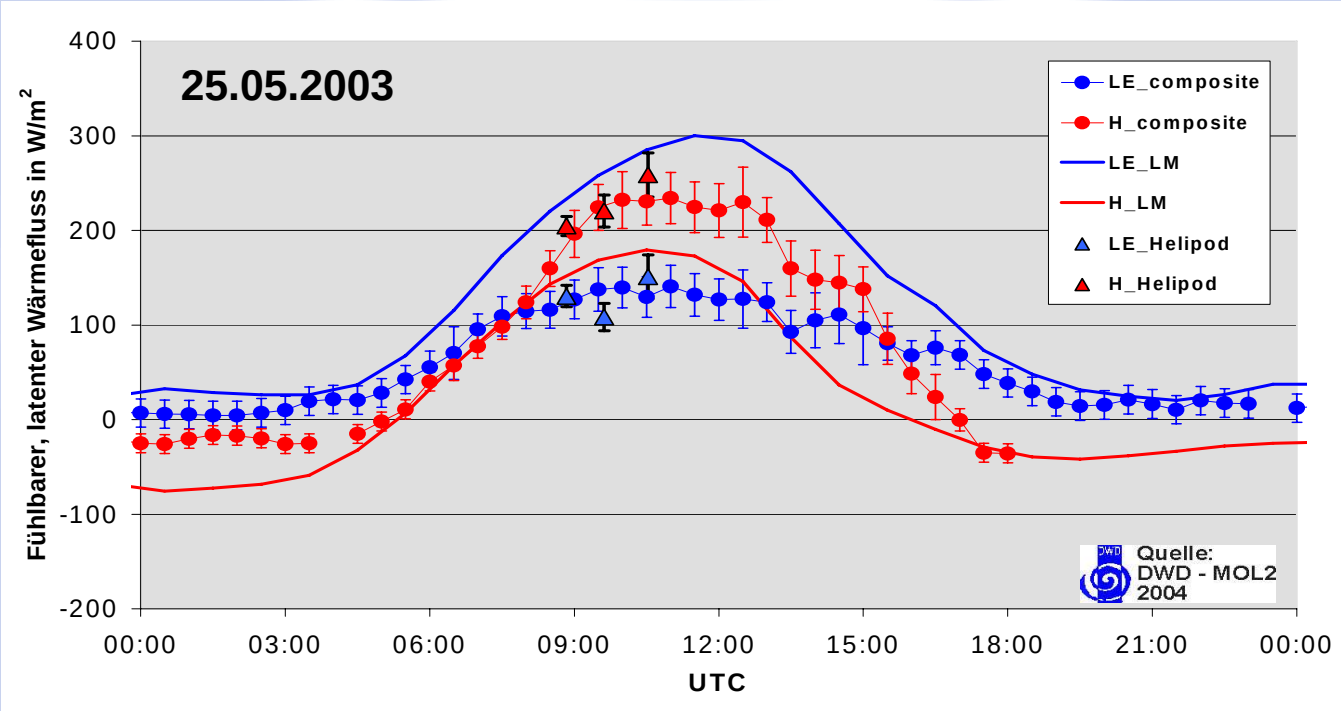


2003

5 years of soil moisture measurements at GM Falkenberg



LITFASS-2003: Area-averaged fluxes H and LE from aggregated micrometeorological measurements and Helipod compared to the operational LM



Using data from DWD, GKSS, TUDD, TUBS, UBT, KNMI, WAU

CEOP Reference Site Lindenberg - Status Report

• full CEOP measurement programme (soil, radiation, standard meteorology, turbulent fluxes, tower, high-res radiosoundings) during EOP-1 to EOP- 4 (2001 - 2004) at GM Falkenberg (grassland), additional forest data available for 2003 / 2004

•additional measurements operational - data available upon request: wind profiler / RASS, microwave radiometer profiler , cloud radar, ceilometer, rain gauge network

• field experiment LITFASS-2003: Area averaged evaporation over a heterogeneous land surface

•measurements will be continued for CEOP Phase II

Future Issues include:

<u>Lindenberg:</u> Forest Site Data to be added to CEOP Archive

<u>All 4 BALTEX Sites:</u>

- **Principally prepared for CEOP Phase II – Directions urgently required !!**
- **Seek funding through a major EU-FP6 proposal *EURAT***

<u>All CEOP Sites:</u>

Need to compile vegetation, soil characteristics and other meta data

Thank you !

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