

Triggering of convection by boundary-layer processes during IOP4b (June 20, 2007)

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Synoptic conditions

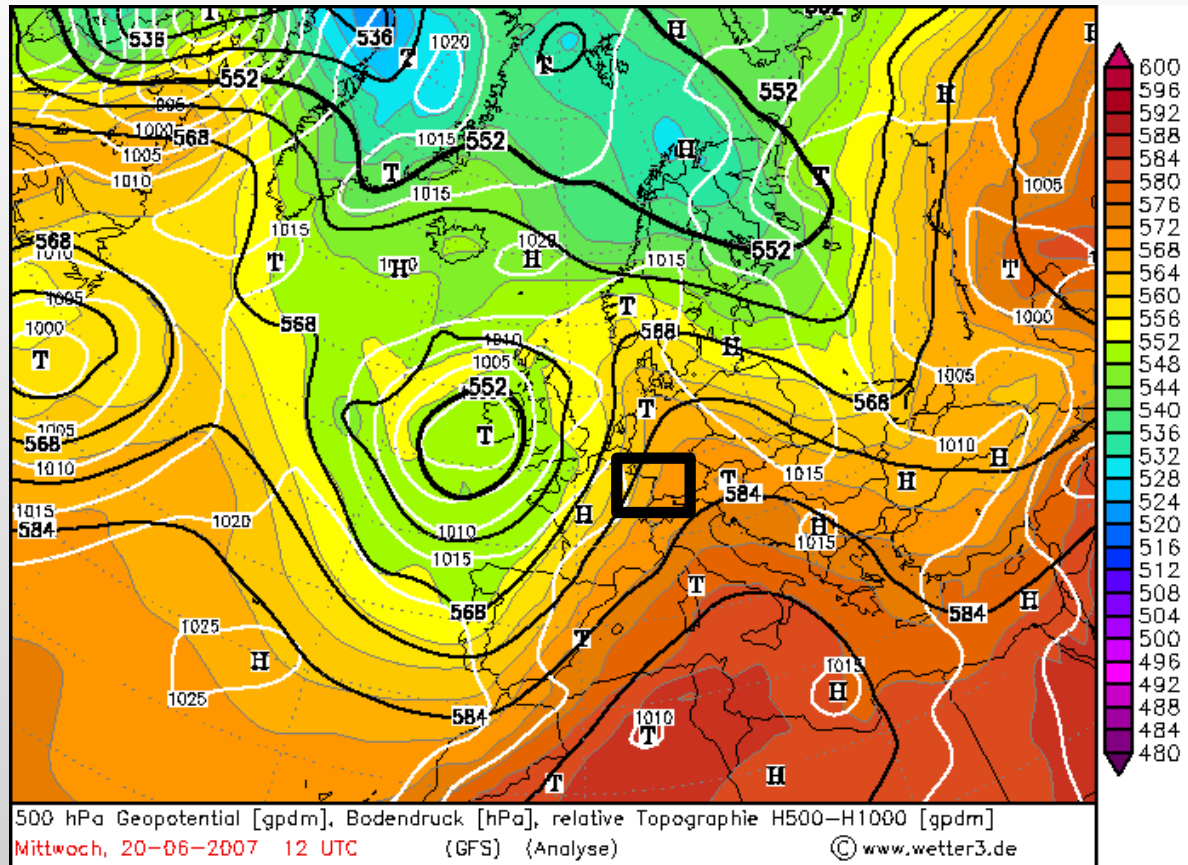


