# Convection in the Alps

***Liliane Hofer***

***Andreas Wirth***

*Vera Meyer*

*Christian Ortner*

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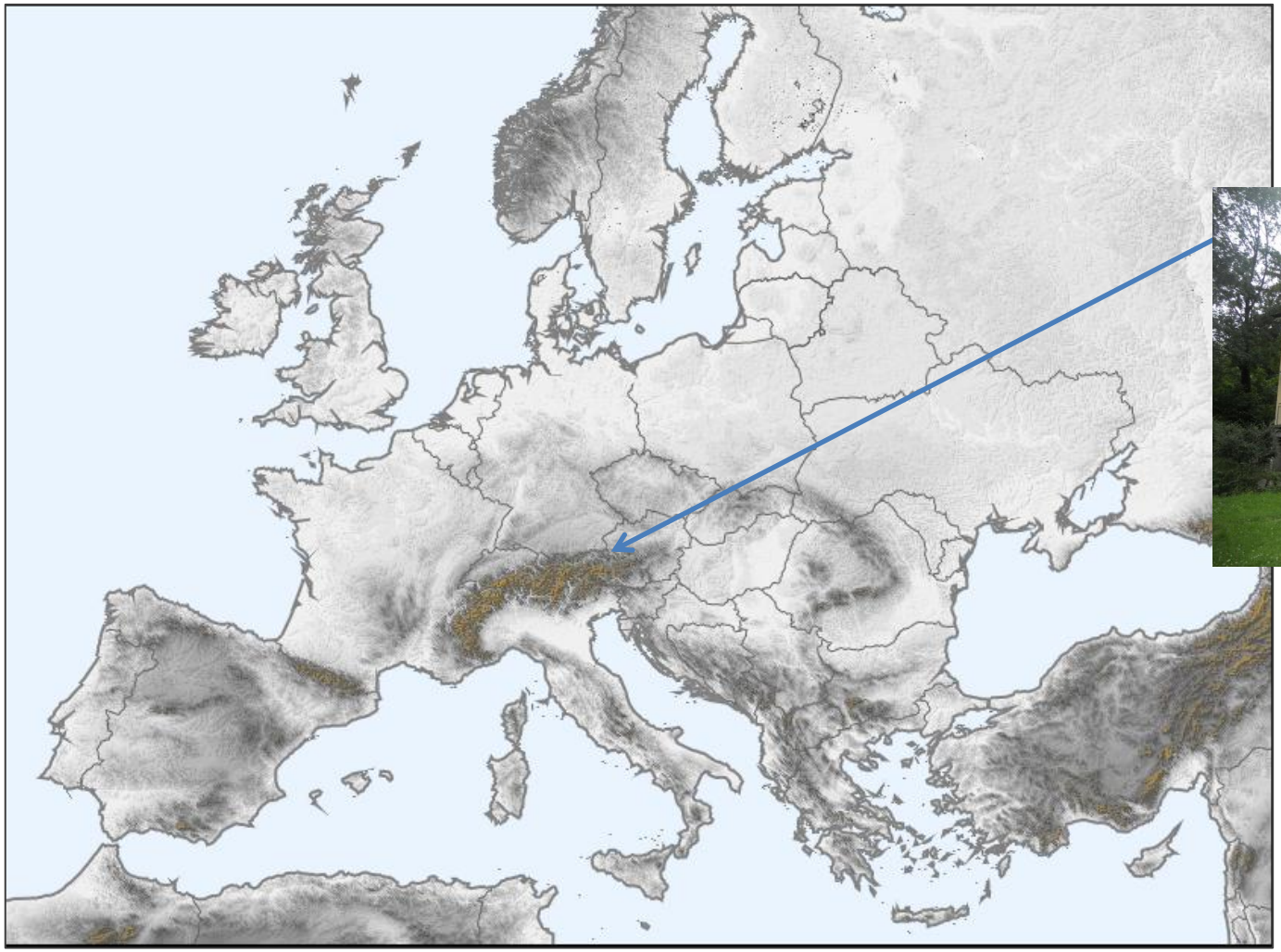
# To begin with…



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# „The hills are alive with the sound of ~~music~~“ thunder

## ALPINE PUMPING

Definition: differential heating between mountain ridges and the adjacent foreland – a circulation pattern transporting mass, heat and moisture


Requirements:

- high solar radiation
- weak synoptic pressure gradient

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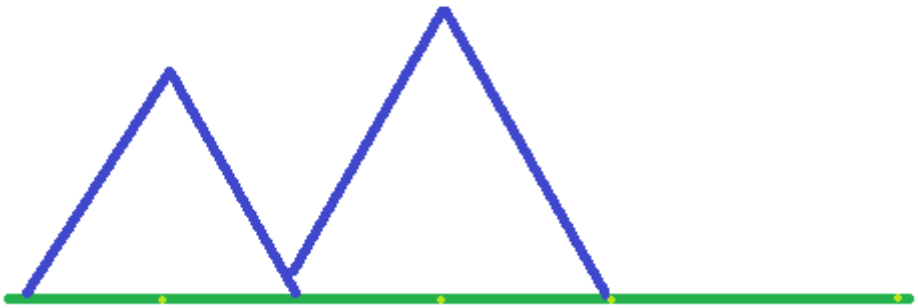
# „Alpine Pumping“

## Effects leading to Alpine Pumping:

**Radiative energy is the driving force!**

- air column has a lower volume over valley locations

  => faster warming
- increased heating surface
- lower pressure in higher regions – smaller air mass has to be heated
- faster cooling during the night



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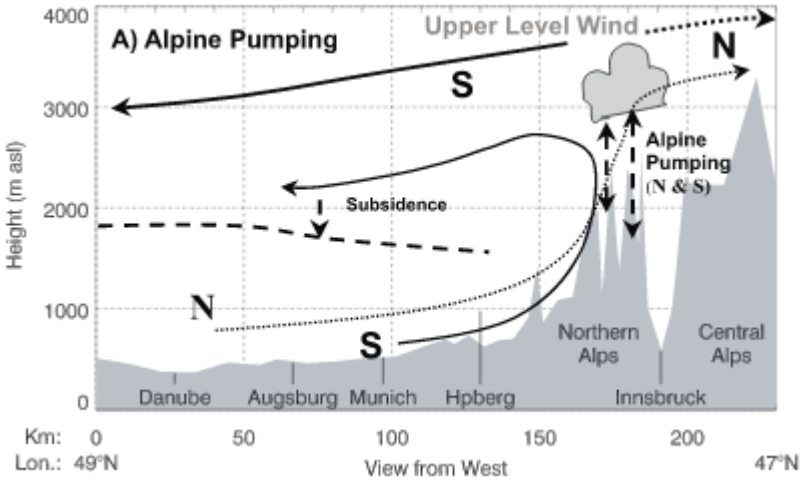
# „Alpine Pumping“

## Influences affecting the formation of Alpine Pumping:

- weather conditions

  => northerly/southerly airflow,…
- atmospheric stability
- snow cover in higher regions
- synoptic pressure gradient




from Lugauer et al. (2005)

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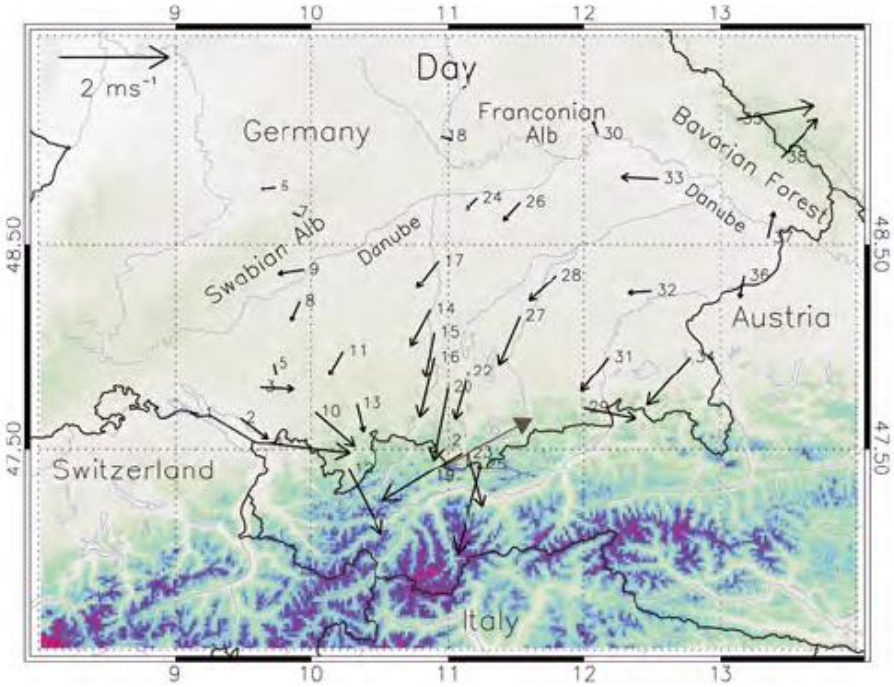
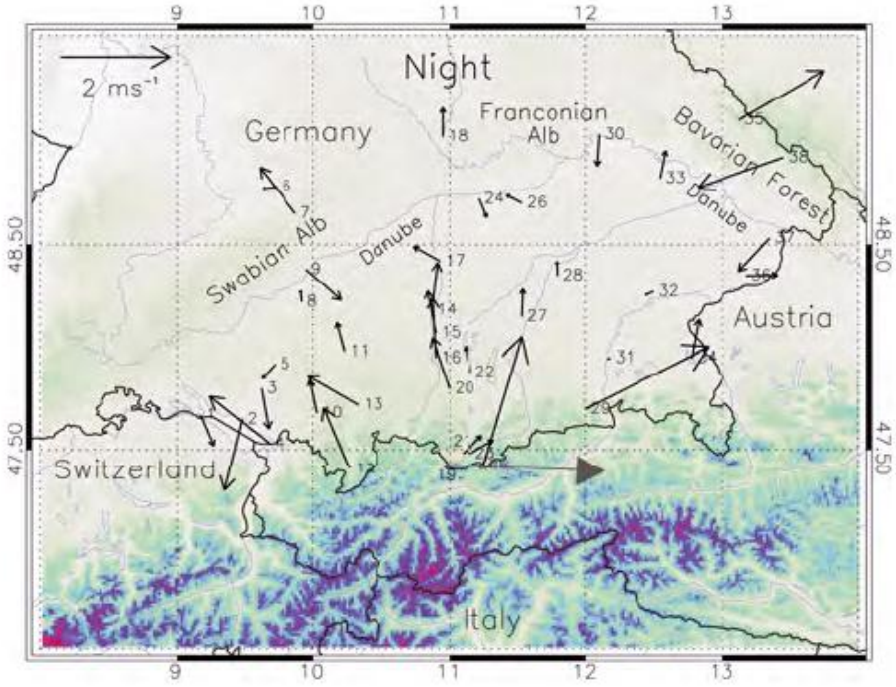
# „Alpine Pumping“

