wege entstehen, indem wir sie gehen
*ways emerge in that we go them*

Wegener Center
www.wegcenter.at

Atmospheric Remote Sensing and Climate System Research Group
ARSCliSys

# The WegenerNet observing weather and climate at 1 km-scale resolution: a new look at convective precipitation and other local-scale processes

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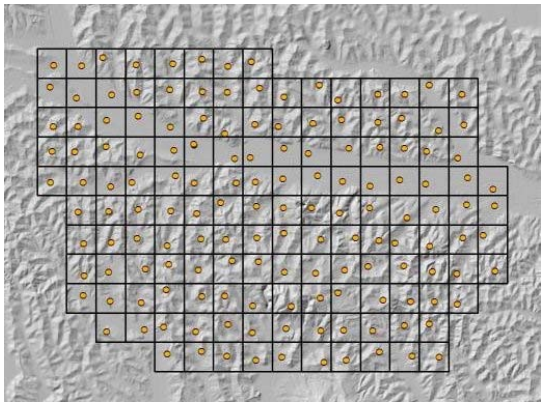
***Session GI2 "Atmosphere, Ocean, Meteorological Instruments and Ocean Observatory Instrumentation"***
***@ EGU General Assembly 2009; 19-24 Apr 2009, Vienna, Austria***

# Outline

- WegenerNet Team & Sponsors
- One-slide Overview & Research Applications
- Station Setup & Measured Parameters
- WegenerNet Processing System & Data Product Generator
- First Results: Convective Precipitation (and Temperature) at 1km-scale & 5-min Resolution – a new look (example cases from summer 2007, 2008)
- WegenerNet Web and Data Portal – Welcome



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26.11.08 17:30:33 89.144.235.77 UPL ./data/in_ok/D00167_261108_173033.000 <Delta: 2 sec> <No Mail set> <Run Time: 0> --- 30
0
26.11.08 17:30:34 89.144.249.82 UPL ./data/in_ok/D00103_261108_173034.000 <Delta: 0 sec> <No Mail set> <Run Time: 0> --- 30
0
```

```
QCS Level: 2 (sensor check)
---------------------------
 Stat   1  Rule: 0
  Good:    13 (all)
  Good:    13 (all)
 Stat   1  Rule: 1
  Good:    13 (all)
  Good:    13 (all)
  Good:    13 (all)
```

# WegenerNet Team & Sponsors

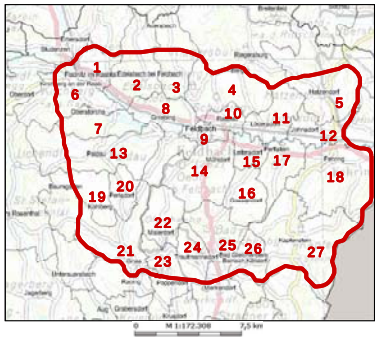
***WegenerNet Core Team:***

G. Kirchengast
T. Kabas
A. Leuprecht
C. Stieb
C. Bichler

***Further Contributors:***

H. Truhetz
M. Suklitsch
A. Pilz
R.[2] Gsöls
A.[2] Neuwirth

***and more – Thanks***

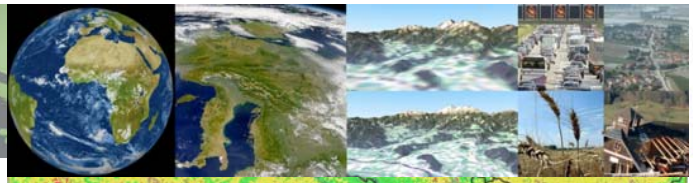


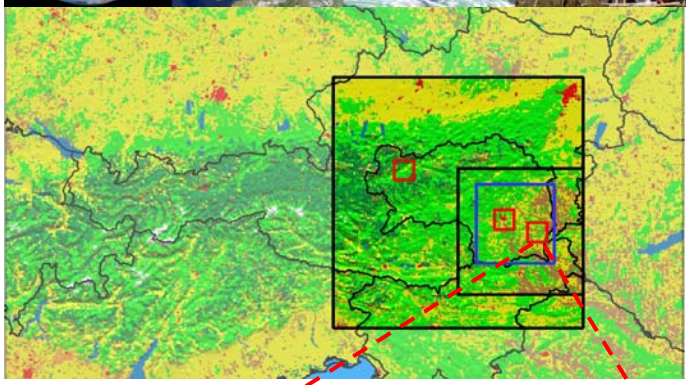

BK Feldbach

***and Thanks to many sponsors***

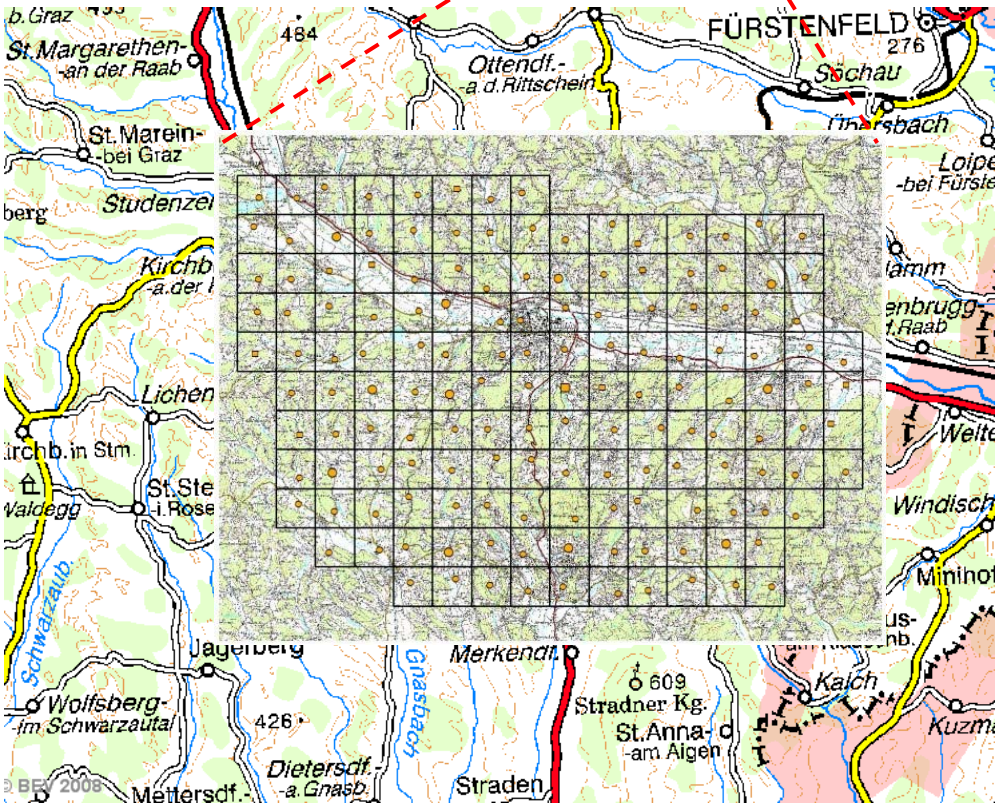
(those with logo here, and all others as well!)

# What is the WegenerNet?





- a pioneering experiment for high-resolution weather & climate observations, supporting monitoring, modeling, and prediction
- joint funds of federal, provincial, municipal, region partner & university levels (total ~800 k€, 4-yrs mid-2005 to mid-2009)
- 151 quality stations in ~20 km x 15 km region (1 station per ~2 km$^2$); several special main stations
- automatic near-real-time observation of parameters such as temperature, humidity, precipitation, wind, pressure, radiation, complemented by soil moisture (pF) and temperature; also high-res lightning, weather radar data (more extensions considered: hail, air quality, hydrological parameters, cloud properties, GPS water vapor, etc.)
- a whole new data set for research & practical use by the region itself



# For what is the WegenerNet? Research Applications

Many research projects **investigating climate and environmental change** and their impact, as well as local weather (extremes), **will benefit from WegenerNet data** covering the local scales from 1-10 km. This is a key domain for future high-resolution climate modeling and analysis, for meeting the needs of climate impact models and studies in heterogenous orography such as the Alpine region.