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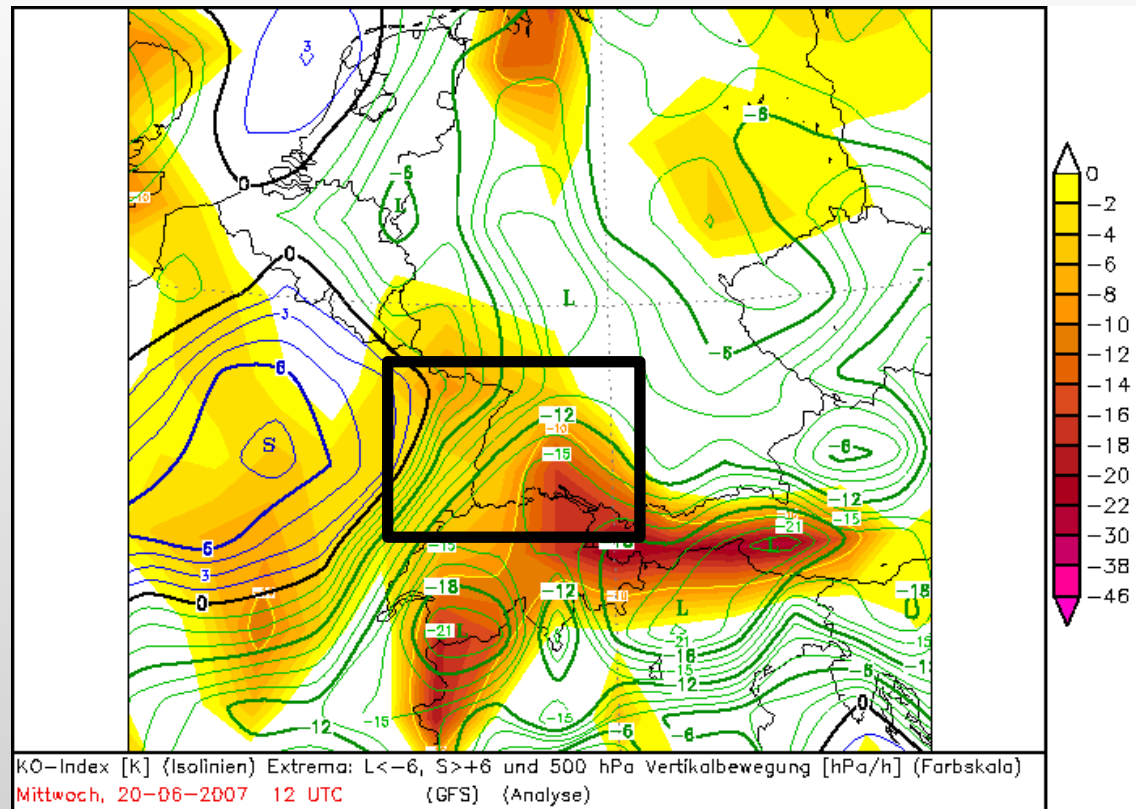
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Synoptic conditions



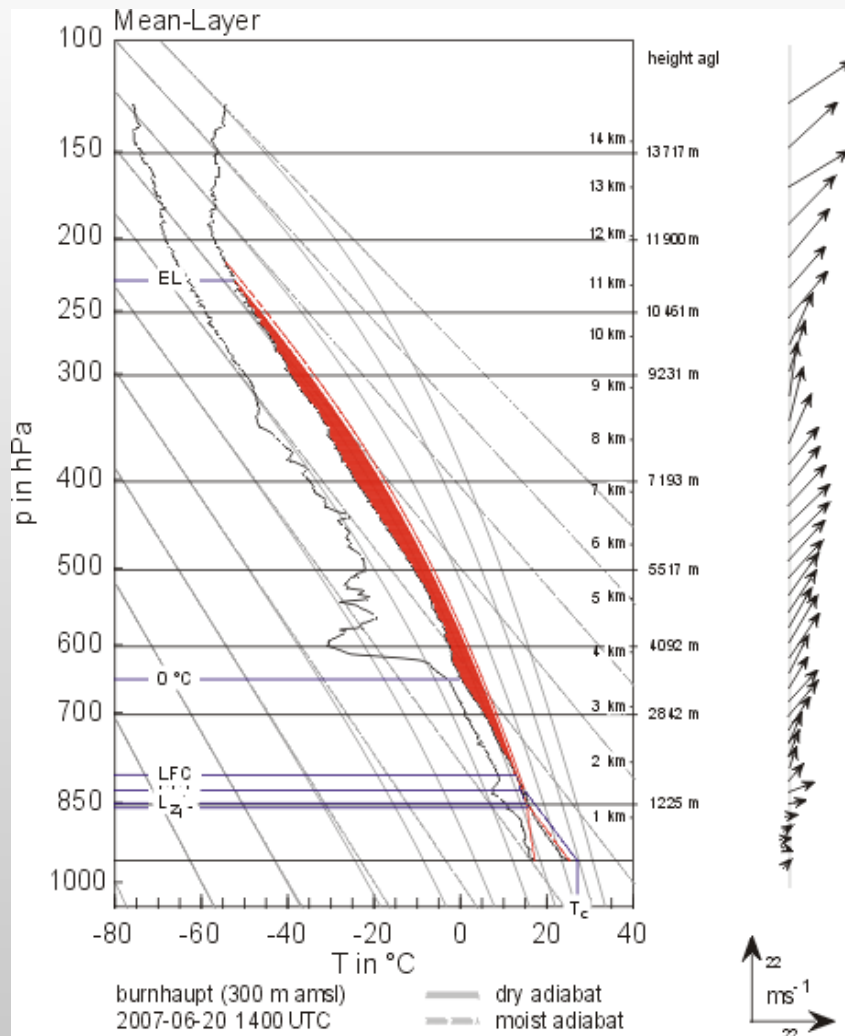
- Trough over Atlantic – moving slowly eastward