**Diurnal cycle – mean surface wind (1996 – 2000, daily global radiation > 20 MJ/m²)**




8-20 CET




20-8 CET

from Lugauer et al. (2005)

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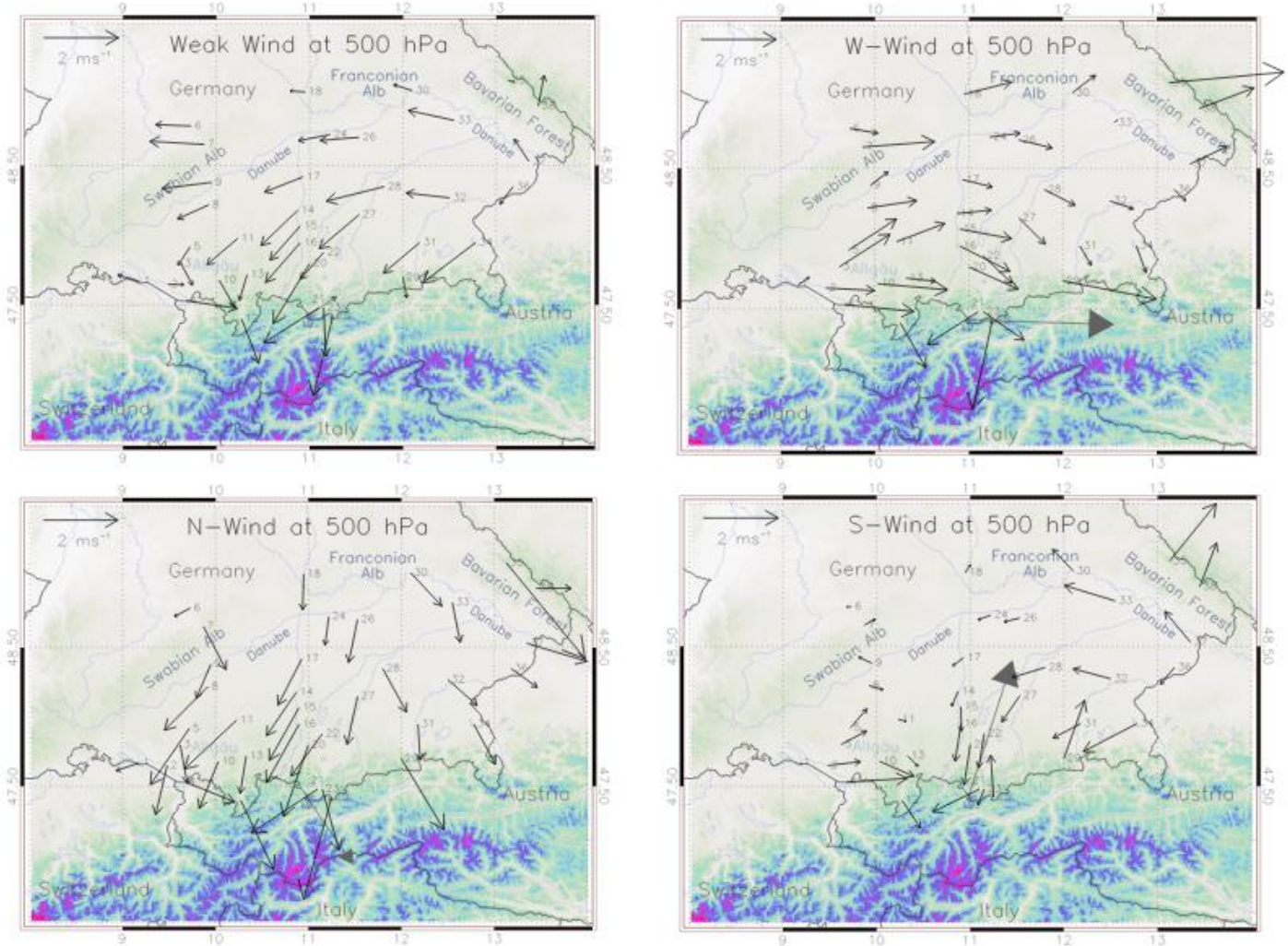
# „Alpine Pumping“

## Different weather patterns – mean surface wind




8-20 CET

from Lugauer et al. (2005)

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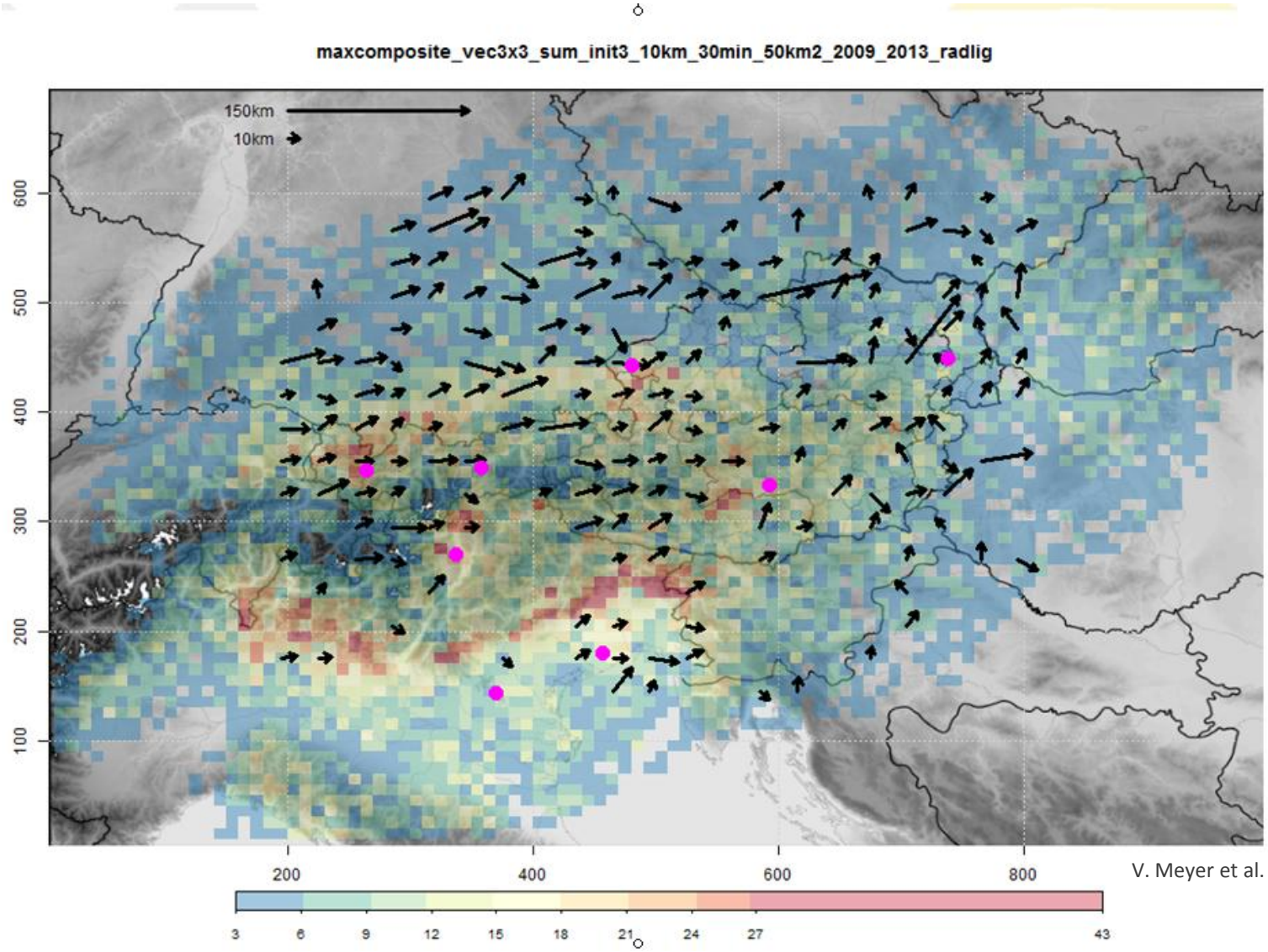
# „Thunderstorm climatology“




V. Meyer et al.

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# Ingredients for thunderstorms… (3+1)

radar
MSG
lifting
*radio-sounding*
derecho
dynamics
*rain*
hodograph
sunshine
***tornado***
moisture
downburst
forecasters
HR-VIS


instability
**halo**
orography
EUMeTrain
**mountains**
***cumulonimbus***
*overshooting tops*
CAPE
isotachs
**convection**
lightning
storm chaser
wind shear
tropopause
clouds
**hail**
*MTG*
**flash flood**
**vorticity**
*rainbow*
bow echo
equivalent thickness
*thunder*
NWCSAF
weather
**snow**
sleet
satellite images

