

## CEOP Reference Site Data Set Metadata Information

**Reference Site:** BALTEX Lindenberg  
**Station Identifiers:** Falkenberg / Forest  
**Time Period:** January 01, 2009 to December 31, 2009

### Contacts

#### ***CEOP Reference Site Manager***

Dr. Frank Beyrich  
Meteorologisches Observatorium Lindenberg /  
Richard-Aßmann Observatorium  
Deutscher Wetterdienst (DWD)

Am Observatorium 12  
D - 15848 Tauche - OT Lindenberg  
Germany

Tel.: +49 33677 60228  
Fax: +49 33677 60280  
email: [frank.beyrich@dwd.de](mailto:frank.beyrich@dwd.de)  
www: <http://www.dwd.de/MOL/>

#### ***CEOP Data Manager:***

Wolfgang K. Adam  
Meteorologisches Observatorium Lindenberg /  
Richard-Aßmann Observatorium  
Deutscher Wetterdienst (DWD)

Am Observatorium 12  
D - 15848 Tauche - OT Lindenberg  
Germany

Tel.: +49 33677 60223  
Fax: +49 33677 60280  
email: [wolfgang-k.adam@dwd.de](mailto:wolfgang-k.adam@dwd.de)  
www: <http://www.dwd.de//MOL/>

### ***Abstract***

This document includes specific information of relevance when using any of the BALTEX Lindenberg reference site data from the CEOP Central Data Archive (CDA) submitted for the measurement period January 01, 2009 to December 31, 2009. It relies on the ***Lindenberg Reference Site Data Set Metadata Information*** document for the ***BALTEX Lindenberg*** site during ***CEOP Phase II*** where a detailed description of the measurement sites, the instrumentation, and the data collection and quality control procedures is given.

## 1. Data Set Overview

### 1.1 Site and Time Period

This description refers to the data from the BALTEX Lindenberg reference site for the period January 01, 2009 - 0030 UTC to December 31, 2009 - 2400 UTC (January 01, 2010 – 0000 UTC). The BALTEX Lindenberg reference site comprises two independent stations named Falkenberg and Forest. These represent the two major land use types in the Lindenberg area (grassland / farmland, forest).

### 1.2 Site Co-ordinates

All surface ~, soil ~, tower ~ and flux measurements of the Falkenberg station have been performed at the Falkenberg Boundary Layer Field Site (in German: Grenzschichtmessfeld <GM> Falkenberg) of the Meteorological Observatory Lindenberg - Richard-Aßmann Observatory (MOL-RAO).

The co-ordinates of the GM Falkenberg are given by:

52° 10' 01" N	14° 07' 27" E	73 m NN
52.17° N	14.12° E	

The radiosondes are released at the site of the Meteorological Observatory Lindenberg – Richard-Aßmann Observatory (MOL-RAO) which is about 5 km to the North of the Falkenberg site.

The co-ordinates of the radiosonde release point at MOL-RAO are given by:

52° 12' 36" N	14° 07' 12" E	112 m NN
52.21° N	14.12° E	

The Forest Station is situated in a pine forest about 10 km to the West of the Falkenberg site. The co-ordinates of the Forest Station are given by:

52° 10' 56" N	13° 57' 14" E	49 m NN
52.18° N	13.95° E	

### 1.3 Site Operator

The Meteorological Observatory Lindenberg – Richard-Aßmann Observatory (MOL-RAO) is part of the business area Research and Development of the Deutscher Wetterdienst (DWD), the national meteorological service of Germany.

### 1.4 General Site Description

The detailed site description is given in the *Lindenberg Reference Site Data Set Metadata Information* document for the **BALTEX Lindenberg** site during **CEOP Phase II**. Since no changes occurred the user is referred to this document.

## 1.5 Site Details

### Falkenberg

The Falkenberg site represents a grassland area surrounded by agricultural farmland. The meadow is mowed regularly (up to six times per year) in order to keep the mean vegetation height below 20 cm. This leads to a typical roughness length for momentum ( $z_0$ ) at around or below 0.01 m. A time series of vegetation height and roughness length (determined from the momentum flux measurements during near-neutral stratification) over the 2009 annual cycle is shown in Figure 1.

