

WegenerNet Climate Station Network – Feldbach region

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STUDY AREA

The WegenerNet climate station network Feldbach region (WegenerNet) is a pioneering weather & climate observation facility with very high resolution in south-eastern Austria. The network comprises 151 meteorological stations within an area of about 20 km x 15 km in the Alpine foreland (Fig. 1; one station per ~2 km²). Measurements sampled every 5 min include the meteorological parameters air temperature, humidity, precipitation, and others (see box at right). The data are processed by an automatic system comprising data transfer, quality control, data product generation, and website provision. The resulting data sets consist of station data and gridded data on various temporal scales since Jan 1, 2007. All data are provided at the WegenerNet data portal and represent a new resource for climate and environmental research at regional to local scales. The network is part of the LTSER platform Eisenwurzen and has a “sister network” in a mountainous area of Upper Styria (WegenerNet Johnsbachtal).

- pioneering observation facility of 151 meteorological stations (~1.4 km x 1.4 km station grid)
- air temperature, relative humidity, precipitation (main parameters), complemented by wind and soil parameters (soil moisture, temperature, and matric potential) at selected sites, and air pressure and net radiation at one reference station
- measurements with 5 min sampling
- automatic processing system including data transfer, quality control, and the generation of weather and climate data products
- semi-automatic maintenance system detecting data anomalies and tracking maintenance tasks
- interpolated regular grids for the main parameters + heat index (200 m x 200 m UTM grid)
- station and gridded data since January 1, 2007 (basic-5 min, half-hourly, hourly, daily, monthly, seasonal, and annual data)
- data provision at the data portal with data latency less than 1-2 hours in standard operation