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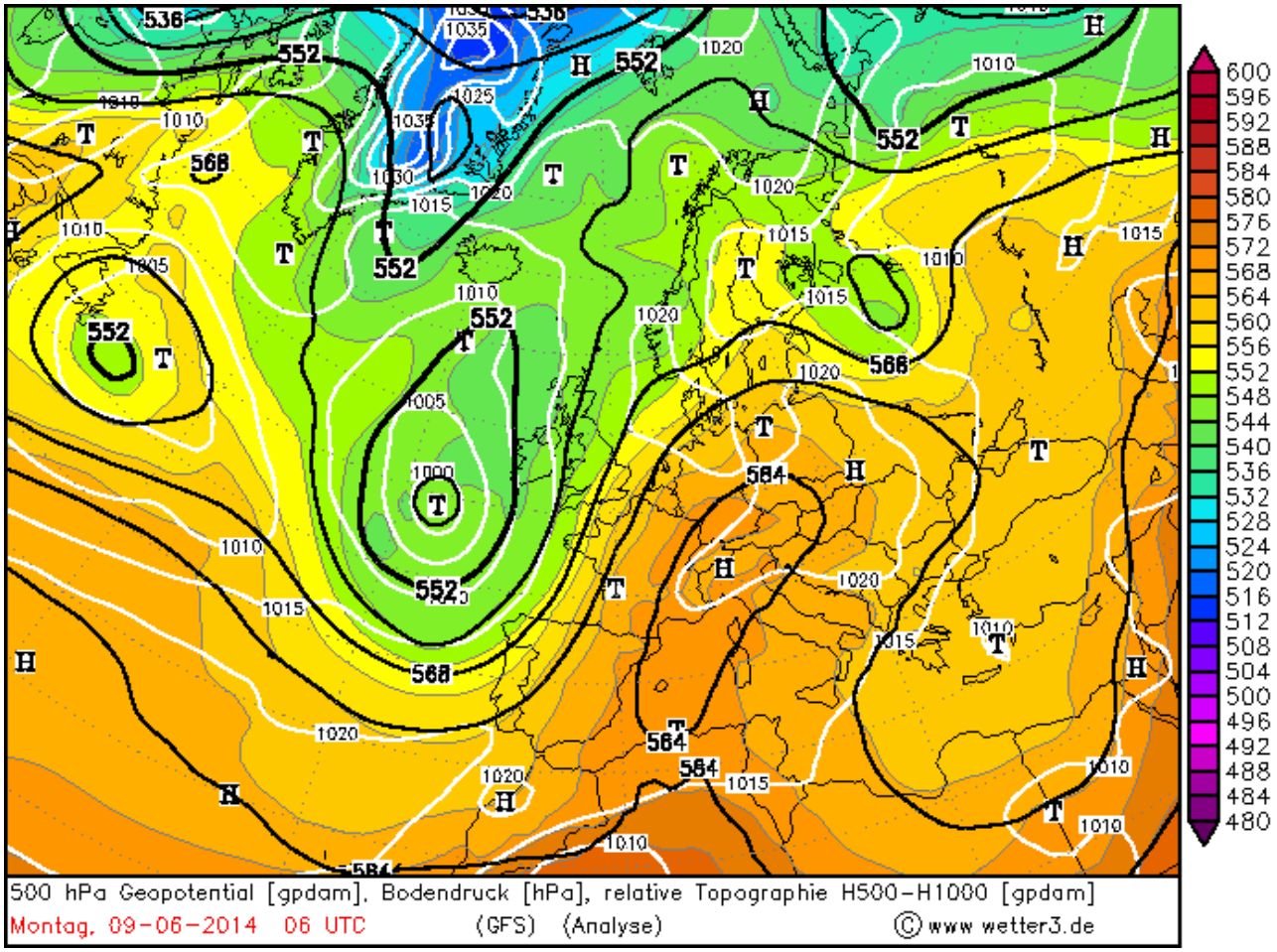
# Case study - 9 June 2014

Geopotential 500 hPa / MSLP / Equivalent thickness (500-1000)

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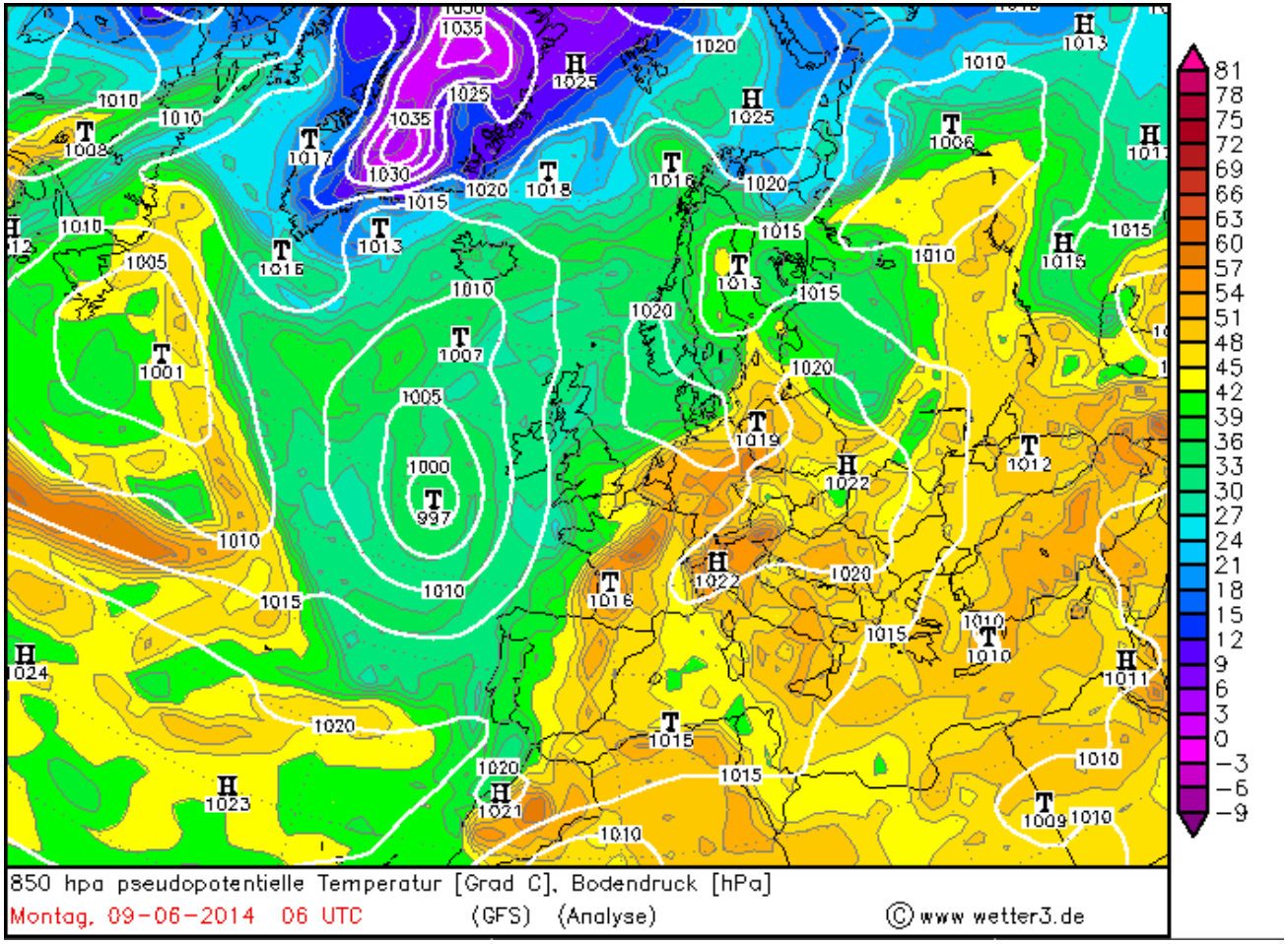
$\Theta_e$ 850 hPa

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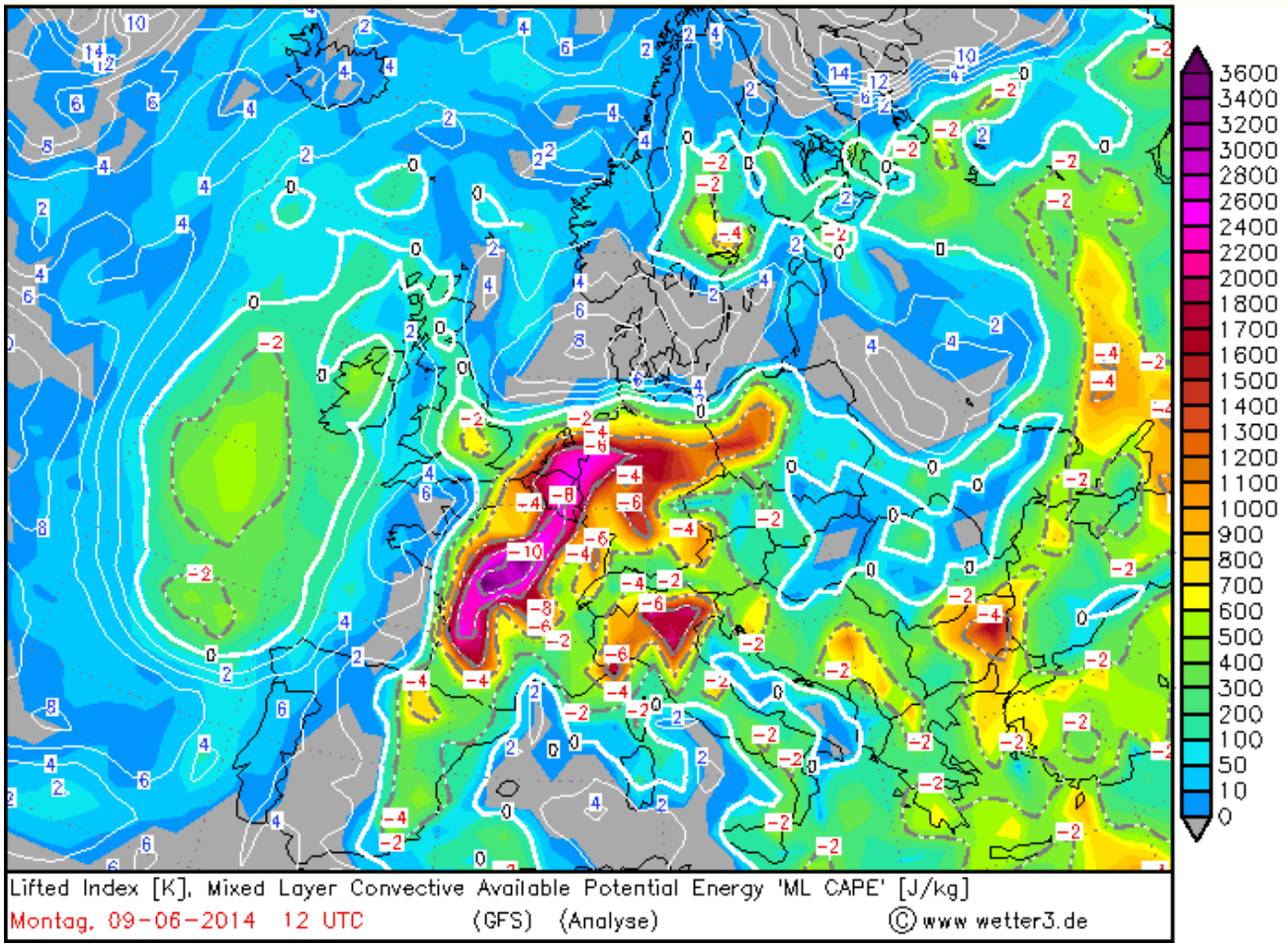
Lifted Index / CAPE