Synoptic conditions



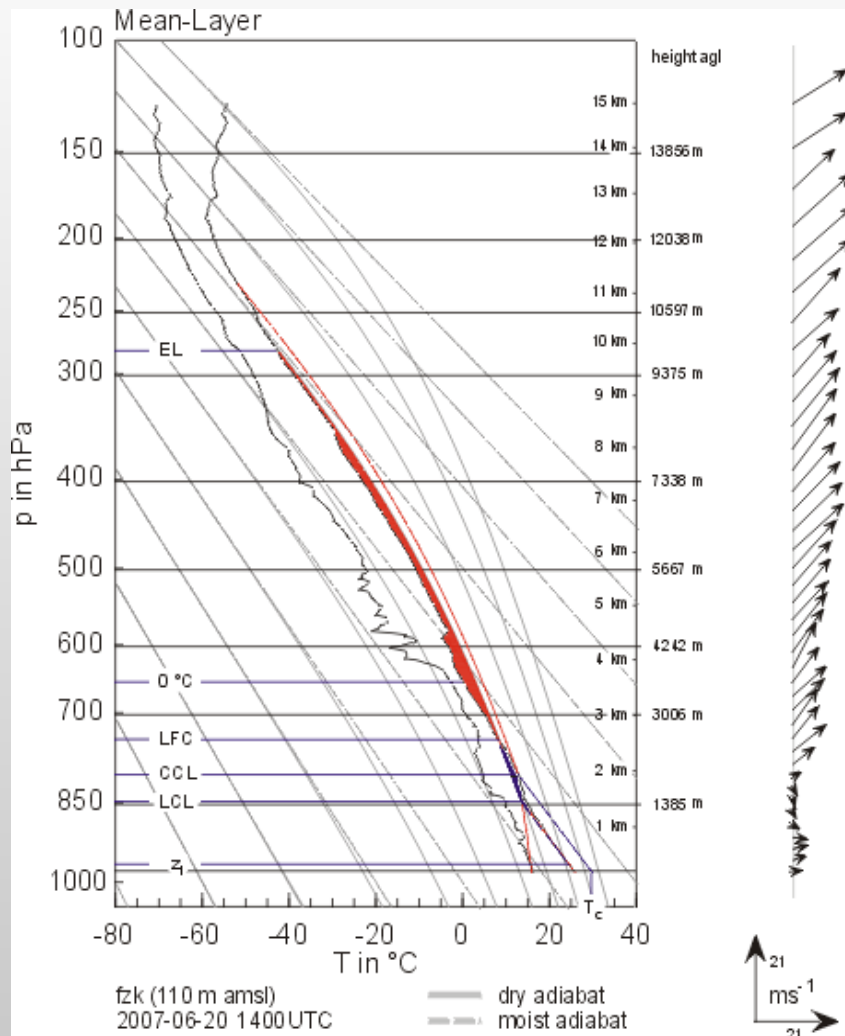
- Moderate mid-tropospheric lifting (~ -8 hPa/h)
- Potential instability high in south east, low in north west

Synoptic conditions – Burnhaupt 1400 UTC



- High CAPE: 1300 J/kg
 - Low CIN: 5 J/kg
- High conditional instability

Synoptic conditions – Karlsruhe 1400 UTC



- Moderate CAPE: 450 J/kg
 - Moderate CIN: 40 J/kg
- Moderate conditional instability