*Possible applications include:*

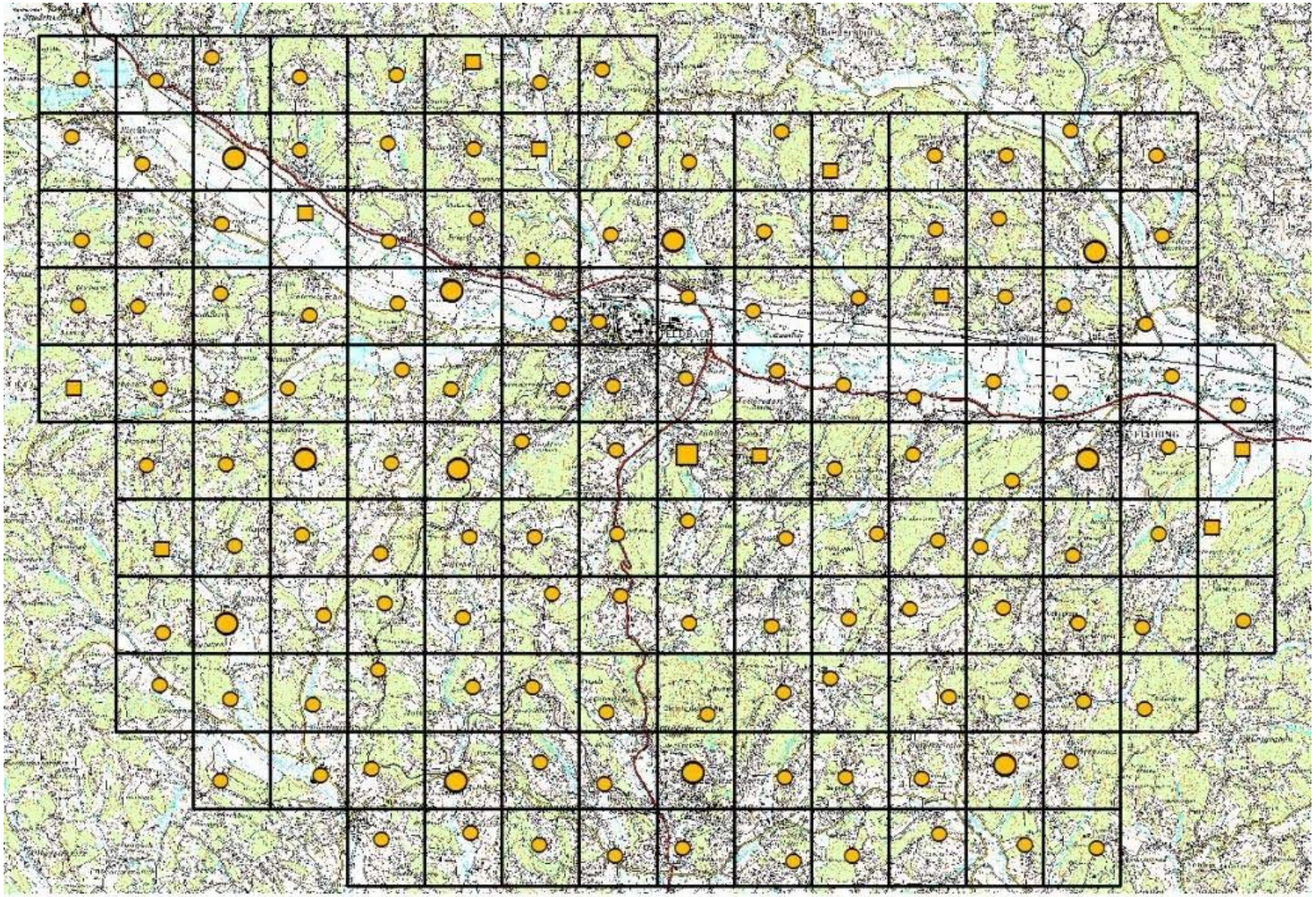
**Model Testing and Validation at Local-scale Resolution:**

- testing and validation of high-res non-hydrostatic climate models (NHCMs) used for dynamical downscaling to 1-10 km resolution
- testing and validation of statistical climate downscaling techniques, in particular of downscaling of precipitation to 1-10 km resolution
- validation and calibration of high-resolution atmospheric & hydrologic Earth Observation data from satellites
- validation and calibration of weather radar rain rate estimates

**Local-scale Weather and Climate Studies:**

- study of weather and climate extremes
- monitoring and study of orography-local climate relationships
- basin-scale and local water balance assessments
- study of local meteorological condition-air quality relationships
- and many others

# WegernerNet Station Grid



# Station Types & Measured Parameters

| Base Stations | Special Base Stations | Primary Stations | Reference Station |
|---|---|---|---|
| 127 stations | 12 stations | 11 stations | 1 station |