Lifted Index: LI = T(500) – T(parcel)

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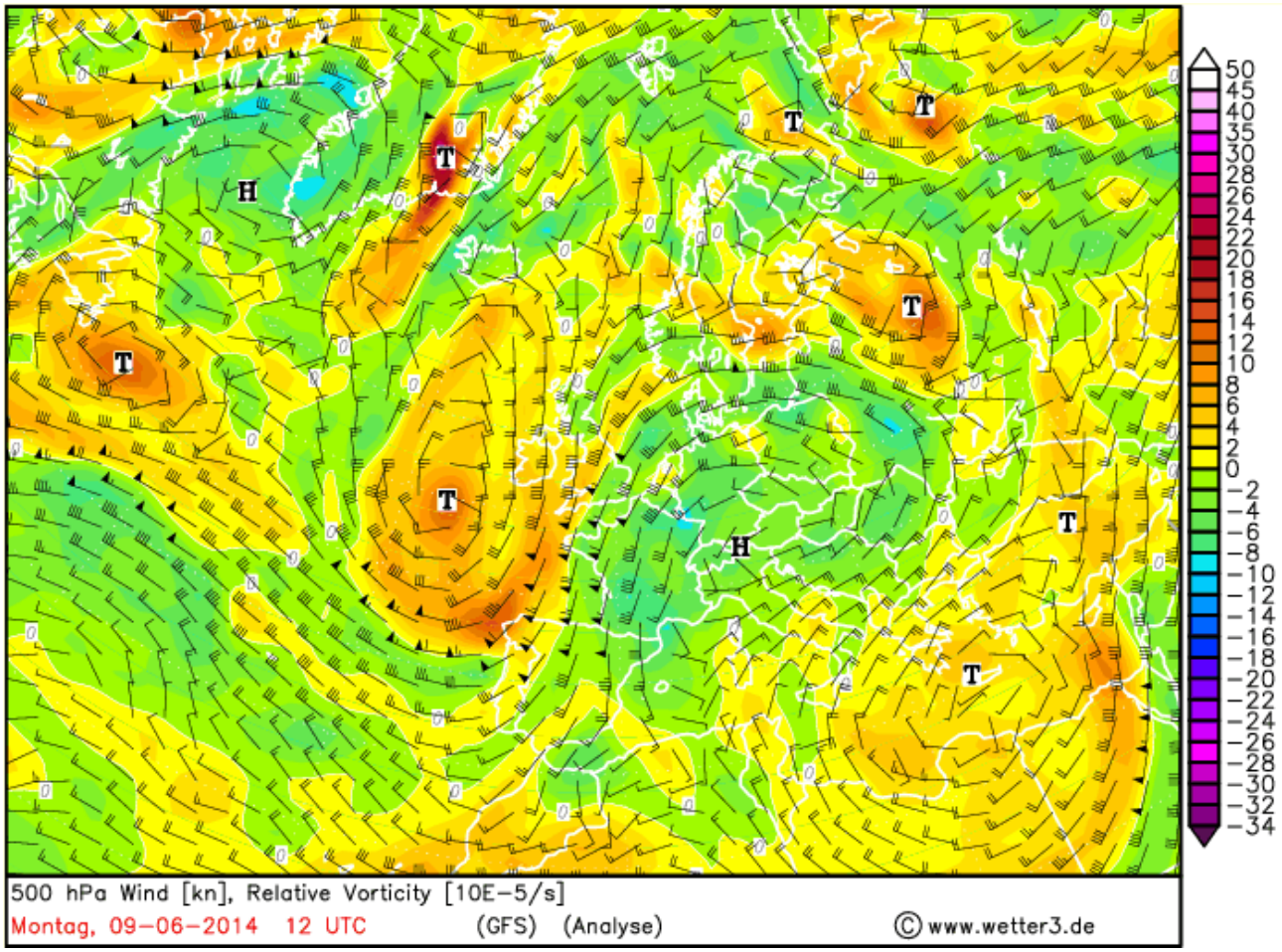


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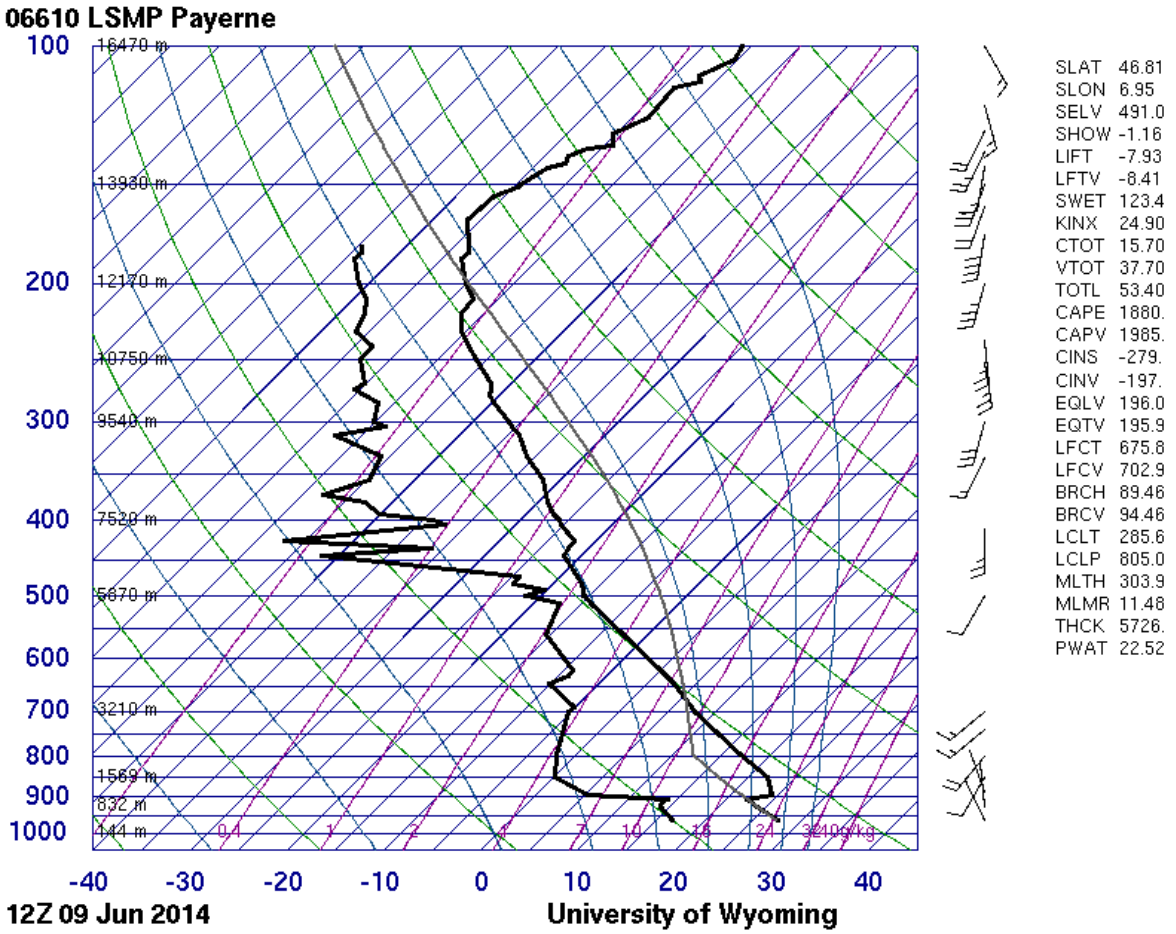