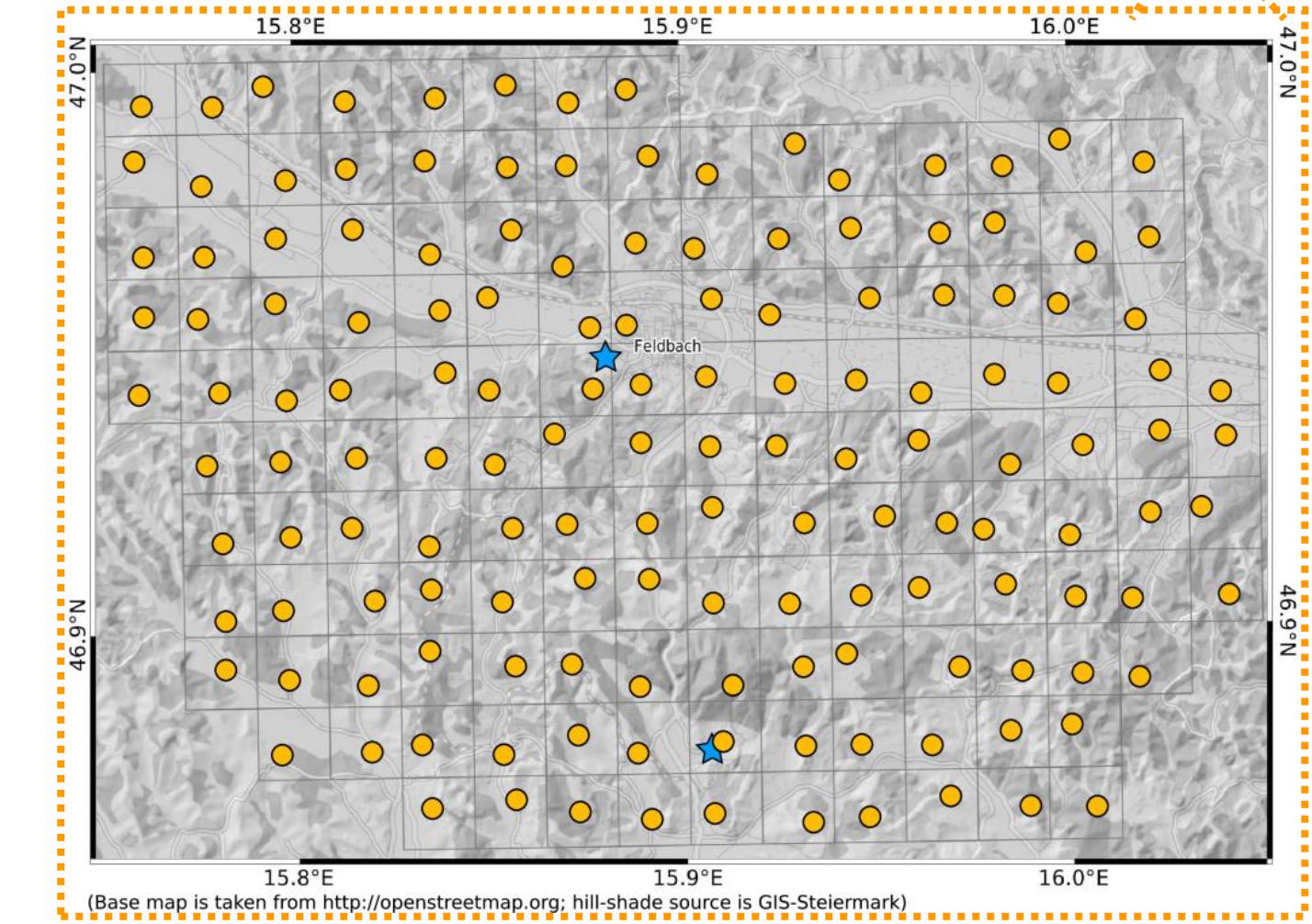
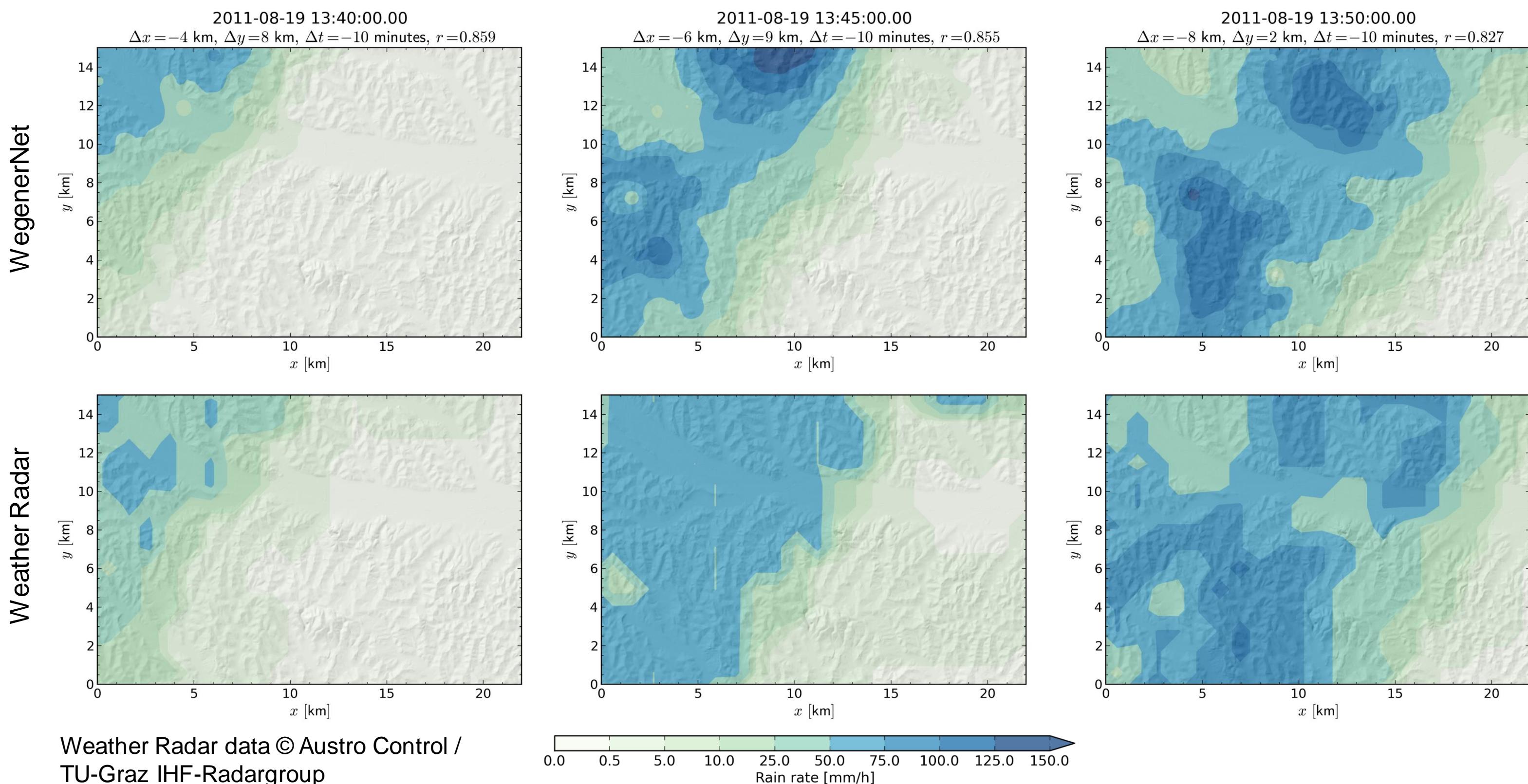


