

## Doppler Sodar:

A Doppler sodar (PCS.2000-64/MF, METEK, Germany) installed at Selhausen delivers profiles of wind speed, direction, turbulent activity and acoustic backscatter to up to 400 m with a resolution of 40 m and 10 minutes (Fig. 1). The instrument runs in multi-frequency mode and sends about every 2 s five acoustic pulses at different frequencies around 1800 Hz in the vertical and two, slightly tilted, directions. The backscattered signal is averaged every 10 minutes and horizontal wind speed components are calculated from the Doppler shift. The width of the backscattered Doppler spectra gives a measure for the standard deviation of the wind speed. Acoustic reflectivity is derived from the backscattered signal and gives a measure for the small scale turbulence. Data is automatically transferred by a radio link and via FZ-Jülich to Cologne. First raw data plots are generated automatically and can be found at <http://tr32.uni-koeln.de/index.php?view=article&id=211>. Recent data can be found in the TR32 database.



Figure 1: Metek PCS.2000-64/MF Sodar in Selhausen

The instrument monitors the wind field at Selhausen with high temporal and spatial resolution. Exemplary data from one of the FluxPat flight days is shown in Fig. 1. Several typical patterns can be seen: a part of the inertia circle of the nocturnal flow visible in the turning wind before 6 UTC. The top of the growing mixed layer is visible as a brighter band in the reflectivities. It starts at 6 UTC at the lowest level and reaches 300 m at 9 UTC. Also visible is the reduction of the wind speed within the mixed layer after 6 UTC due to turbulence mediated momentum transport usually referred to as 'friction'. The passage of a mesoscale structure visible in turning wind and increased wind speed around 12 UTC, and

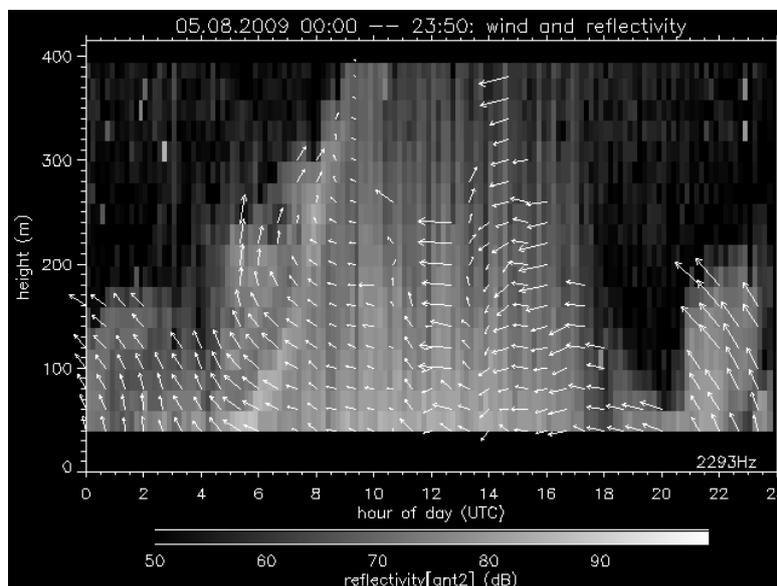


Figure 1.: Data from the sodar at Selhausen from August 5, 2009 one of the flight days during the Fluxpat campaign. Vectors indicate horizontal wind, shading gives the acoustic reflectivity. For clarity vectors are plotted only every hour.

the decay of small scale turbulence visible in lower reflectivity starting at 16 UTC in 300 m reaching the lowest level at 20 UTC. The instrument provides information on the general weather situation and has been used for the interpretation of the airborne measurements of the FluxPat campaigns.

Data comes in one zip file per month containing daily netcdf files and plots as in fig. 1. The netcdf contain profiles of wind speed, wind direction and reflectivity and some further information (see netcdf header in table 1). Also contained is a variable 'plausibility' an integer number containing flags giving information about the quality of the processed data. Its meanings are described in table 2. In general data should not be used if the plausibility code is larger than 16 (=octal '0020').

Table 1: content of the netcdf files as described in the netcdf header of every file.

```

dimensions:
    time = 144 ;
    height = 21 ;

variables:
    double time(time) ;
        time:units = "julian day" ;
    float height(height, time) ;
        height:units = "m above ground" ;
    float temperature(time) ;
        temperature:units = "deg C" ;
    short reflectivity(height, time) ;
        reflectivity:units = "dB" ;
        reflectivity:_FillValue = -32767s ;
    float windspeed(height, time) ;
        windspeed:units = "m/s" ;
        windspeed:_FillValue = -9.9999997e+37f ;
    short direction(height, time) ;
        direction:units = "deg" ;
        direction:_FillValue = -32767s ;
    float vert.wind(height, time) ;
        vert.wind:units = "m/s" ;
        vert.wind:_FillValue = -9.9999997e+37f ;
    float sigma_w(height, time) ;
        sigma_w:units = "m/s" ;
        sigma_w:_FillValue = -9.9999997e+37f ;
    short plausibility(height, time) ;
        plausibility:units = "octal" ;

// global attributes:
    :Date_of_file_generation = "Tue Jul 6 20:37:02 2010 UTC" ;
    :location = "Selhausen" ;
    :longitude = 6.4510002f ;
    :latitude = 50.869301f ;
    :altitude = 105.f ;
    :system = "METEK SODAR PCS.2000-64/MF" ;
    :day = "01" ;
    :month = "07" ;
    :year = "2010" ;
    :institution = "Data processed by University of Cologne;
contact: jschween@meteo.uni-koeln.de" ;
    :sample_int = "10 minutes" ;

```

Table 2: Description of the plausibility codes of the instrument.

bit	octal	meaning
	code	

- 0 00001 Saturation of the receiver for one or several samples. The affected instantaneous spectra are rejected and not used in the averaging process. The measurements are not influenced by the saturation events.
- 1 00002 High level of white noise for one or several samples. The affected instantaneous spectra are rejected and not used in the averaging process. The measurements are not influenced by the white noise events.
- 2 00004 Local maximum in the spectra too strong as compared to the main/absolute maximum. Local maxima can be generated by fixed echoes, high ambient noise of certain frequencies. The computed radial components and all derived values are invalid.
- 4 00020 Signal/Noise ratio too low. The computed radial components and all derived values are invalid.
- 5 00040 Low statistical significance of the measured backscattered acoustic signal. Most of the instantaneous signal spectra have been rejected. The computed radial components and all derived values are invalid.
- 6 00100 Low statistical significance of the measured ambient noise. Most of the instantaneous noise spectra have been rejected.
- 8 00400 The maximum of the averaged signal spectrum is too slim as compared to the theoretical value. The computed radial components and all derived values are invalid.
- 9 01000 The maximum of the averaged signal spectrum is too wide. The computed radial components and all derived values are invalid.
- 10 02000 The maximum of the averaged signal spectrum is smaller than the maximum of the averaged noise spectrum. The computed radial components and all derived values are invalid.
- 11 04000 The standard deviation as computed by the width of the averaged signal spectrum shows an imaginary value. If the atmospheric turbulence is very low (below 15 cm/s) this error message can occur frequently. The sigma-value must be set to zero.