

Rain [#3]

This document describes the content in the Radar data and Rain gauge data folder.

Rain gauges

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; Harremöes, 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 by DMI, but for this paper we have been given exclusive access to two rain gauges, 5425 and 5427, in the 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 emphasize 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 -> with minor data outages. The data is delivered in flips per minute, that is converted to an intensity. As can be seen from data from the two rain gauges, the 5425 Brændekilde will underperform slightly while 5427 Dalum tends to have higher intensities than the average statistics (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 SVK rain gauges, VCS Denmark installed a temporary rain gauge, Aabakken, for a year on a locked ground in Bellinge in the period 2017-2018 for a local project. The rain gauge is not a part of the national SVK rain gauges, and the type is tipping bucket rain gauge with a basket of 0.2 mm.

Radar

From 2012, VCS Denmark has a local X-band radar located app. 4 km from Bellinge. The signal is converted to rain intensity by rain gauges, see (Borup et al., 2016; Pedersen et al., n.d.).

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. However, it has been attempted to find information on when the magnetron was replaced.

The cell size is app. 925 mx925 m in this output and the coordinates given in the files are in the lower left corner, and to find the center coordinate, you have to add 462,5 m to each coordinate.

The method for converting the signal from the radar to intensity applying the rain gauges in the area is described in (Borup et al., 2016). In short, this method 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):

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

where T_{ad} is how long a period that is used to calculate α , N is the number of rain gauges and R_g 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.

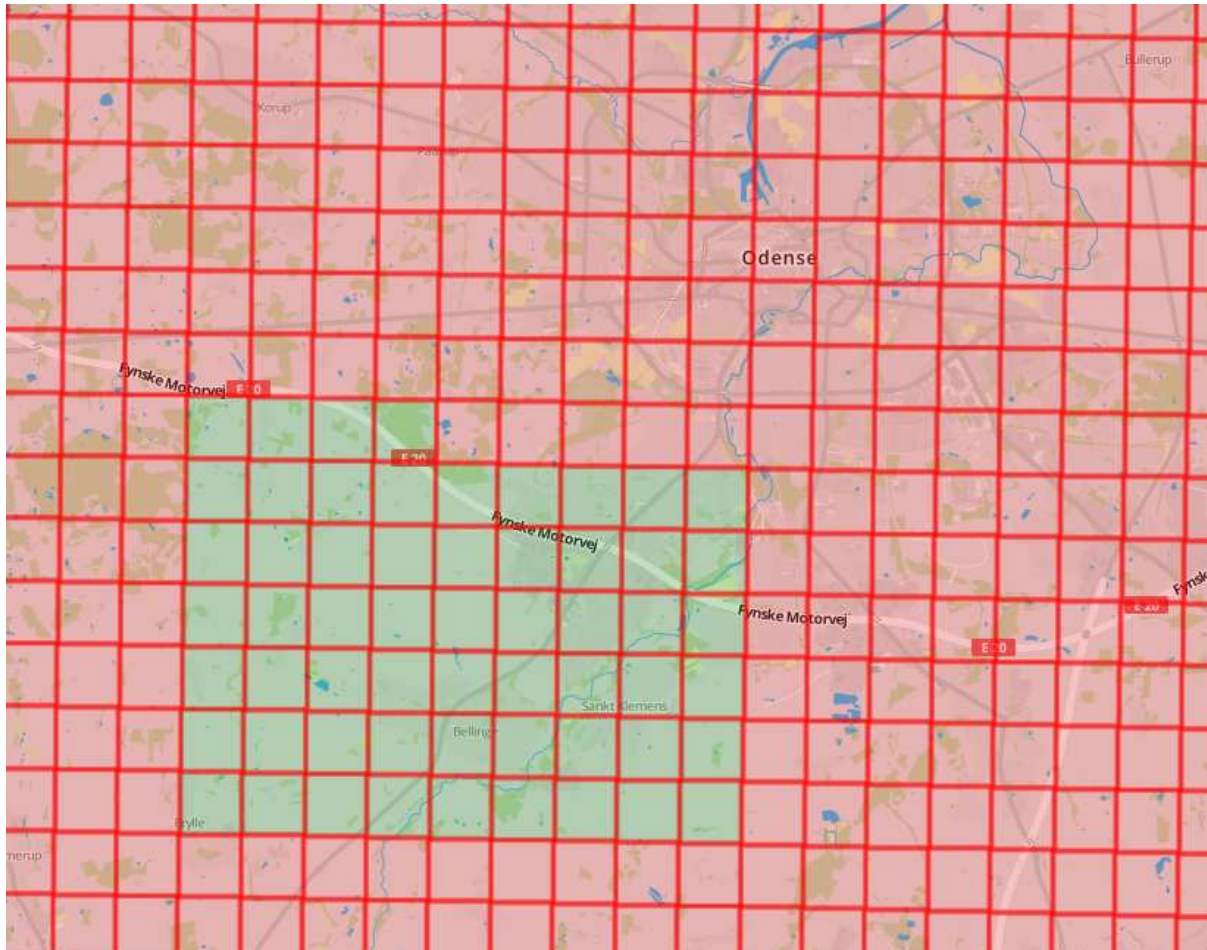


Figure 1: The provided radar picture (green) from the local X-band radar.

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

In 2016, VCS Denmark purchased the signal from DMIs C-band radar in Viring, which is converted to rain intensity according to the methods used on the local radar.

DMI data

DMI has an open data access to their data, and for this compilation, we include the following 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 (oC 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 set.

References

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