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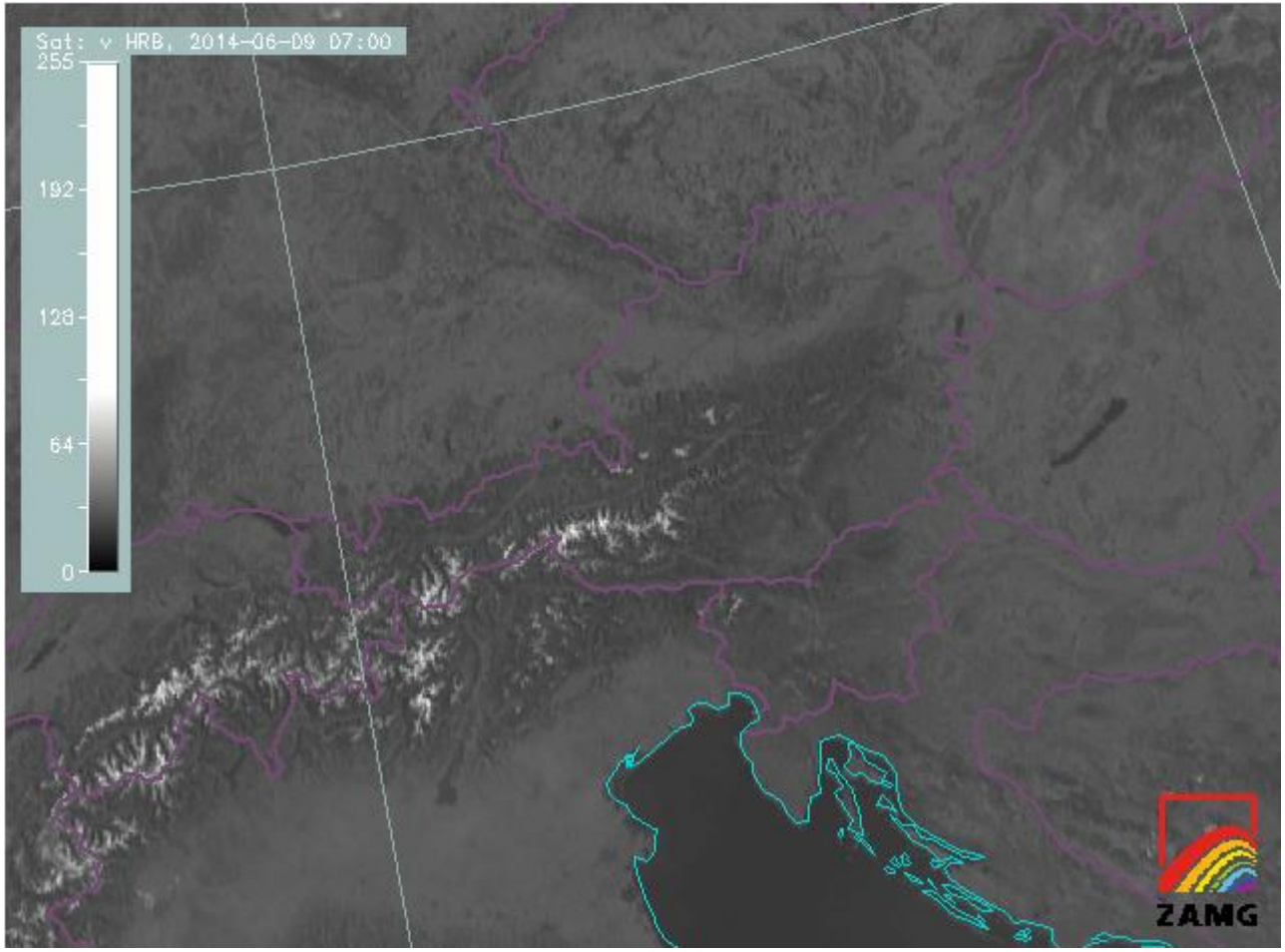


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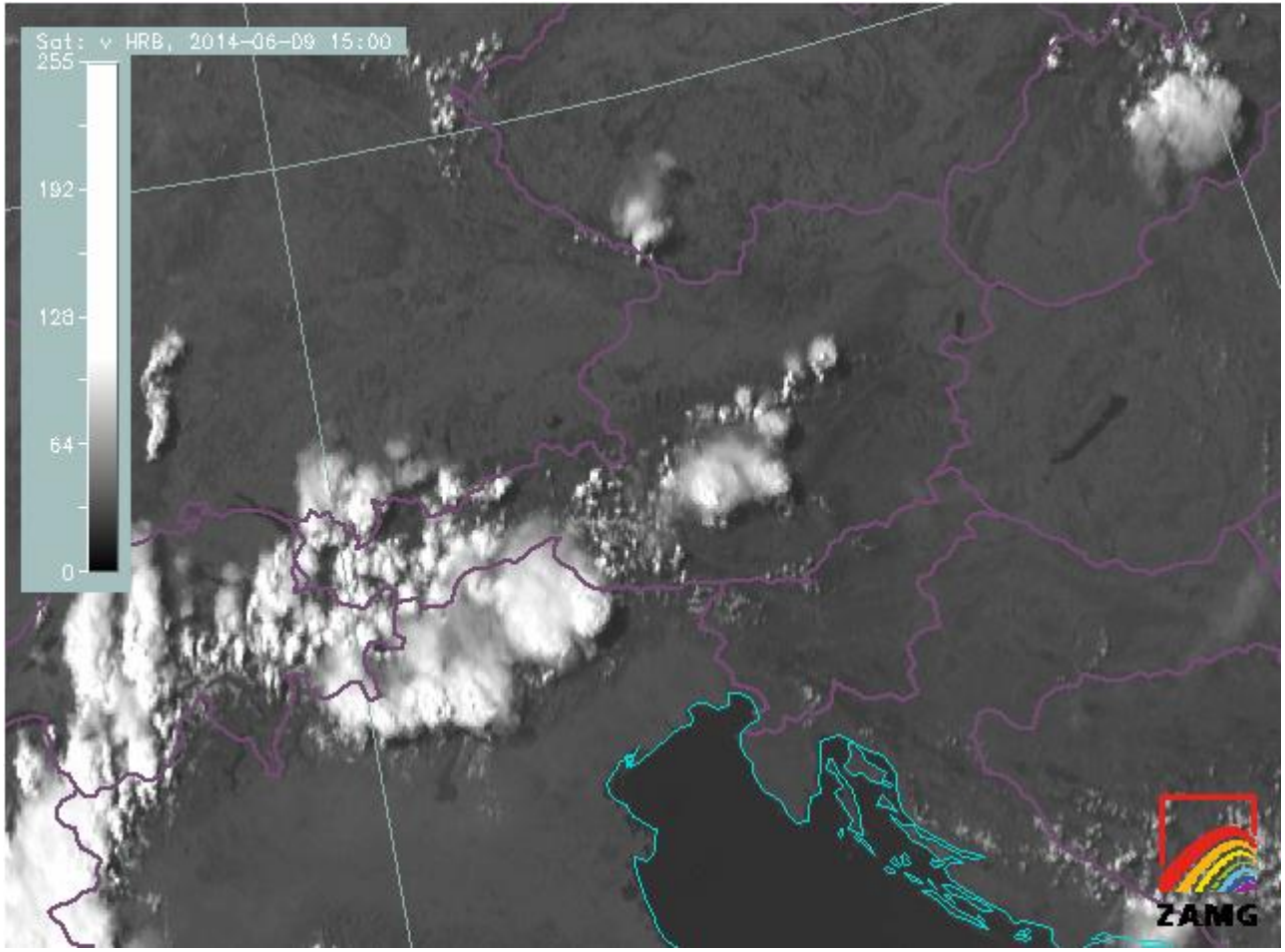


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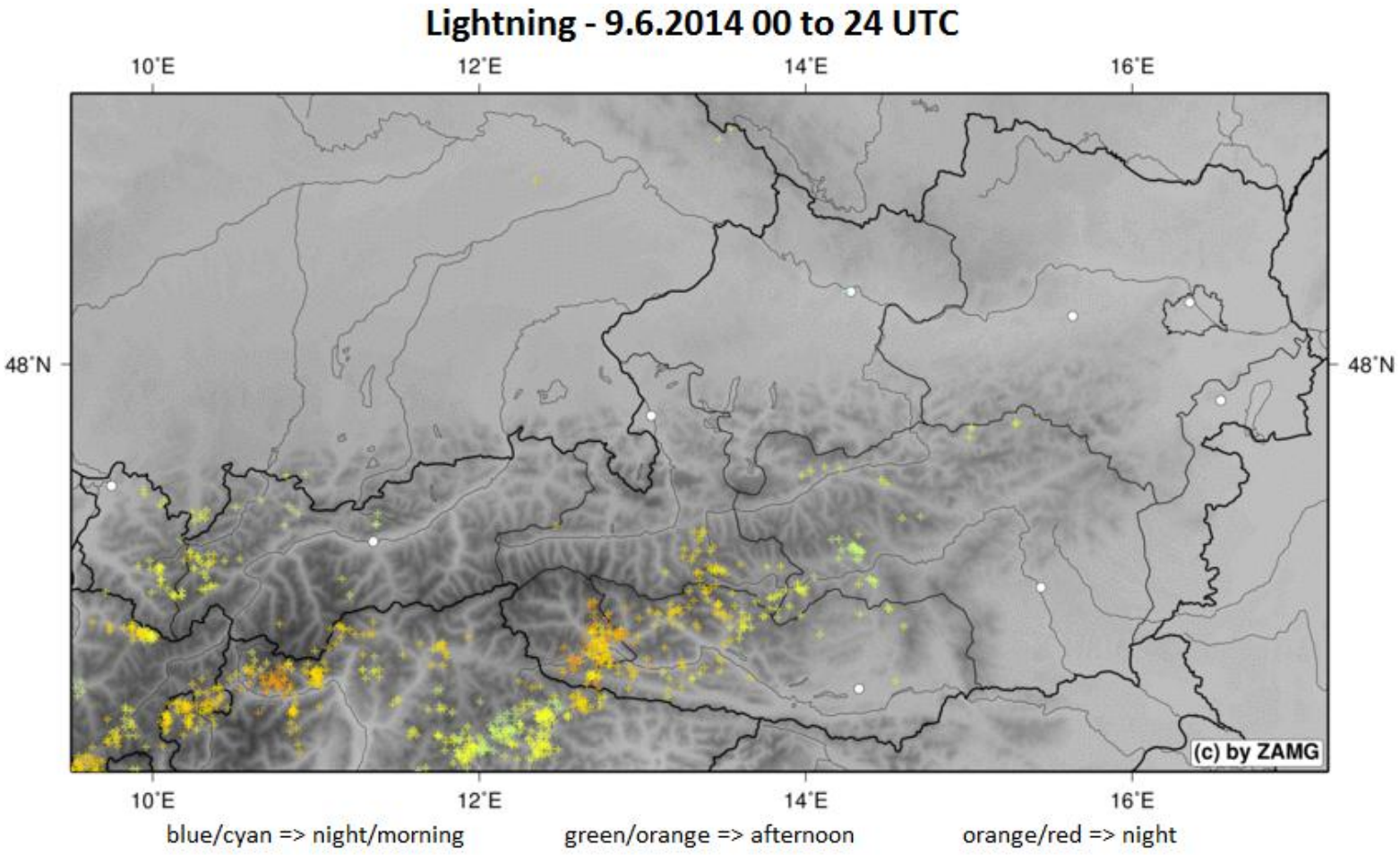