Evolution of convection

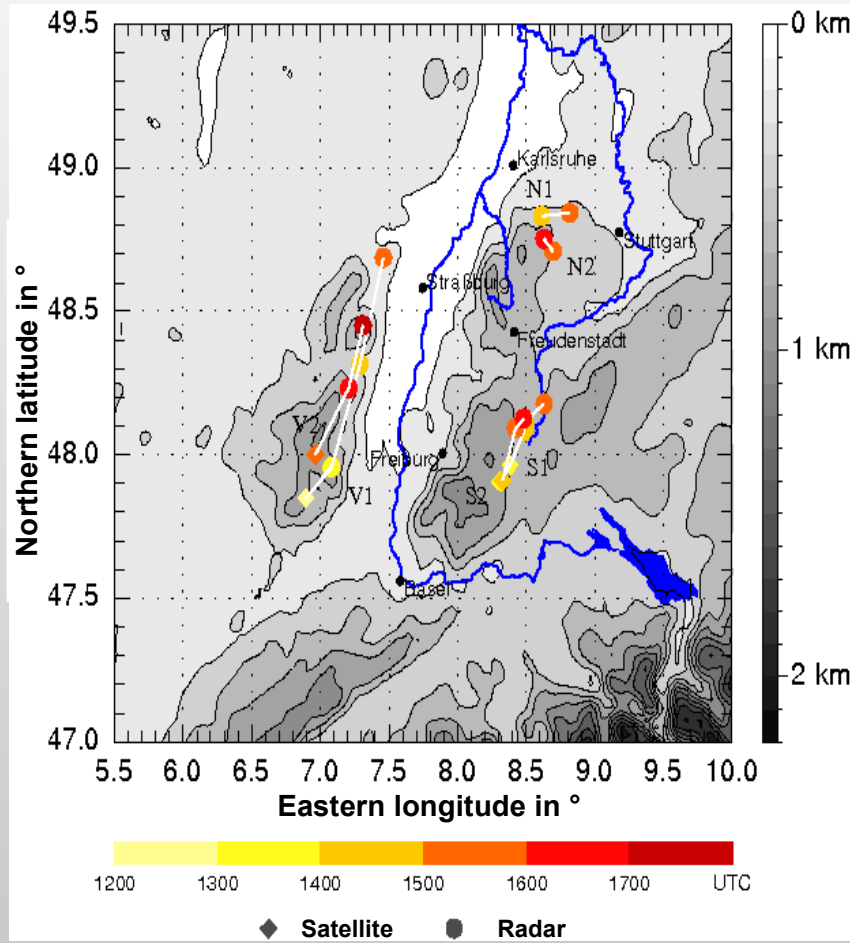


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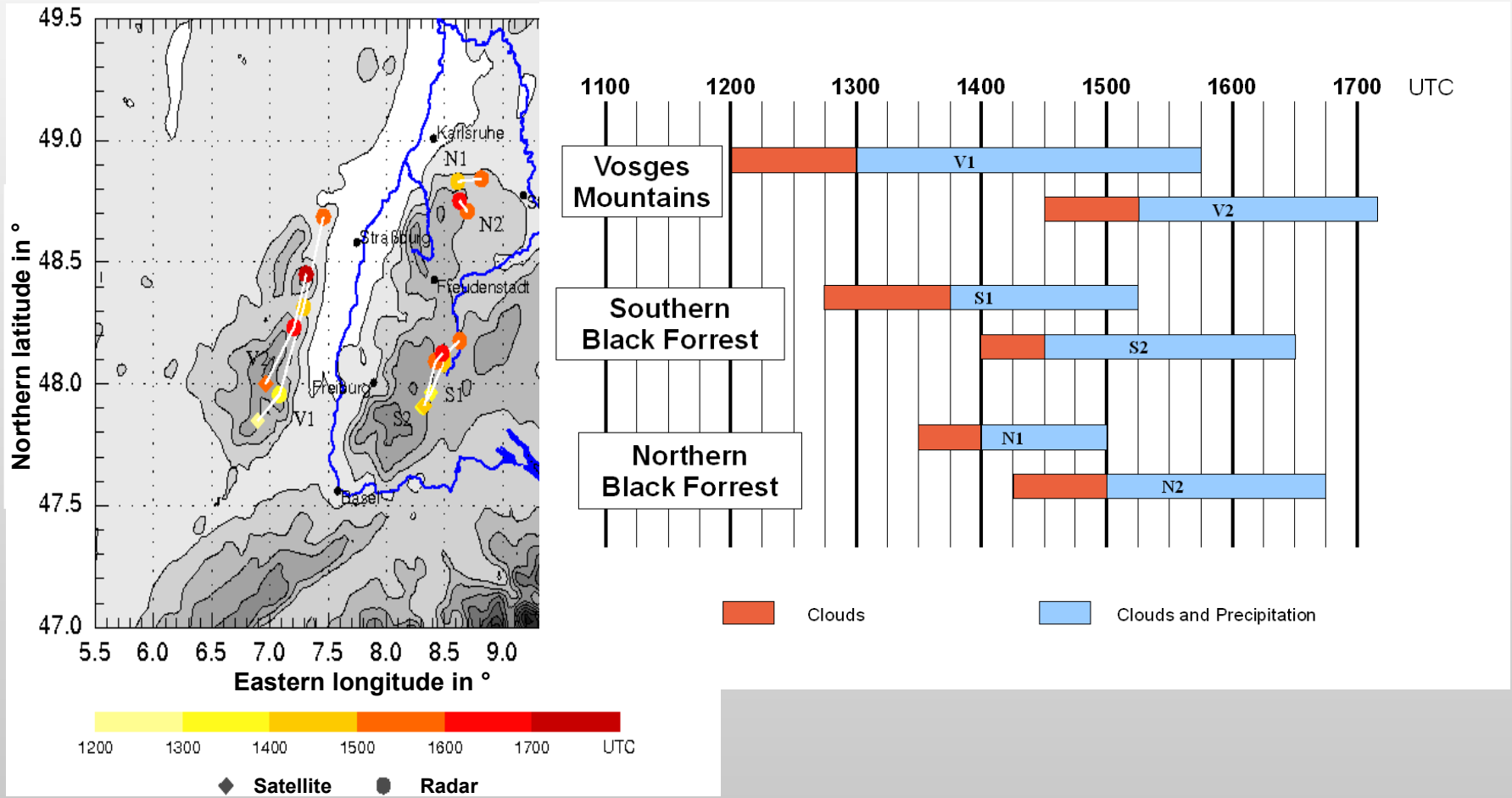
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Evolution of convection



- 6 cells
- First over Vosges mountains at noon
- Northern Black Forrest not until afternoon