| temperature, precipitation, rel.humidity | temperature, precipitation, rel.humidity, soil temperature & pF (yielding soil moisture) [one station just temp&rel.humi] | temperature, precipitation (all *T* incl. *T* < 0°C), rel.humidity, wind parameters (incl. wind gusts) | temperature, precipitation (all *T*), rel.humidity, wind parameters, soil temperature & pF, net radiation, air pressure |

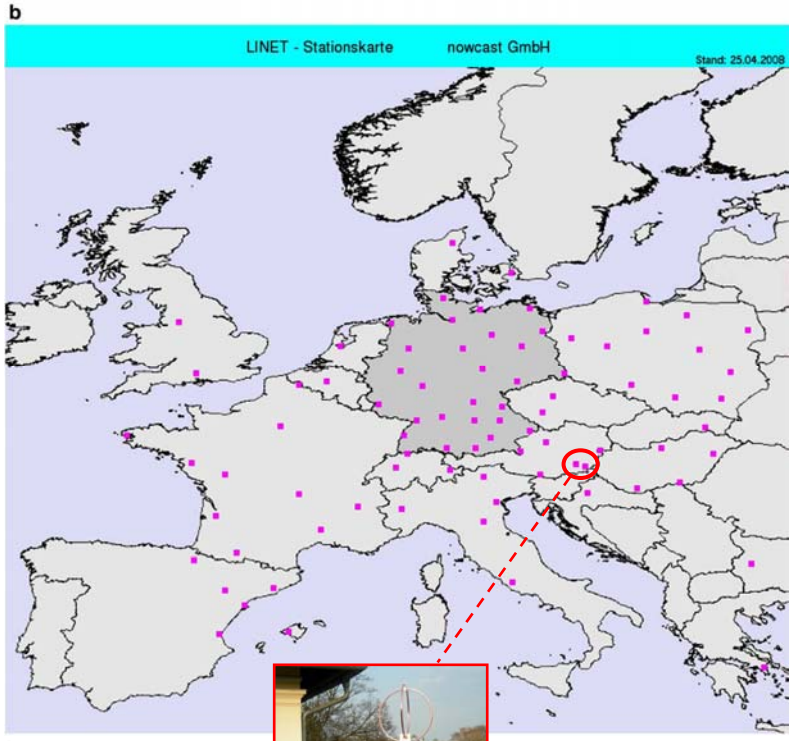
**Time Resolution**

| | |
|---|---|
| temperature: | 5min |
| precipitation: | 5min |
| rel.humidity: | 5min |
| wind params: | 5min |
| soil temp&pF: | 30min |
| net radiation: | 5min |
| air pressure: | 5min |

# Cooperation/some additional (planned) measurements

## LiNet – Lightning detection network

Cooperation with the Inst. of Physics/ University of Munich & nowcast GmbH

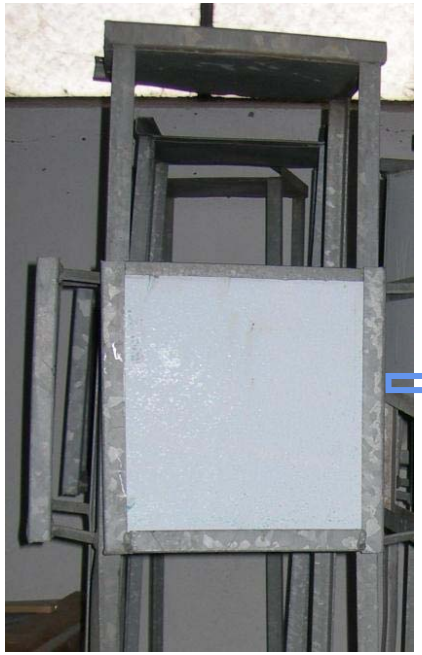


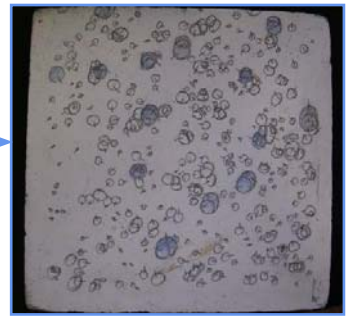

(Source: nowcast GmbH, www.nowcast.de)

Stations in
- Raabau/Feldbach (WegenerNet region)
- Graz (at roof of the Wegener Center)

## Hailpad measurements (planned)

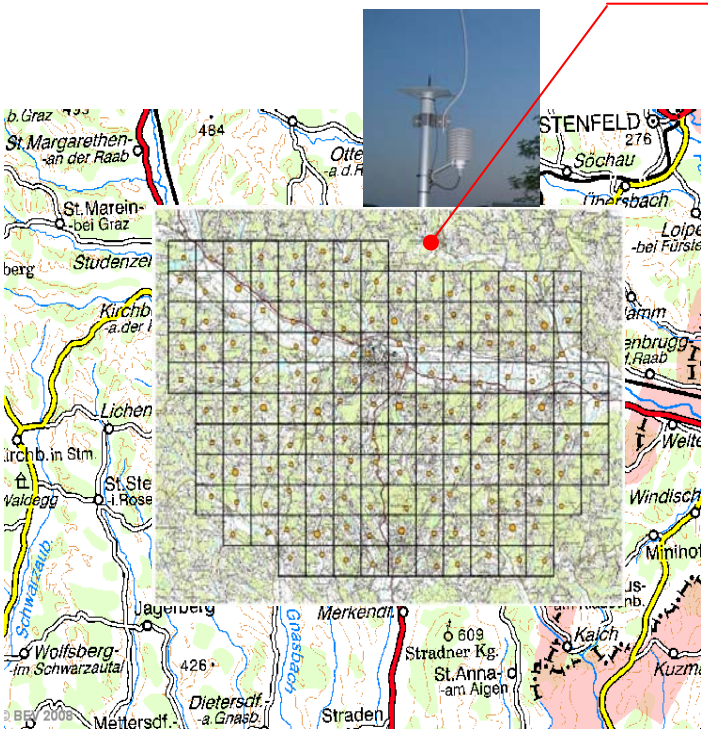
Cooperation with the Inst. BBComm./Graz Univ. of Technology, Styrian Hail Protection Society, Styrian Chamber of Agriculture





(Source: O. Svabik)

# WegenerNet Processing System (WPS) – Overview




NRT transfer of measured data
(GPRS mobile communications)

## data base

raw data

processed data