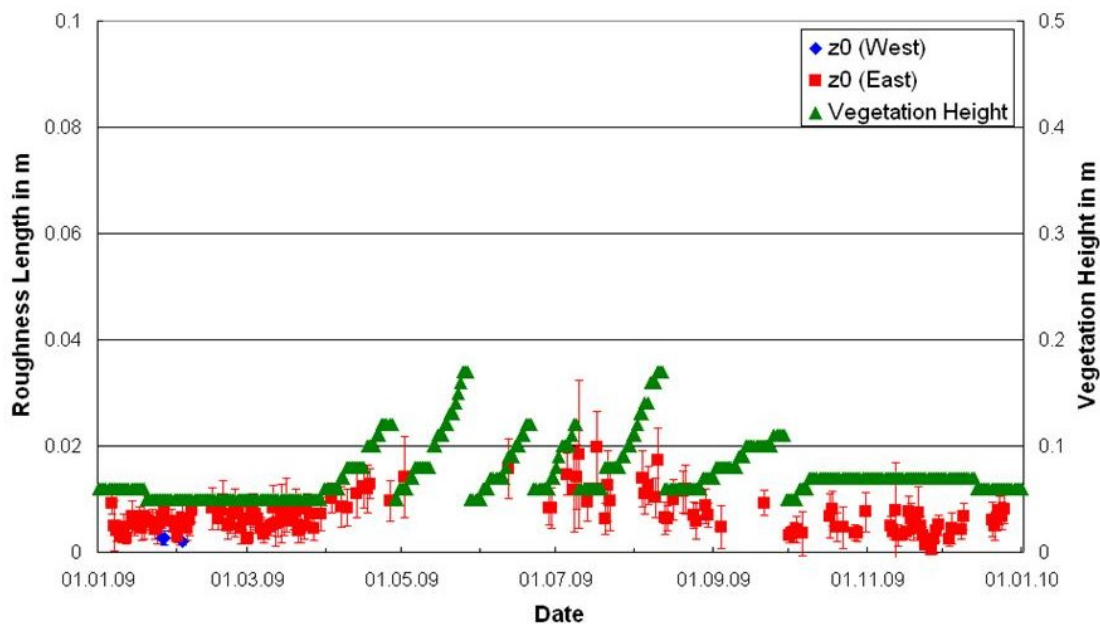


Figure 1 Time evolution of the estimated values of mean vegetation height (right y-axis) and roughness length for momentum (left y-axis) at the Falkenberg boundary layer field site for the 2009 annual cycle (red and blue symbols indicate estimates based on measurements at the two flux stations in the eastern and western part of the field site, respectively).

## 2. Instrumentation Description

A detailed instrumentation description is given in the *Lindenberg Reference Site Data Set Metadata Information* document for the *BALTEX Lindenberg* site during *CEOP Phase II*. The user is referred to this document. The following paragraphs just report on the modifications relevant for the 2009 data set.

### 2.1 The Falkenberg Field Site

No major changes of the general set-up occurred in 2009. The snow-depth sensor had been re-installed prior to the winter 2009 / 2010 from a bar mounting to a tower mounting. In May 2009, the pressure sensor was replaced from nearby the small mast to the data acquisition container in the NE corner of the field site.

## 2.2 The Forest Station

No changes of the general set-up occurred in 2009.

## 2.3 Sensor List

No changes of instrumentation occurred in 2009.

A few sensor replacements (e.g., of the turbulence and radiation sensors, and of the cup anemometers in connection with configuration updates or regular maintenance and calibration activities, respectively) were performed without changing the sensor type.

Vaisala sensor HMP-45D was used throughout the year to perform humidity measurements, supplemented by psychrometric measurements during the summer season.

## 3. Data Collection and Processing

A detailed description of the data collection and processing algorithms is given in the ***Lindenberg Reference Site Data Set Metadata Information*** document for the ***BALTEX Lindenberg*** site during ***CEOP Phase II***. No modifications were introduced in 2009.

## 4. Quality control procedures

A detailed description of the quality control procedures is given in the ***Lindenberg Reference Site Data Set Metadata Information*** document for the ***BALTEX Lindenberg*** site during ***CEOP Phase II***. The user is referred to this document. No modifications were introduced in 2009.

## 5. Gap Filling Procedures

No gap filling procedures using model assumptions have been applied for the data period January 01, 2009 to December 31, 2009, except for the replacement of missing pressure data at the Falkenberg site (see below).

## 6. Data Remarks

This section gives specific additional information on different parameters the user should be aware of when using the data. General remarks given in the ***Lindenberg Reference Site Data Set Metadata Information document*** for the ***BALTEX Lindenberg*** site during ***CEOP Phase II*** are not included here again. The user is referred to this document. The following paragraphs just report on the specific issues relevant for the 2009 data set.

### ***General***

Power failures at Falkenberg caused data losses on October 06, 0520-0050 UTC, and on November 18, 1600-1640 UTC. Extensive maintenance activities (e.g. cleaning, check of bearings, replacement of desiccants and wearing material etc.) are performed regularly twice a year (in spring and autumn) at all stations. This may cause short operation interrupts for a number of sensors. In 2009, these maintenance activities were performed on March 22 (TWR), 26 (SFC, FLX) and 30 (TWR), and on November 09-10 (SFC, FLX) and 10-11 (TWR) at Falkenberg, and on March 18 and November 01 at the Forest site, respectively. During the autumn maintenance period, additional activities related to the renewal of some infrastructure

elements (logger boxes, power supply) at the 99m-tower resulted in further data gaps in the TWR data sets. Serious sensor and measurement problems causing a high number of D-, B-, and M-flagged data occurred during a period of snowfall and subsequent very cold weather on January, 04-07.