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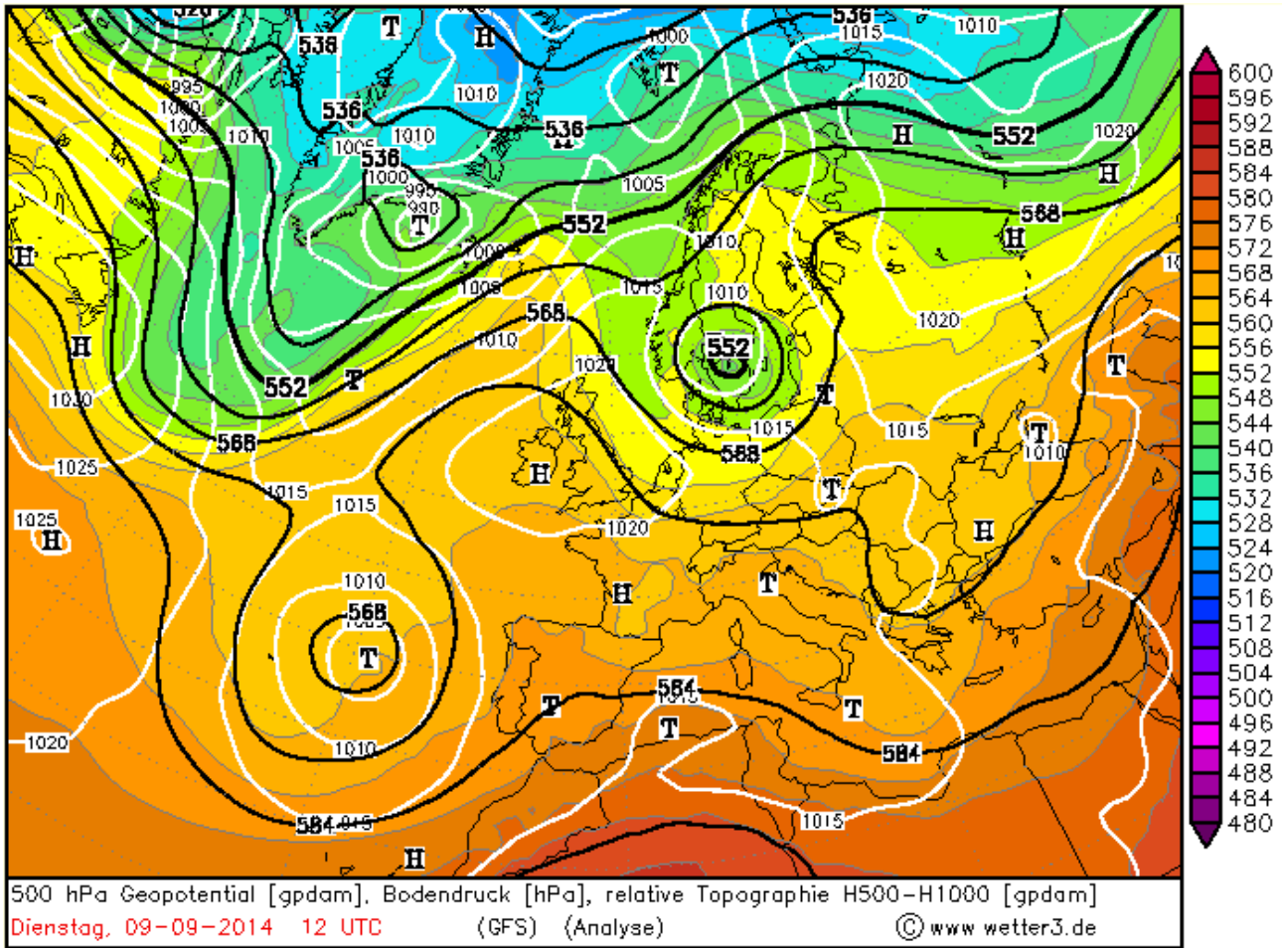


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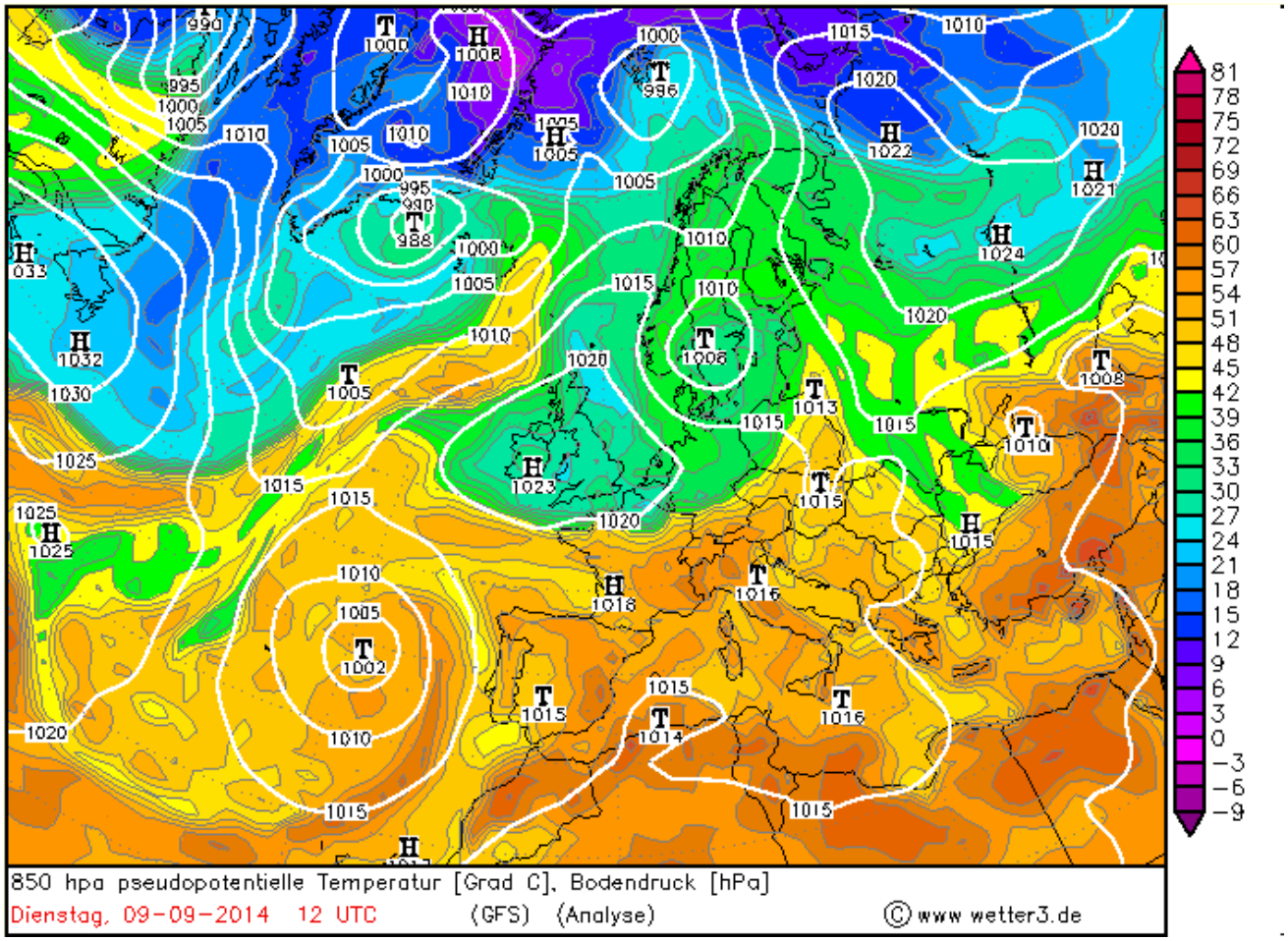