## data processing

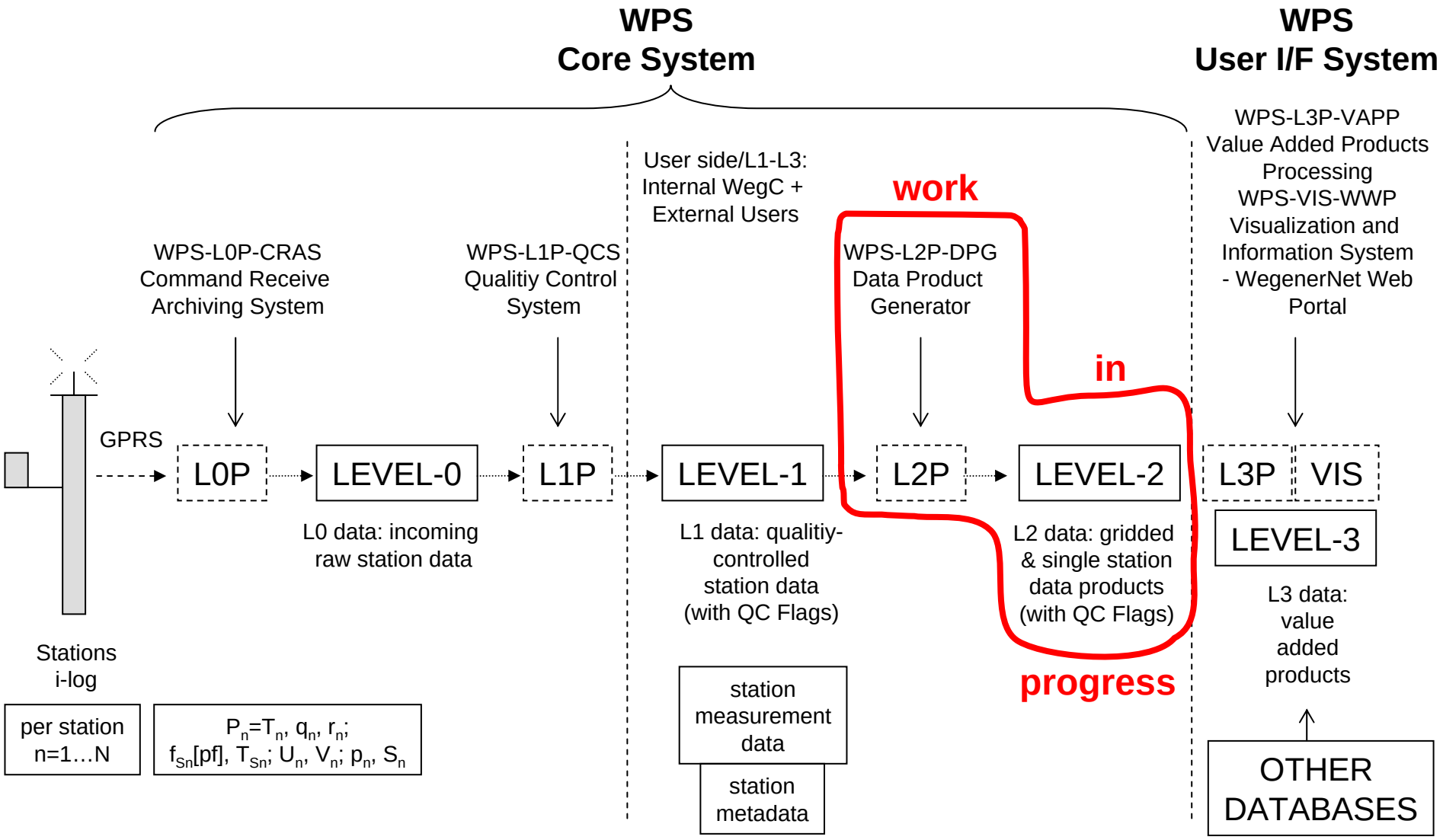
## data users

access to data

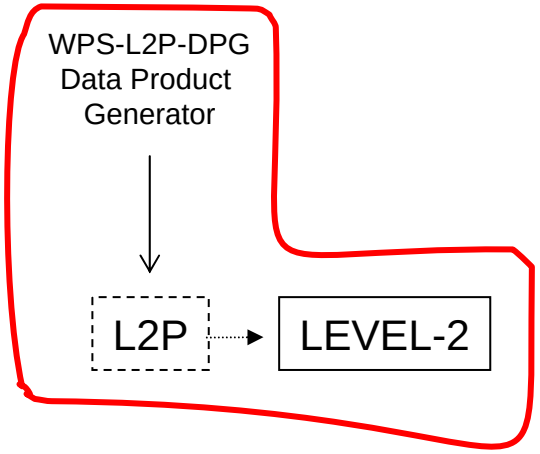
visualization, download

presentation of data

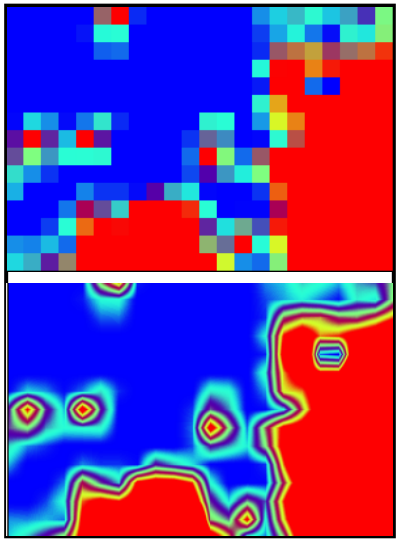
# WPS More Technical – System View



# WPS – Data Product Generator (DPG)




Initial experiments…



…in different views

## Data Products

- Level 2 station data
  timeseries, interpolated and/or flagged data gaps
- Level 2 grid data
  2 interpolated grids (~22kmx15km), using a 10m x 10m DEM
  - Parameters:
    temperature, rel.humidity, precipitation,(…)
  - Coordinate systems and geogr. resolution:
    - UTM: 1km x 1km (22x15km$^2$, WGS84, Zone 33N)
    - GEO: 0.01° x 0.01° (~1.1km lat x 0.7km lon)
  - Altitude options:
    - zTerrain (temperature: also zAvgTerr, z300m)

## Data Types

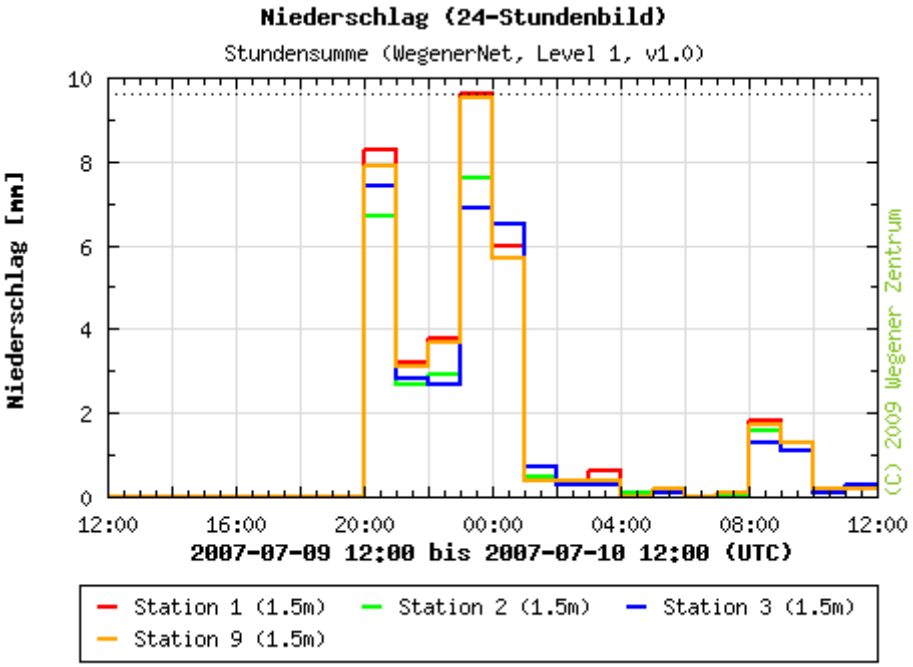
- Basic data (no averaging/summation, raw 5-min resolution)
- (half)hourly/ daily/ monthly/ seasonal/ annual data

# First Results: 1-km & 5-min Resolution – a new look

Two **example cases** with (heavy) rainfall from summers 2007, 2008:

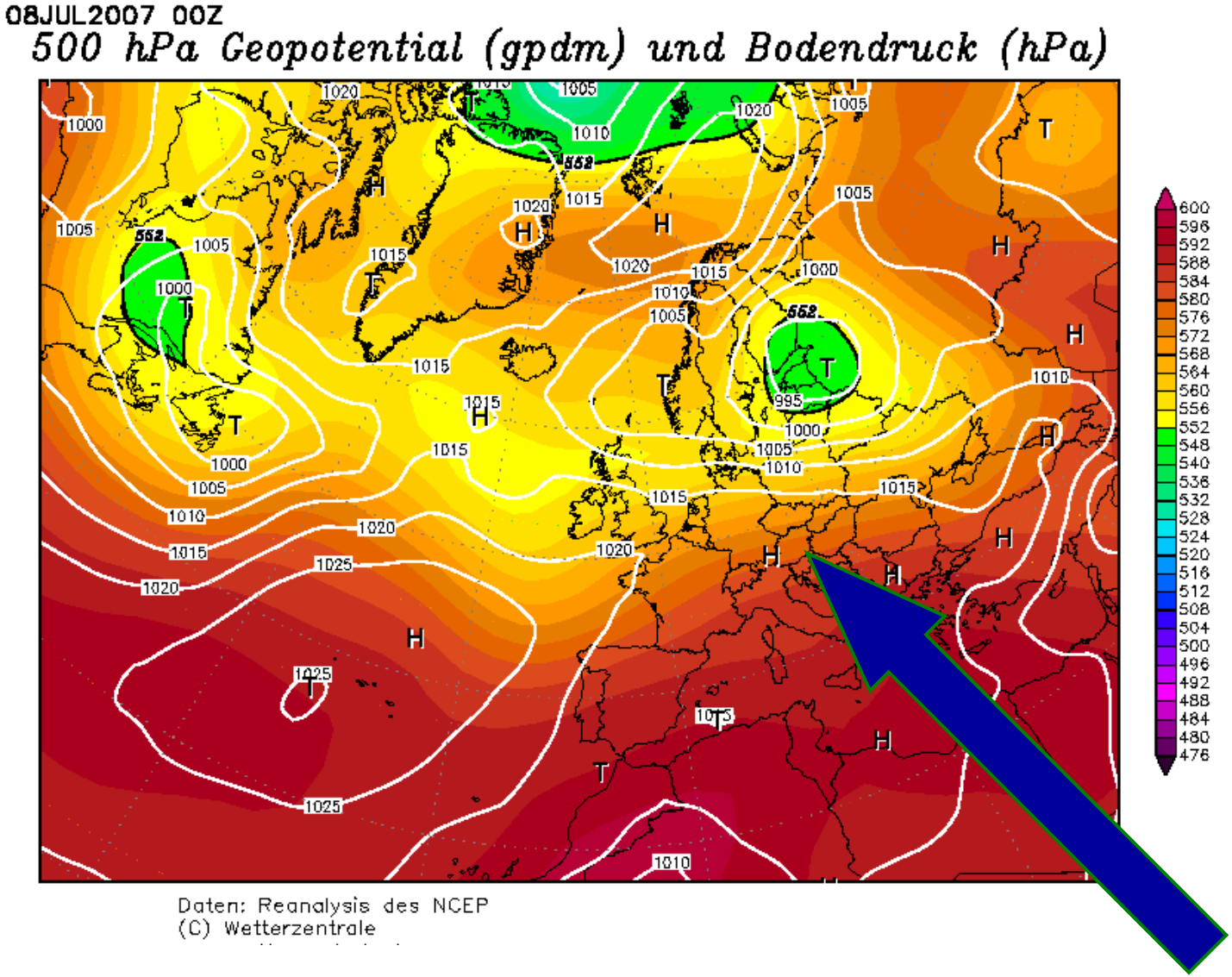
temperature & precipitation shown for

- **9th - 10th July 2007** (focus: heavy precip evening of 9th July)
- **24th June 2008** (focus: heavy precip late afternoon/early evening)



