

Rain [#3]

This document describes the content in the “Rain gauge data” and “Radar data etc.” folders.

Rain gauge data

The Water Pollution Committee, Spildevandskomiteen (SVK) of The Society of Danish Engineers has together with the Danish Meteorological Institute (DMI) made a network of high-resolution rain gauges (Arnbjerg-Nielsen et al., 2006; Gregersen et al., 2014; Harremoës, 1980). The local rain gauges are purchased by the local utility with a maintenance program provided by DMI, which ensures that the data is quality checked by DMI. Quality-assured data from these rain gauges can be purchased from DMI, but for this paper we have been given exclusive access to distribute data from two rain gauges, 5425 and 5427, in the Bellinge area. The condition for providing the data is that the data from these rain gauges can only be used for research and educational purposes, and not for commercial purposes. We kindly request that this is respected.

The two local rain gauges are heated tipping bucket rain gauges with a 0.2 mm bucket (Jørgensen et al., 1998). The data is delivered from 2009 and onwards with minor data outages. The data is recorded in tips per minute, which is converted to an intensity. Rain statistics from Denmark can be found in Gregersen et al. (2014). Further information about the quality and data format can be found in (Cappelen, 1993; Jørgensen et al., 1998).

In addition to the SVK rain gauges, VCS Denmark installed a temporary rain gauge, Aabakken, for a year on a fenced ground in Bellinge in the period 2017-2018 for a local project. The rain gauge is not a part of the national SVK rain gauge system. The type is tipping bucket rain gauge with a basket of 0.2 mm similar to the SVK-rain gauges.

X-band and C-band radar data

From 2012, VCS Denmark has operated a local X-band radar located app. 4 km from Bellinge.

It has unsuccessfully been attempted to find information on when the magnetron has been replaced. Thus, the change of parameters in the radar is undocumented and the intensity of the radar can only be provided with the uncertainty that comes with equipment as those.

The cell size of the X-band radar data is app. 925 mx925 m. The coordinates given in the files refer to the South-West corner of each cell, and thus 462.5 m must be added to each coordinate to find the center coordinates.

The radar reflectivity signal has been converted to rain intensity by utilizing measurements from rain gauges placed in selected grid points, see (Borup et al., 2016; Pedersen et al., 2021). In short, the method for converting the signal from the radar to intensity uses the rain gauges in an area to continuously estimate the multiplicative factor, α , that relates rainfall at the ground and radar observations:

$$R = \alpha \cdot R_r \quad (1)$$

where R is the rainfall intensity and R_r the radar observation. Rain gauge data is used as an estimate for the actual rainfall at the ground for the area covered by the radar pixel in which a specific rain gauge is located. α for time t is estimated from multiple gauges according to (2):

$$\hat{\alpha}(t) = \frac{\sum_{\tau=t-T_{ad}+1}^t \sum_{n=1}^N Rr(n, \tau) Rg(n, \tau)}{\sum_{\tau=t-T_{ad}+1}^t \sum_{n=1}^N Rr(n, \tau)^2} \quad (2)$$

where T_{ad} is how long a period that is used to calculate α , N is the number of rain gauges and Rg is the rainfall intensity recorded by rain gauge n . The parameters of the radar adjustment scheme might have changed several times during the data collection period, but this was handled by a private contractor and no detailed log of this has been kept.