Fig. 1: Study area (~20 km x 15 km, mean alt. ~330 m) and station locations in the station grid (~1.4 km x 1.4 km). Within the area, two synoptic stations of the ZAMG are marked by stars. WegenerNet Johnsbachtal, and the location of the Weather Radar Zirbitzkogel, are additionally marked in the small upper image by a yellow rectangle and a blue dot, respectively.

EXAMPLE 1: CALIBRATION OF WEATHER RADAR DATA

Taking advantage of the network's high resolution, the relation between Weather Radar (WxR) reflectivity and rain rate on the ground can be derived for single radar images (5-min time step). To accomplish this, the spatial and temporal shift of the radar data w.r.t. the ground data must be taken into account. In this example, data from the C-band Zirbitzkogel WxR are used. The radar is located at an altitude of 2372 m at a distance of around 100 km west of the study area (Fig. 1). The results, radar-derived precipitation data, resemble the spatial structure and intensity of the ground data, which is indicated by the high correlation between the two datasets ($r > 0.8$, Fig. 2).

Fig. 2: Spatial grids of WegenerNet precipitation data (top) and radar-derived precipitation data (bottom) for a convective event on Aug. 19, 2011, 13:40 – 13:50 UTC. Spatial (Δx , Δy) and temporal (Δt) shift of radar images w.r.t. the ground data, and correlation (r) between images are noted above.