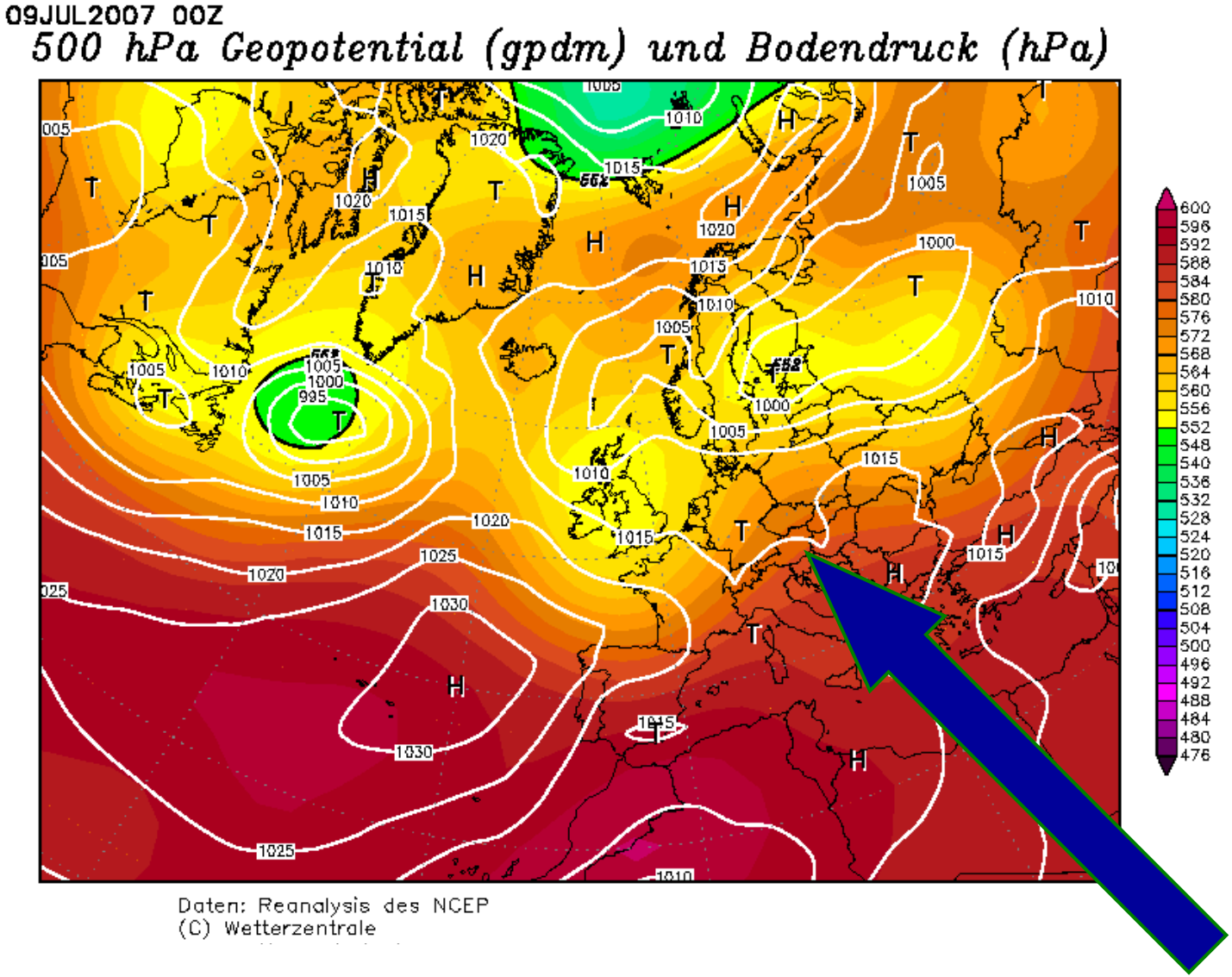
# Example Case 9th - 10th July 2007 – Grosswetterlage

- Geopotential height and surface pressure: **8th July 2007 00:00 UTC**



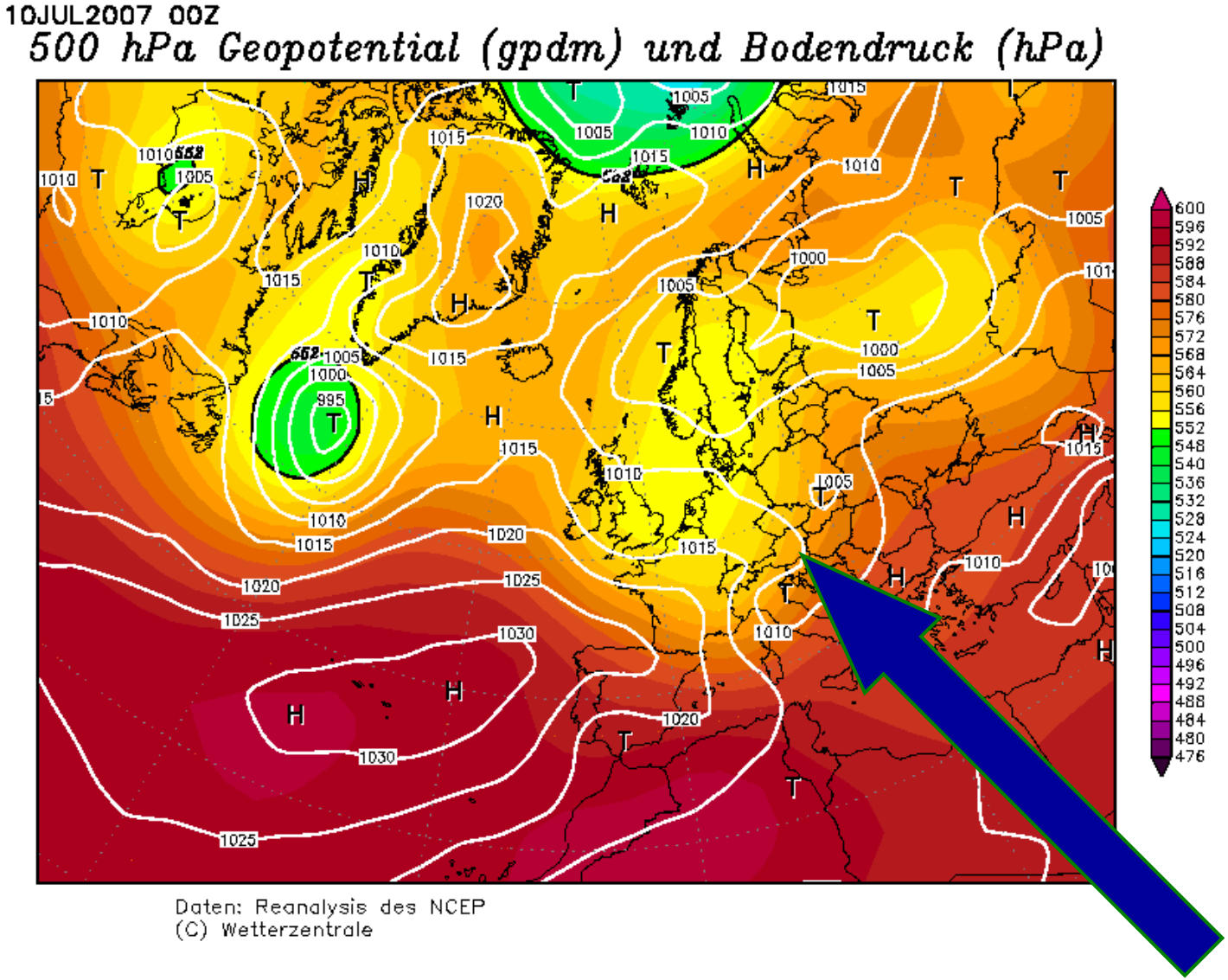
# Example Case 9th - 10th July 2007 – Grosswetterlage

- Geopotential height and surface pressure: **9th July 2007 00:00 UTC**



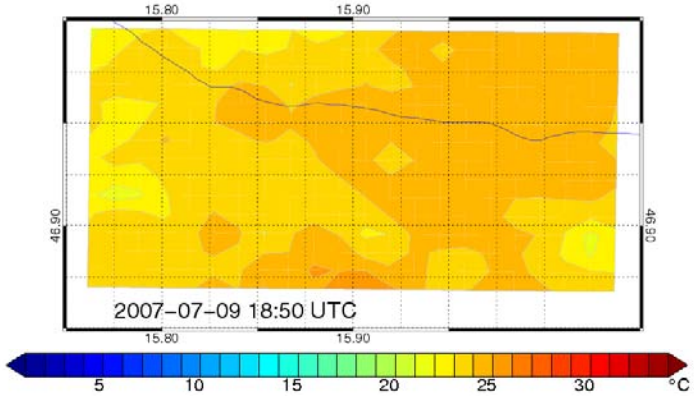
# Example Case 9th - 10th July 2007 – Grosswetterlage

- Geopotential height and surface pressure: **10th July 2007 00:00 UTC**

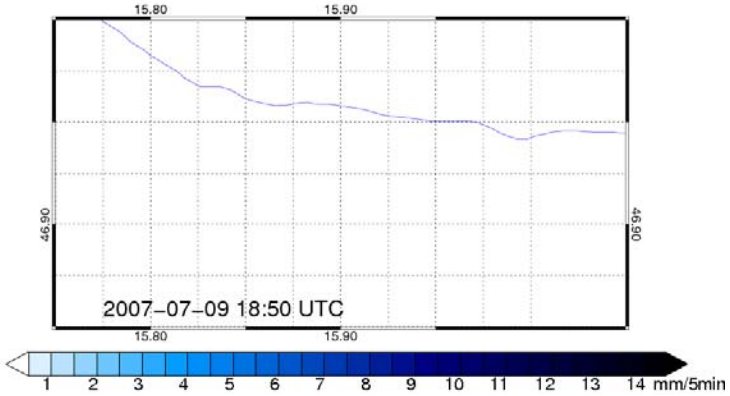


# Example case, 9th July 2007 ~18:50 UTC – a new look

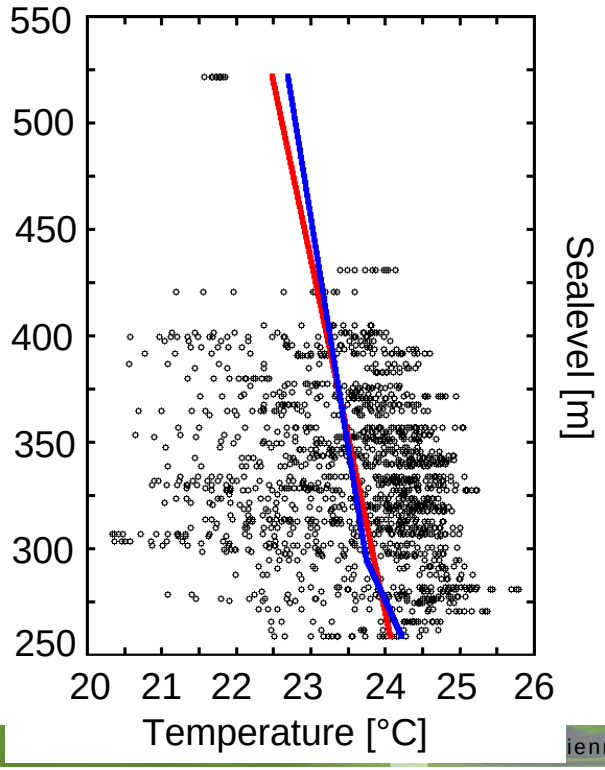
**Temperature** [°C]



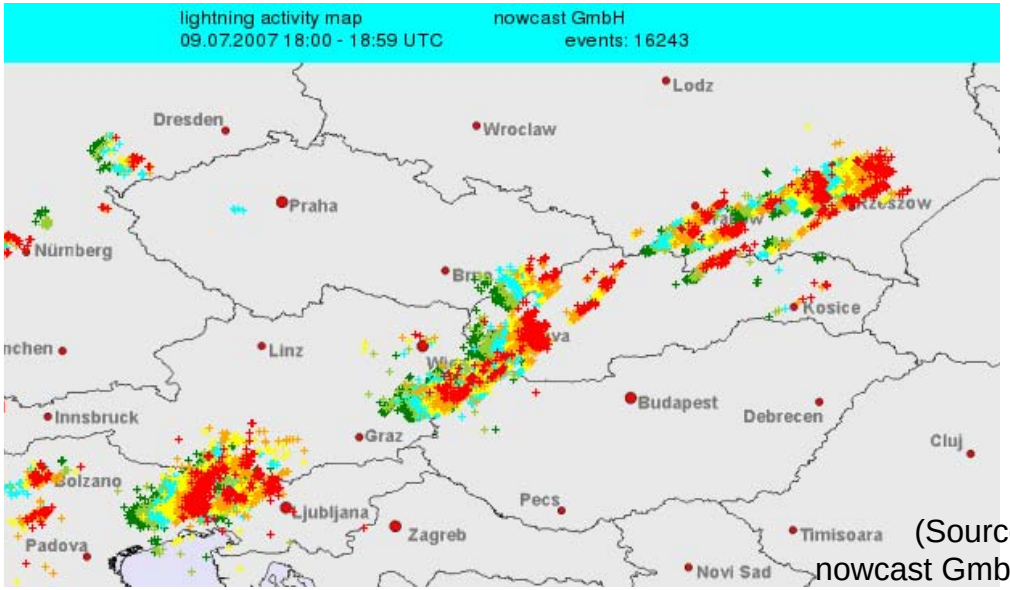

**Precipitation** [mm/5min]




**Temp. lapse rate** 18:50 UTC (±25min)




**LiNet** – lightning acitivity map 18:00–18:59 UTC

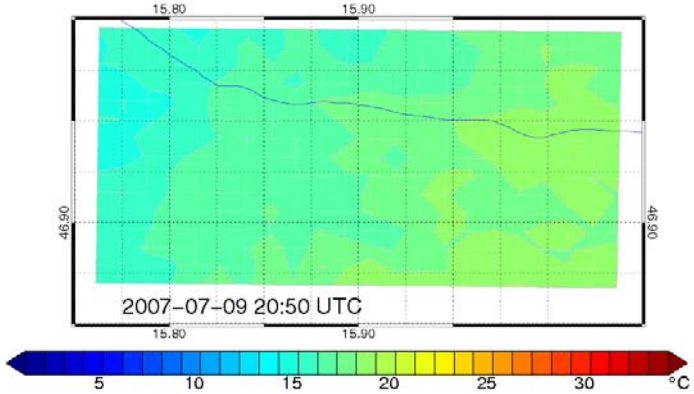



(Source: nowcast GmbH)

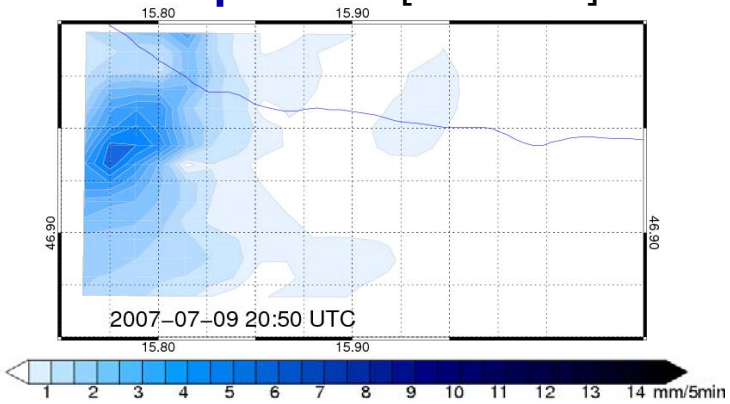
| | | |
|---|---|---|
| 18:50-18:59h | 18:30-18:39h | 18:10-18:19h |
| 18:40-18:49h | 18:20-18:29h | 18:00-18:09h |

# Example case, 9th July 2007 ~20:50 UTC – a new look

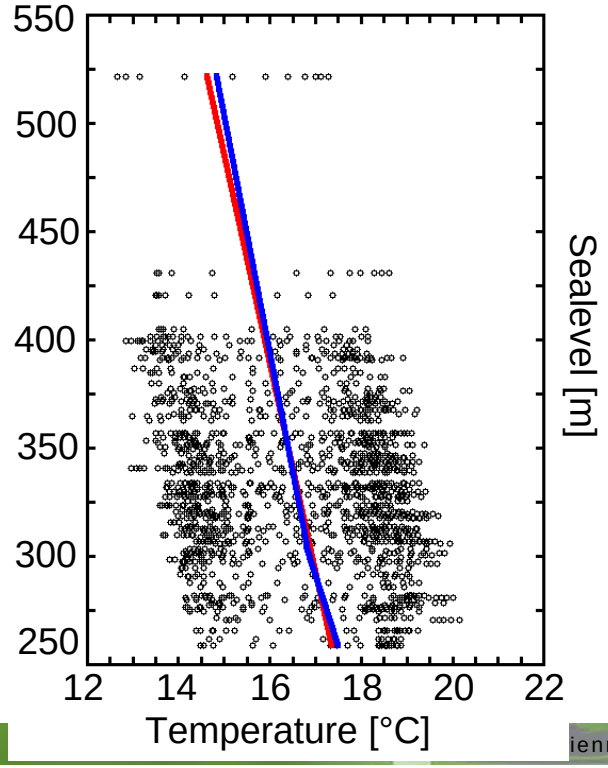
## **Temperature** [°C]



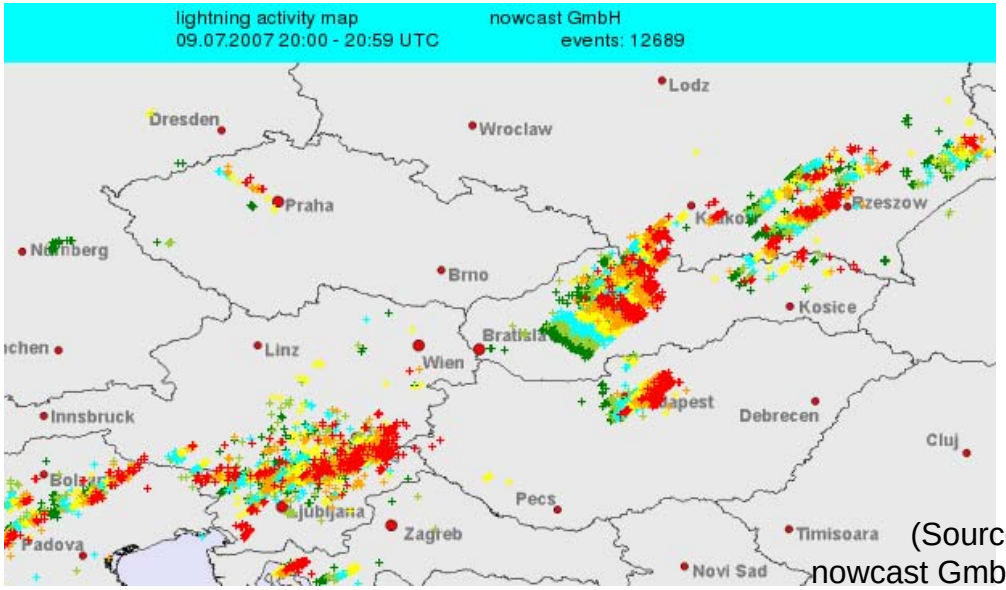