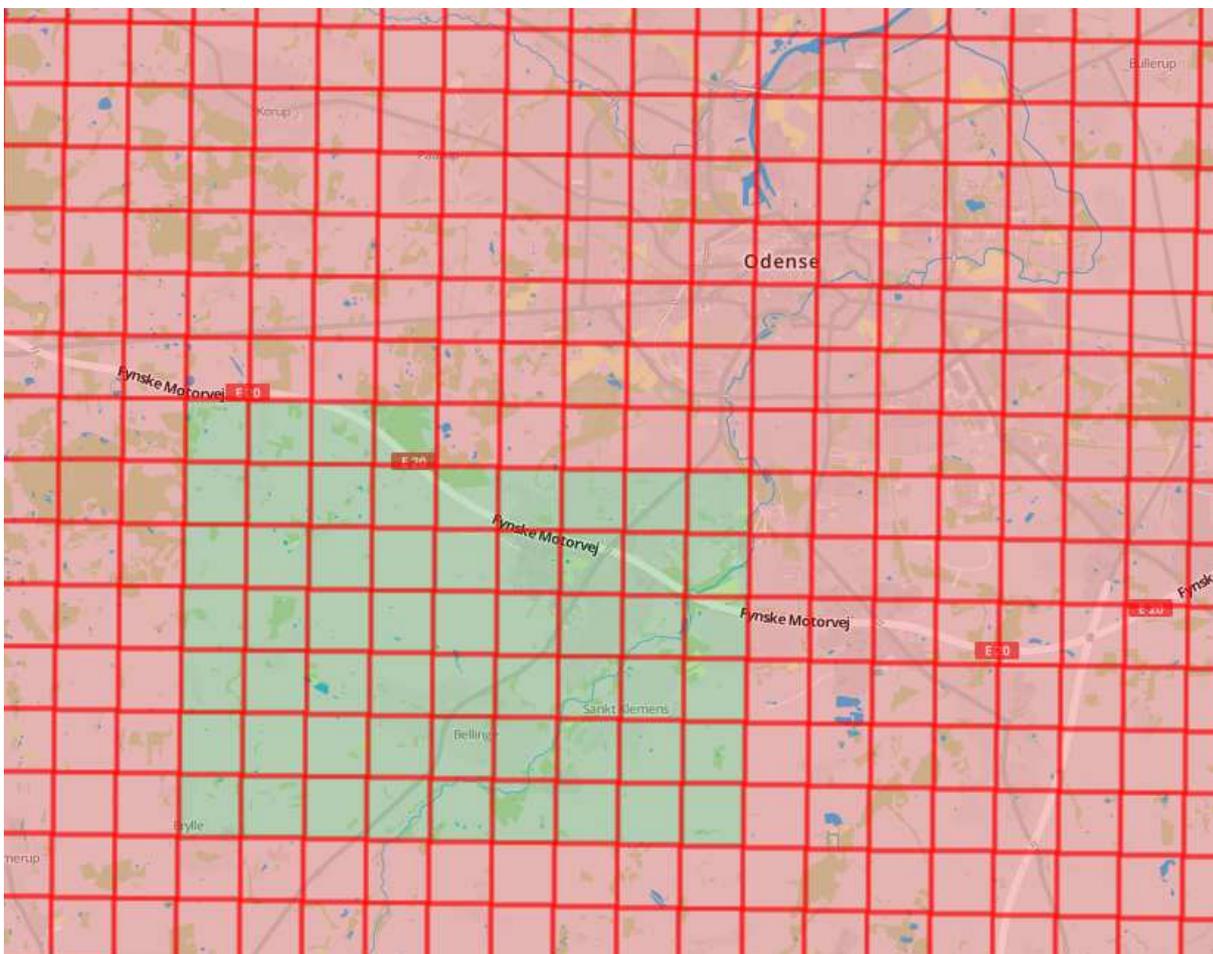


Figure 1: The provided radar picture (green) from the local X-band radar.

The local radar has outfalls as described in (Pedersen et al., 2021). There has been no quality checks of the radar output.

In 2016, VCS Denmark purchased the signal from DMIs C-band radar in Virring (56°01'26.5"N 10°01'29.9"E, UTM 32V E 563883.97 N 6209226.27), which is converted to rain intensity according to the methods used on the local radar.

DMI data

DMI offers open access to parts of their data, and for this compilation we include the following data for a local weather station 06126 in Årslev, app. 10 km away from the area.

- Precip_past10min (mm summed for last 10 min)
- Radia_glob (W/m² as means last 10 min)
- Temp_dry (°C as means last 10 min)
- Humidity (% as means last 10 min)
- Wind_speed (m/s as means last 10 min)

The data can be found at (DMI, 2020) along with other data sets but is included her for user convenience.

References

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