### ***Temperature / Humidity***

The infrastructure renewal activities in November caused a series of break-downs of the HMP-45D ventilation at different levels of the 99m-tower (TWR data set). The complete TWR temperature and humidity profiles during the period November 03-16 were therefore replaced by the corresponding values obtained from the simultaneous operation of a dewpoint mirror system (Thygan, Meteolabor AG). This dewpoint mirror system was in a test mode in 2009 and 2010 aimed to finally replace the psychrometer measurements at the tower. The measurement mode of the Thygan is, however, different from that of the HMP-45D standard temperature and humidity sensor. While for the latter the original 10-minute data represent an arithmetic average from 1 Hz data sampling, the former performs one measurement cycle (lasting about 30 seconds) at the end of each 10-minute interval.

### ***Wind Speed***

Icing during winter conditions caused a series of missing data values in the Falkenberg SFC data set and in the Forest Station TWR data set, basically on January 04-05 and 21-22, February 20-22, November 04, 08, and December 23-25.

### ***Air Pressure***

The standard air pressure measurements at GM Falkenberg were not available due to a re-installation of the sensor and data acquisition during the period May 08-20, data gaps were filled by measured data from a sensor of the same type operated at the Lindenberg observatory. These data had to be transformed considering the difference in altitude between the two sites, they are marked by Flag=l.

### ***Precipitation***

Freezing of the collected water caused erroneous precipitation measurements on several days in January (08, 11-14), data from these days had to be removed from the data set.

### ***Snow depth***

The snow depth sensor at Falkenberg was re-installed on a mast at the beginning of the winter 2009 / 2010. This mounting appeared to be not very suitable during the course of the winter, since the measurements were heavily affected by flow distortion effects from the mast and a nearby infrastructure box in case of north-easterly winds. It has been therefore decided to report the manual snow stick measurements in the CEOP data set for the winter 2009 / 2010. These measurements were performed between 06 UTC and 09 UTC on working days only. They have been assigned to 0600 UTC of the corresponding day. Reported values represent an average of the measurements at six different places at the field site.

### ***Radiation***

Sensor problems caused a larger gap in the data set of upward photosynthetically active radiation (PAR) at the Falkenberg site during the period January 01-29, 2009.

At the forest station, the longwave radiation sensor (DDPIR) ventilation was broken between April 30, 2009, and May 07, 2009 – quality checks did not indicate any significant influence on the measured values. Flag = G was therefore kept for the measurements during this period.

### ***Soil Temperature / Soil Moisture***

If upper soil layers were frozen for longer time periods during the winter, this lead to unphysical soil moisture values which were given Flag=B (this occurred between January 01, and February 12, at the upper soil levels).

Measurements of soil moisture and soil temperature at the forest station were set up along two different sensor profile lines separated by about 1.5 m (these are called the N-profile and the S-profile, respectively). Due to limited capacities, not all of the sensors buried into the soil had been connected to the data acquisition system from the beginning. As a consequence, profile data for previous CEOP data periods were a mixture of N- and S-profile sensors. After the data acquisition had been completed during the year 2008, the N-profile was defined as the standard profile starting on January 01, 2009,. This decision based on a better internal consistency both in depth and time. As a result, a few jumps occur in the time series on January 01, 2009, 0030 UTC where measurements from the S-profile are subsequently replaced by measurements along the N-profile. This holds for the soil temperature at -150 cm (jump from 7.0 deg C to 7.7 deg C) and for the soil moisture at -90 cm (jump from 6.1 Vol-% to 9.2 Vol-%).

### ***Turbulent Fluxes***

Icing during winter conditions caused a number of sensor faults of the sonic anemometer (in particular during January 02-05, and on December 23, 2009). No latent heat flux can be determined in case of water droplets / ice crystals on the windows of the infrared hygrometers due to precipitation or in case of liquid water in the path during fog and rain. This causes missing latent heat flux data typically during 15-25% of the time. A data acquisition problem at the GM Falkenberg flux stations lead to an 18 hours data gap in the FLX time series on June 04-05, 2009.

### **Disclaimer**

The data from the Lindenberg reference site have undergone the QA/QC procedure described in section 4 before being transferred to the CEOP Central Data Archive (CDA). The data supplier, however, can not guarantee the absence of any errors and can not take over any responsibility for results coming out of the use of the data. Data users who should discover problems, inconsistencies or any questionable effects when using the Lindenberg data are kindly invited to contact the Lindenberg site and / or data managers.

## **7. Reference Requirements**

Use of the Lindenberg reference site data should be made according to the CEOP data policy rules outlined in the CEOP Reference Sites Data Release Guidelines. In particular every data user who should discover internal inconsistencies, questionable effects, missing data, or any other problems is encouraged to contact the responsible site and / or data managers.

The data source should be referred to as:

Deutscher Wetterdienst (DWD) - Meteorologisches Observatorium Lindenberg / Richard-Aßmann Observatorium.

Data users are requested to send a copy of any publication making use of Lindenberg data to MOL-RAO (see address above).