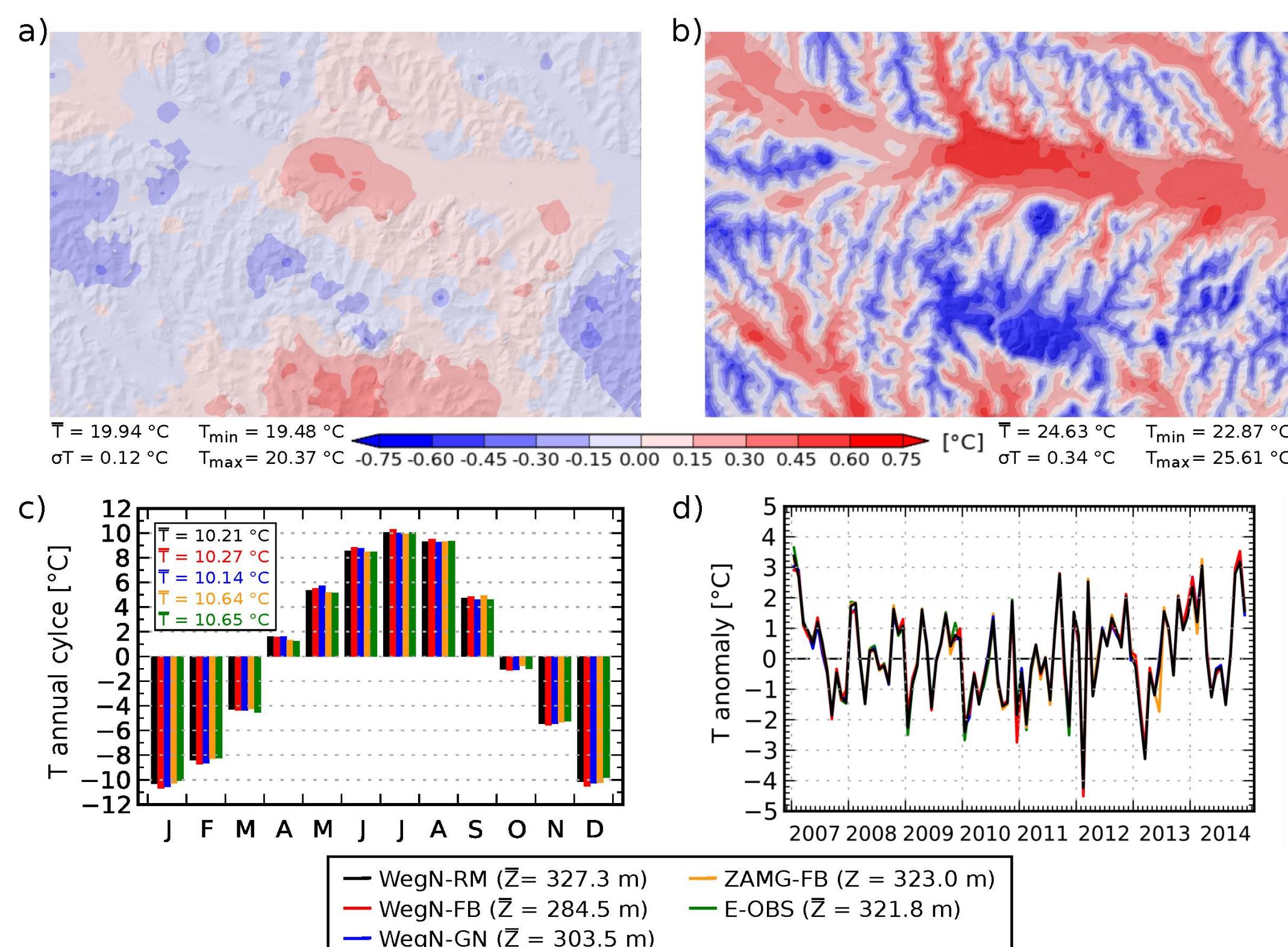
EXAMPLE 2: CLIMATOLOGICAL TEMPERATURE DATA

A monthly-mean temperature (MMT) field (Fig. 3a), and a MMT field after noontime (1300-1400 LT) (Fig. 3b), for July 2008 show the ability to characterize local-scale climate: Data in Fig. 3a indicate a moderate urban heat island effect for the cities of Feldbach (center) and Bad Gleichenberg (south), while Fig. 3b clearly shows the topography, with the Raab valley being warmest.

The mean annual cycle (MAC) of MMTs from the period 2007-2011 (Fig. 3c), and MMT anomaly time series, i.e. MAC subtracted from MMTs, for the period 2007-2014 (Fig. 3d), confirm a high consistency among WegenerNet stations as well as compared to external data sources.

Fig. 3: Illustration of climatological temperature data from the WegenerNet.

- Monthly-mean temperature field, and
- monthly-mean temperature field after noontime (1300-1400 LT) for July 2008. The color bar shows the deviation of the grid-point means against the region mean (\bar{T}).
- Mean annual cycle of monthly-mean temperatures from the period 2007-2011, and
- monthly-mean temperature anomaly time series over 2007-2014 for different regions.



WegN-RM: WegenerNet region-mean data

ZAMG-FB: Central Institution for Meteorology and Geodynamics (ZAMG) Feldbach station data

WegN-FB: Feldbach-subregion-mean data (WegN stations near ZAMG-FB)

WegN-GN: Gnas-subregion-mean data (WegN stations in south-western corner)

E-OBS: Mean of 100 km x 100 km domain including the study area

REFERENCES

Kabas, T., A. Leuprecht, C. Bichler, and G. Kirchengast (2011): WegenerNet climate station network region Feldbach, Austria: network structure, processing system, and example results. *Adv. Sci. Res.*, 6, 49-54, doi:10.5194/asr-6-49-2011.

Kirchengast, G., T. Kabas, A. Leuprecht, C. Bichler, and H. Truhetz (2014): WegenerNet: A pioneering high-resolution network for monitoring weather and climate. *Bull. Amer. Meteor. Soc.*, 95, 227-242, doi:10.1175/BAMS-D-11-00161.1.

WEBSITES

WegenerNet data portal: www.wegenernet.org

WegenerNet homepage: www.wegcenter.at/wegenernet