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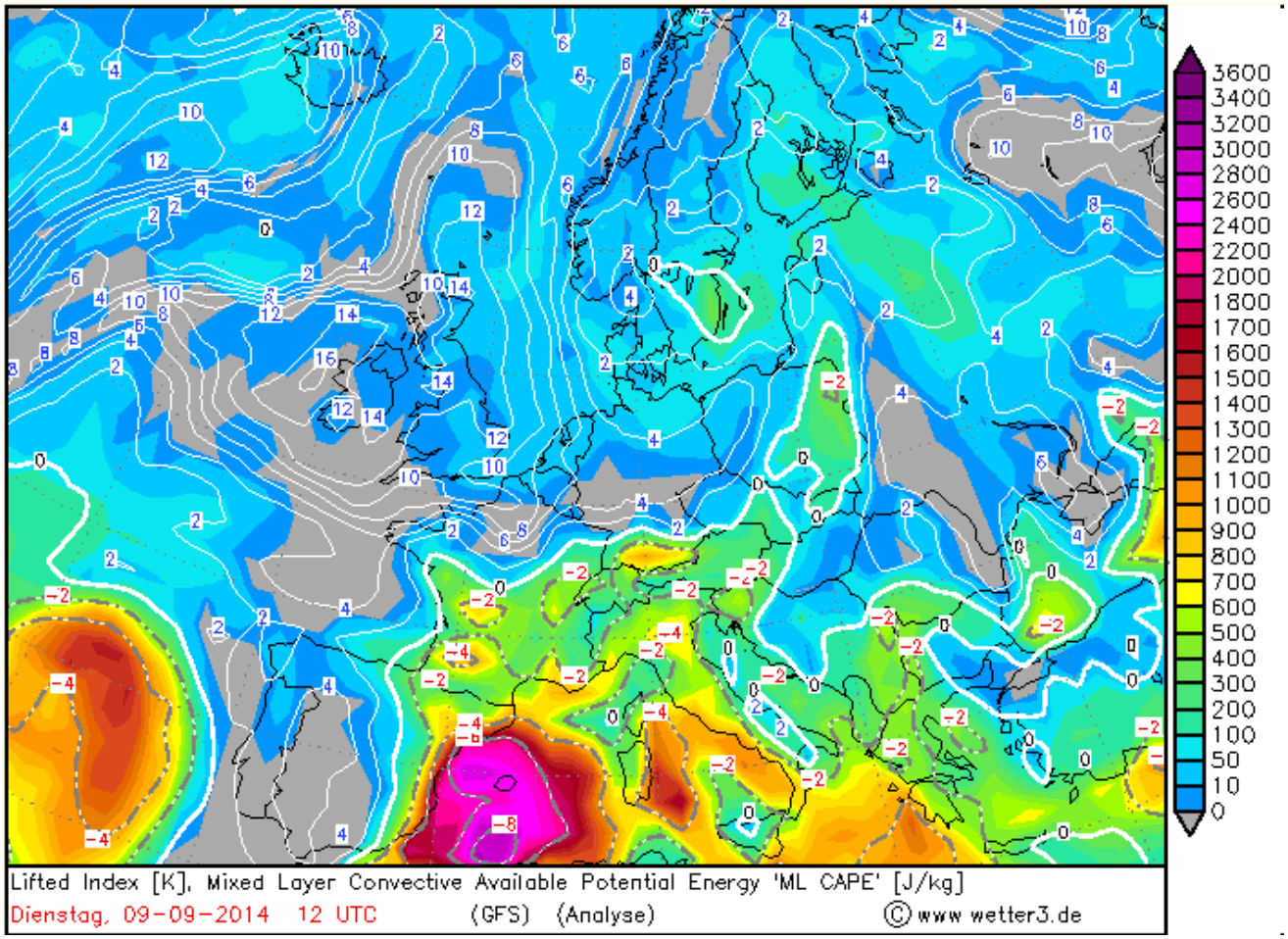


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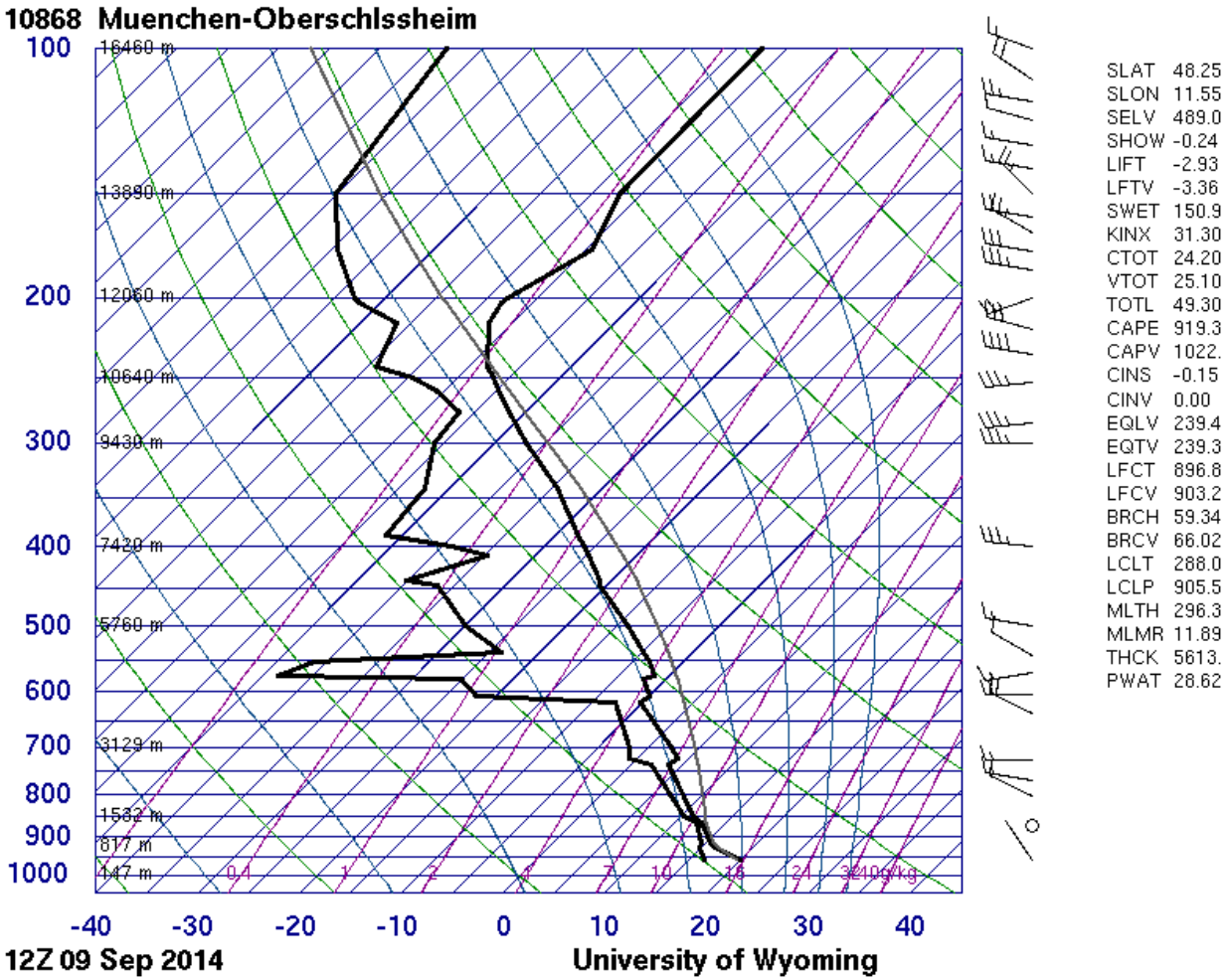


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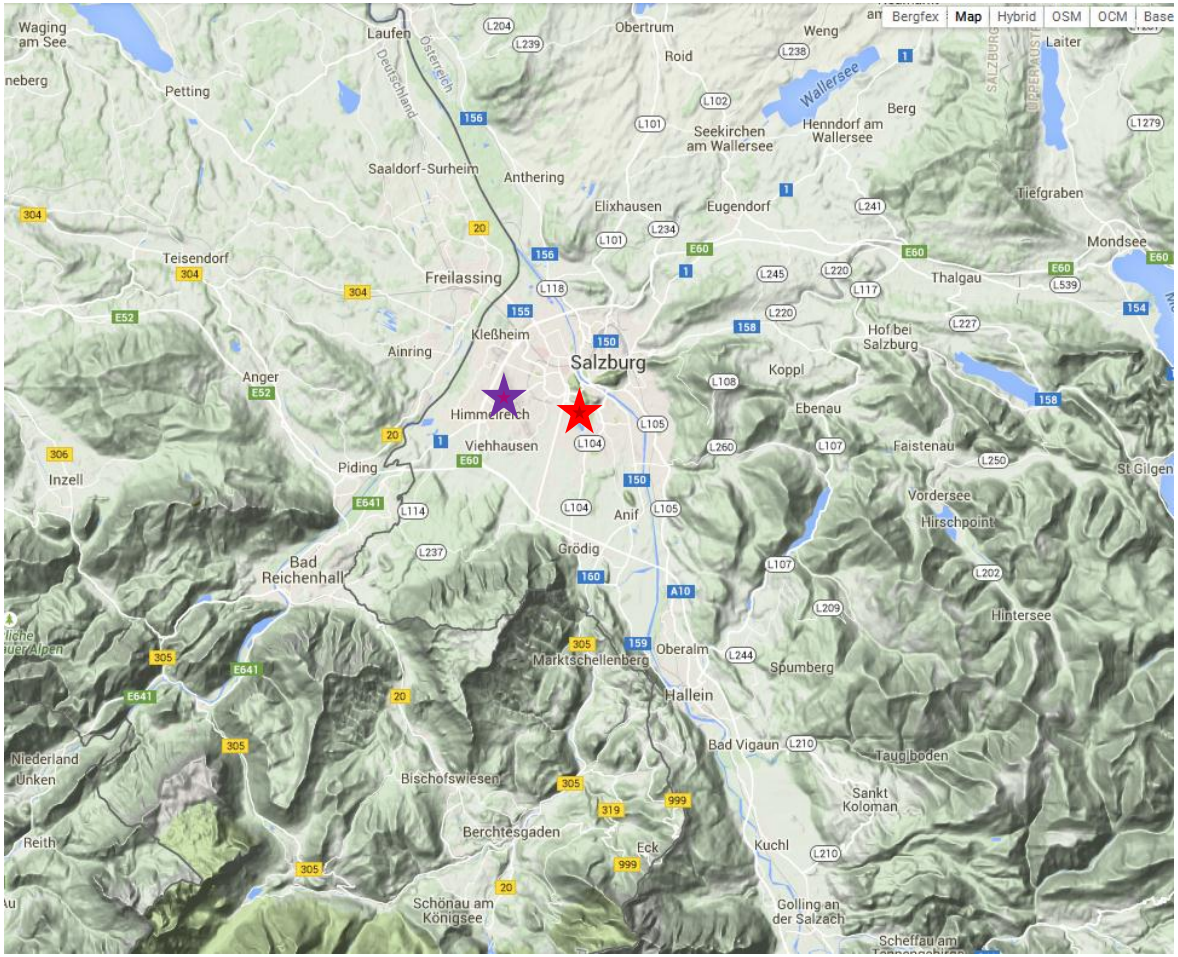