## **Precipitation** [mm/5min]




## **Temp. lapse rate** 20:50 UTC (±25min)




## **LiNet** – lightning acitivity map 20:00–20:59 UTC

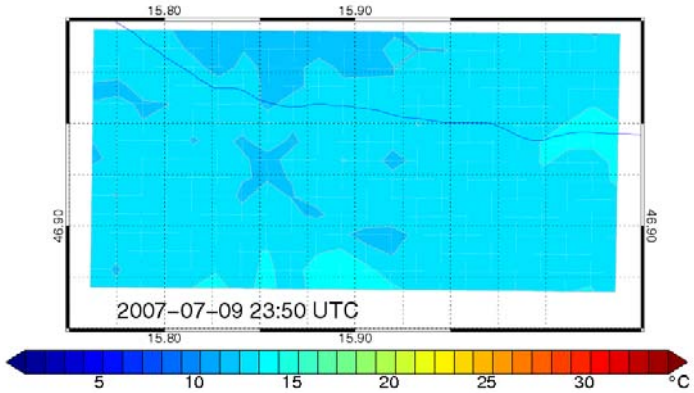



(Source: nowcast GmbH)

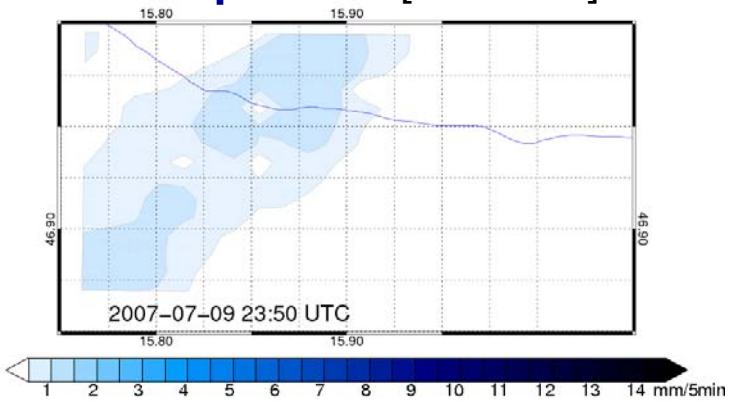
| | | |
|---|---|---|
| **20:50-20:59h** | **20:30-20:39h** | **20:10-20:19h** |
| **20:40-20:49h** | **20:20-20:29h** | **20:00-20:09h** |

# Example case, 9th July 2007 ~23:50 UTC – a new look

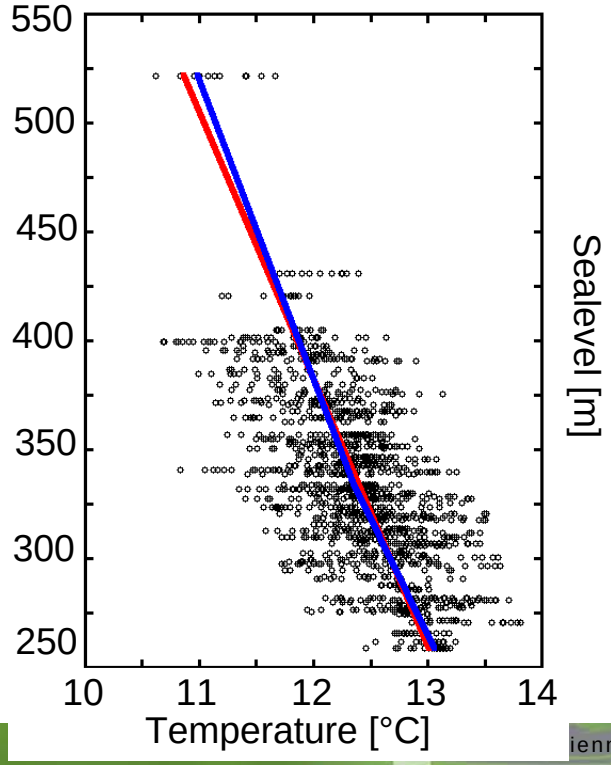
## **Temperature** [°C]



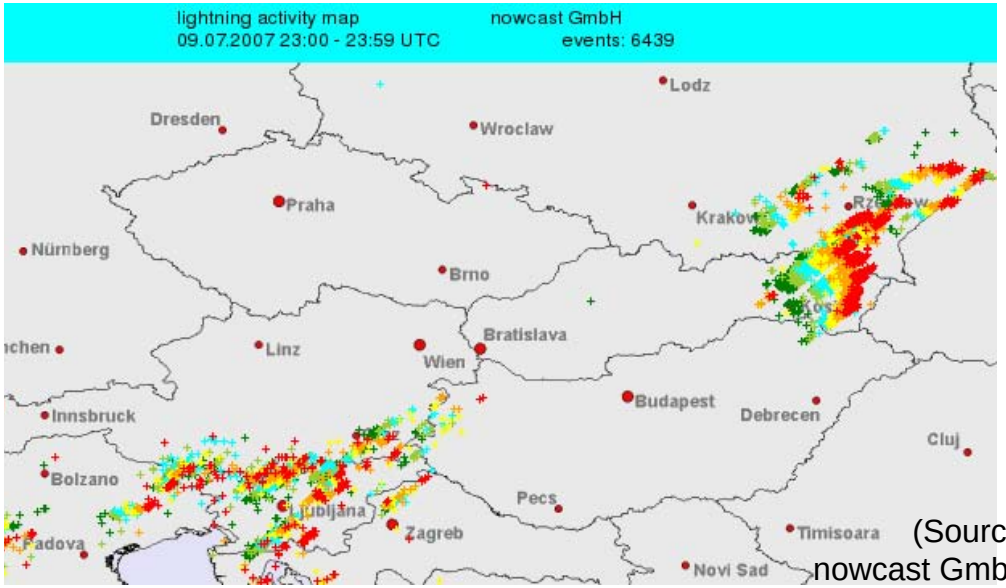

## **Precipitation** [mm/5min]




## **Temp. lapse rate** 23:50 UTC (±25min)




## **LiNet** – lightning acitivity map 23:00–23:59 UTC




(Source: nowcast GmbH)

| | | |
|---|---|---|
| **23:50-23:59h** | **23:30-23:39h** | **23:10-23:19h** |
| **23:40-23:49h** | **23:20-23:29h** | **23:00-23:09h** |

## Temperature [°C] and Precipitation [mm/5min]

**Movie Sequences…**

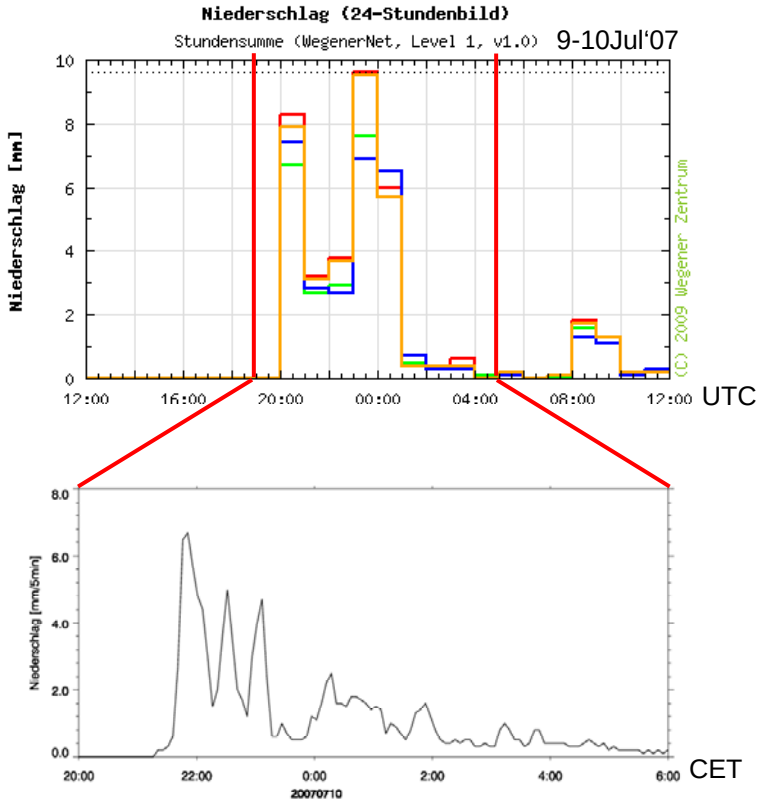
1 km x 1 km UTM Grid,
22 km x 15 km WegenerNet Area,
5-min Basic Data Time Steps

- **9th - 10th July 2007**

  (focus: evening of 9th July)

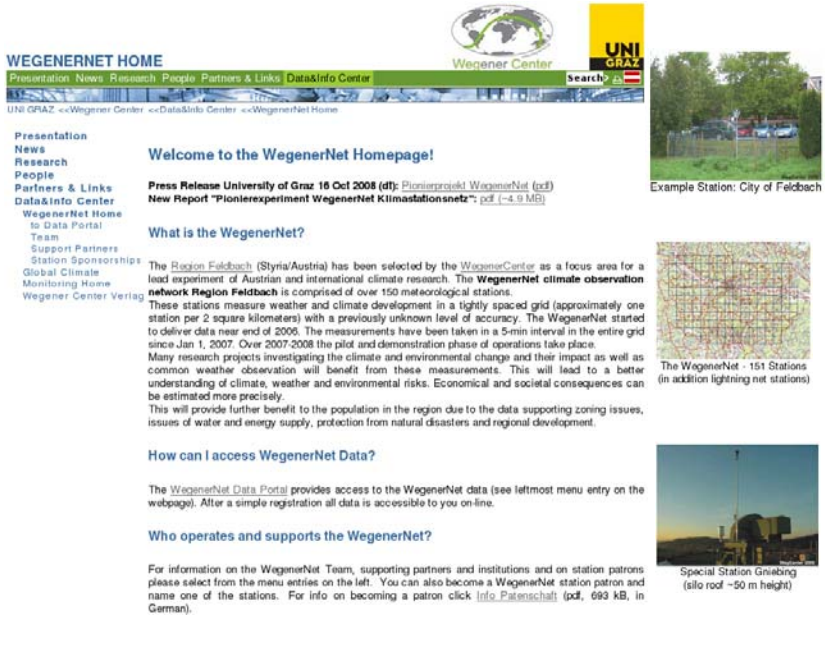
- **24th June 2008**

  (focus: late afternoon/early evening)



# WegenerNet Web and Data Portal – Welcome!

## http://www.wegcenter.at/wegenernet – WegenerNet Homepage





Example Station: City of Feldbach


The WegenerNet - 151 Stations
(in addition lightning net stations)


Special Station Gnieb ing
(silo roof ~50 m height)

**Detailed information - an unique climate observation network**

The following documents and presentations about the WegenerNet provide a detailed overview and insight:
(pdf files need AcrobatReader5 or higher. if needed download here)

*In English:*

**WegenerNet: A new climate station network in Eastern Styria/Austria for monitoring weather and climate at 1 km-scale resolution** (pdf, ~4.7 MB)
(research presentation on the WegenerNet; EGU Meeting 2008, Vienna, Austria)

*In German (or mostly in German):*

**The WegenerNet - General Information Sheet** (pdf, 156 kB; in German)
(overview, 3 pages)

**The WegenerNet Station Info Panel** (pdf, 166 kB; in German)
(short info: station panel, mounted at each station)

**The WegenerNet Data Fact Sheet** (pdf, 25 kB; in German)
(facts about station network, data, data availability, sensor system, general status of network)

**The WegenerNet Data Portal User Guide** (pdf, ~1.4 MB; in German)
(user guide/description for use of the WegenerNet Data Portal)