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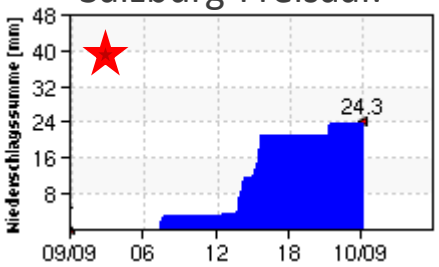
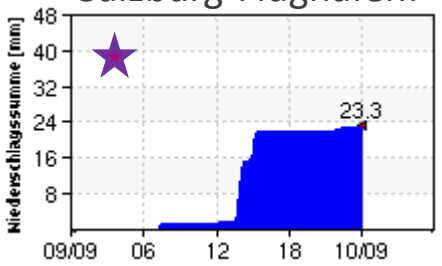



Salzburg-Flughafen:

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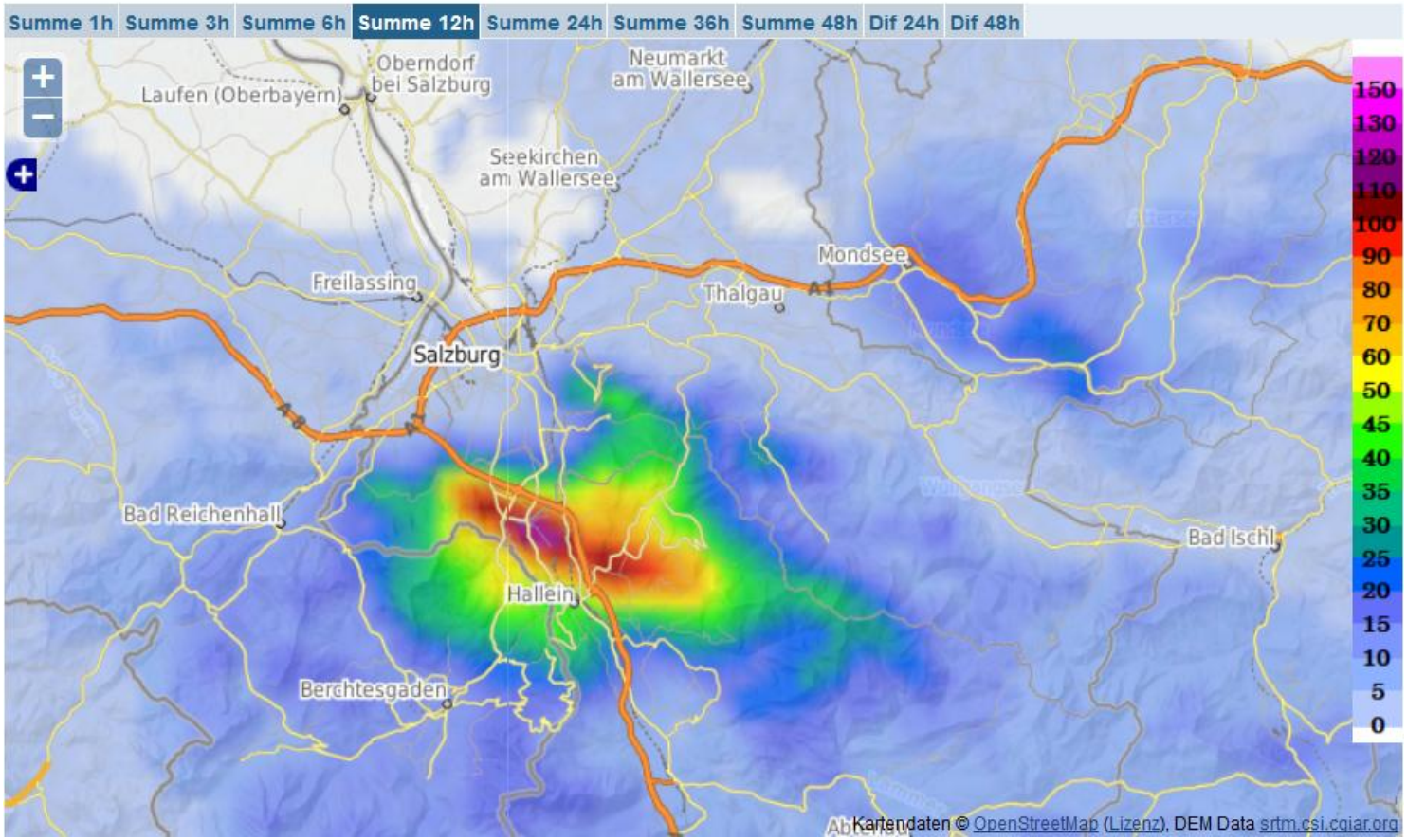
## Niederschlagssumme 12std: Analyse von Mittwoch 09:00 Lokalzeit

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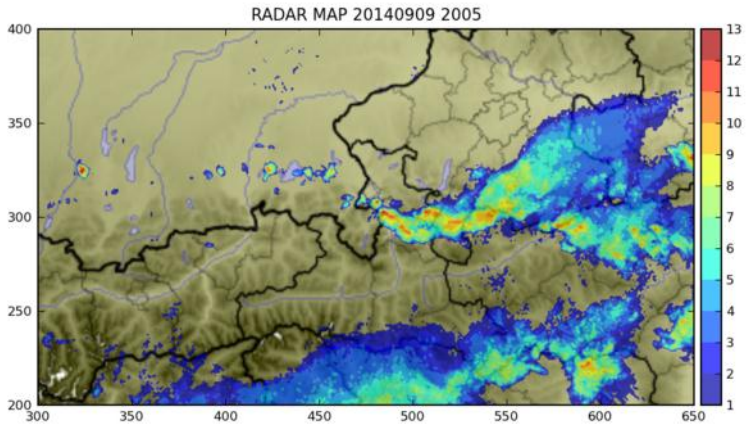


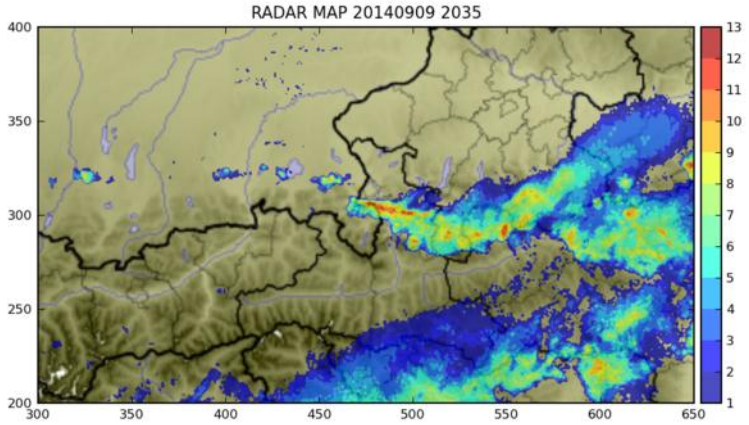


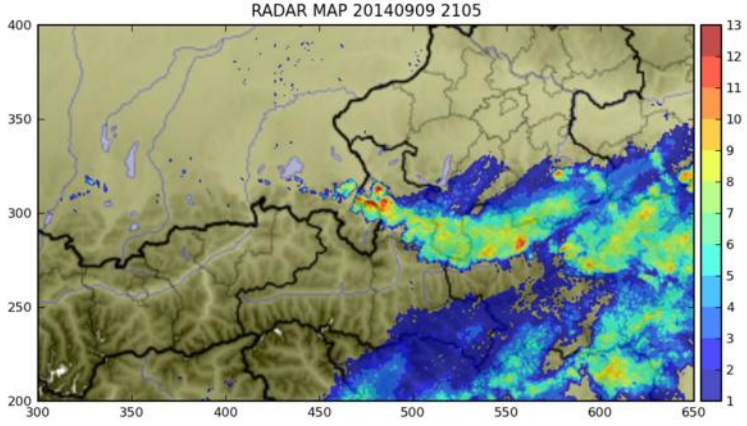


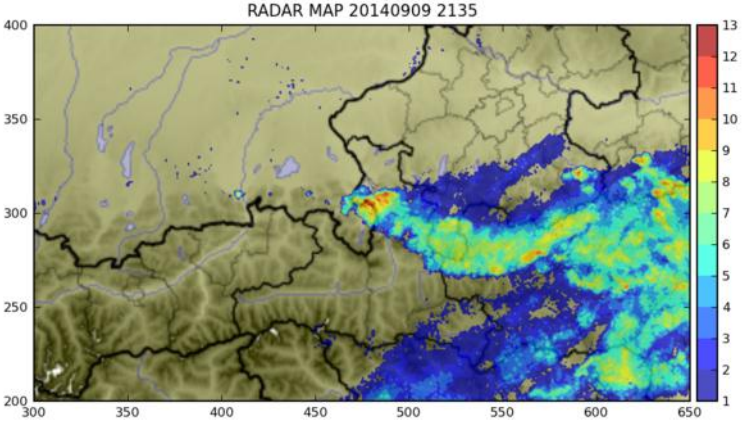


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(Possible) causes:

- very unstable stratification – (nearly) no CIN/capping inversion
- orography
- local wind convergences


=> constant new and re-developements of convective cells

=> small scale-floodings…


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# QUESTIONS?

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