**WegenerNet Short Presentation** (pdf, ~2,4 MB; in German)
(short illustrated overview, 12 pages)

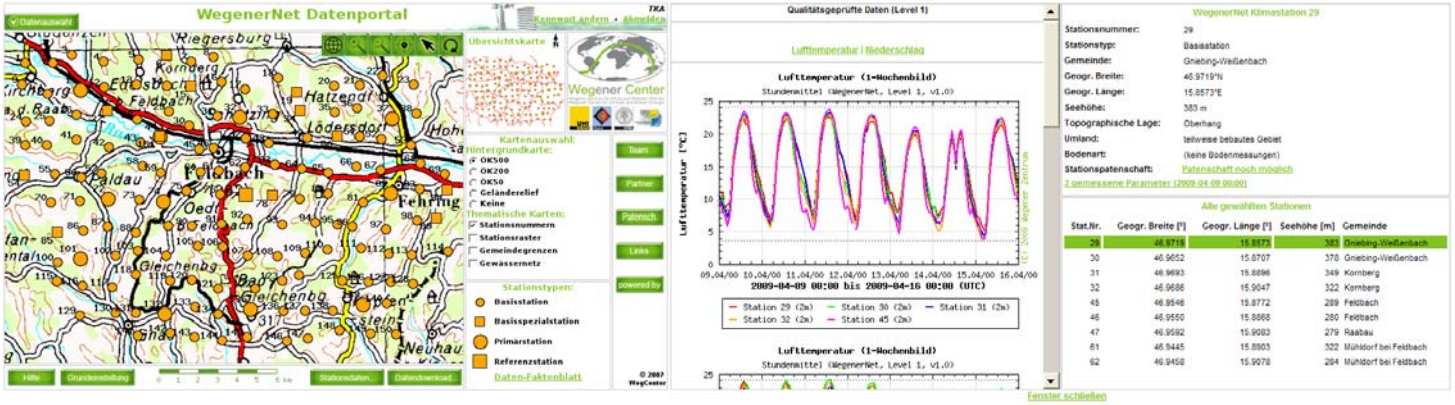
**The WegenerNet - Overview and Construction Work** (pdf, ~5,5 MB; in German)
(detailed presentation, on the occasion of WegenerNet opening event in Feldbach, Oct06)

**The WegenerNet - Scientific Importance and Utility for the Region** (pdf, ~2,6 MB; in German)
(detailed presentation, on the occasion of WegenerNet opening event in Feldbach, Oct06)

**The WegenerNet - Status und Utilization** (pdf, ~3,8 MB; in German)
(detailed presentation, on the occasion of the information evening in Feldbach, Nov07)

**Regional Climate Research at the Wegener Center - Focus South-Eastern Styria** (pdf, ~4,2 MB; mostly in German)
(research presentation with relation to WegenerNet, on the occasion of the information evening in Feldbach, Nov07)

**The WegenerNet - From Data to Exciting Studies** (pdf, ~10,6 MB)
(research presentation about and around the WegenerNet, on the occasion of the information evening in Feldbach, Nov08)

(use of documentation and presentation material is allowed if source is properly cited:
minimal citation: WegenerNet-Wegener Center. <Year>: e.g., WegenerNet-Wegener Center, 2007)

## http://www.wegenernet.org – WegenerNet Data Portal