Evolution of convection

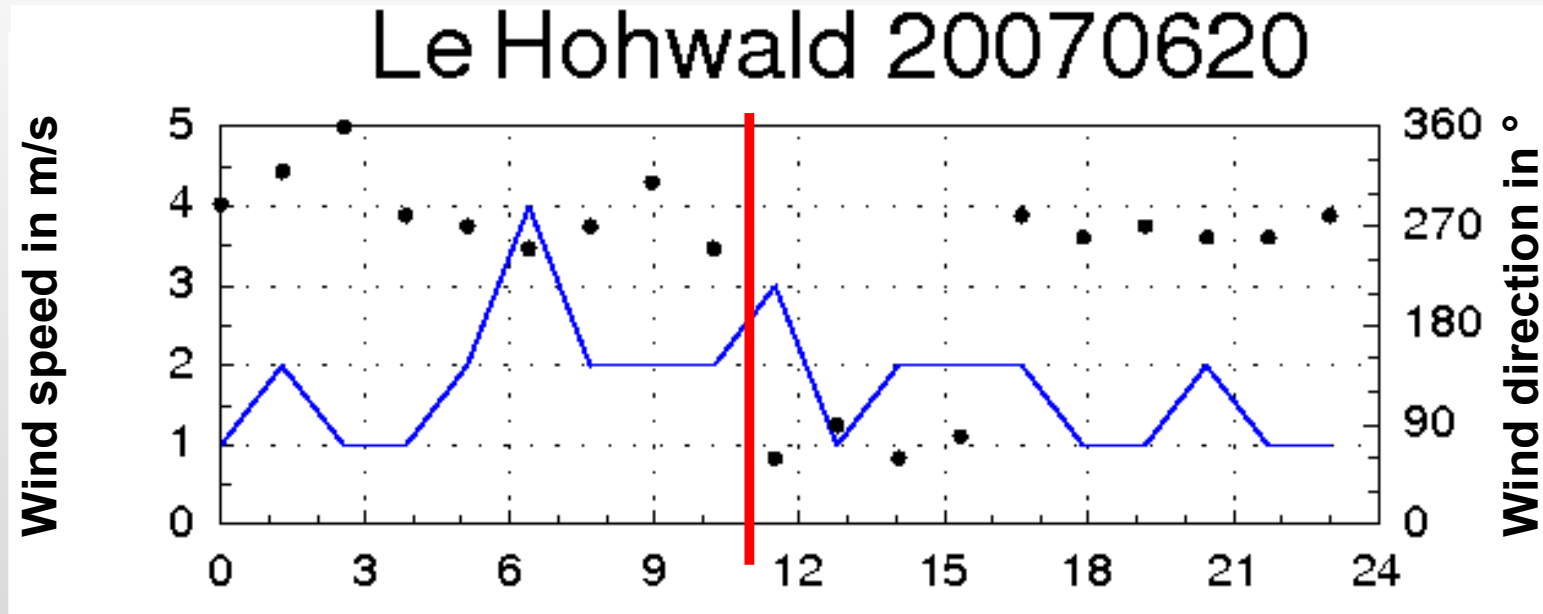


Trigger mechanisms

- Valley winds may produce mass convergence at the head of the valley
- Slope winds may produce mass convergence above the mountain crests

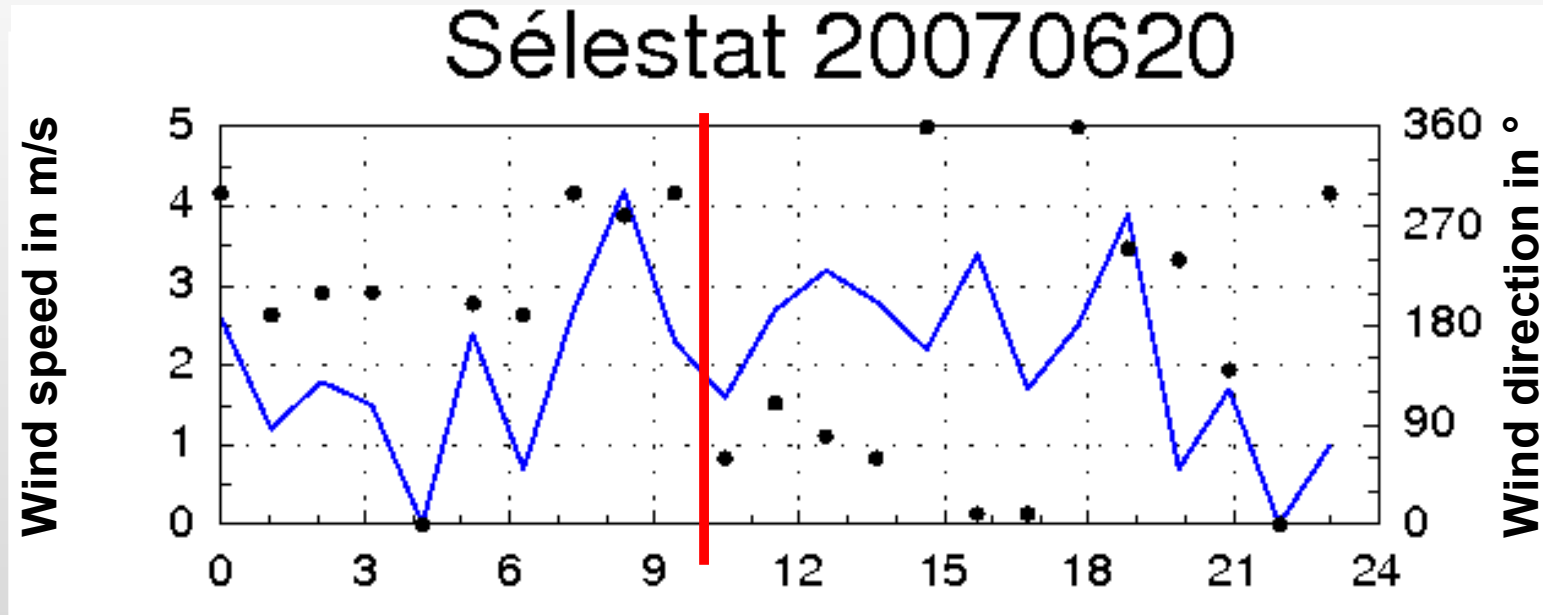


Local winds in the Vosges Mountains



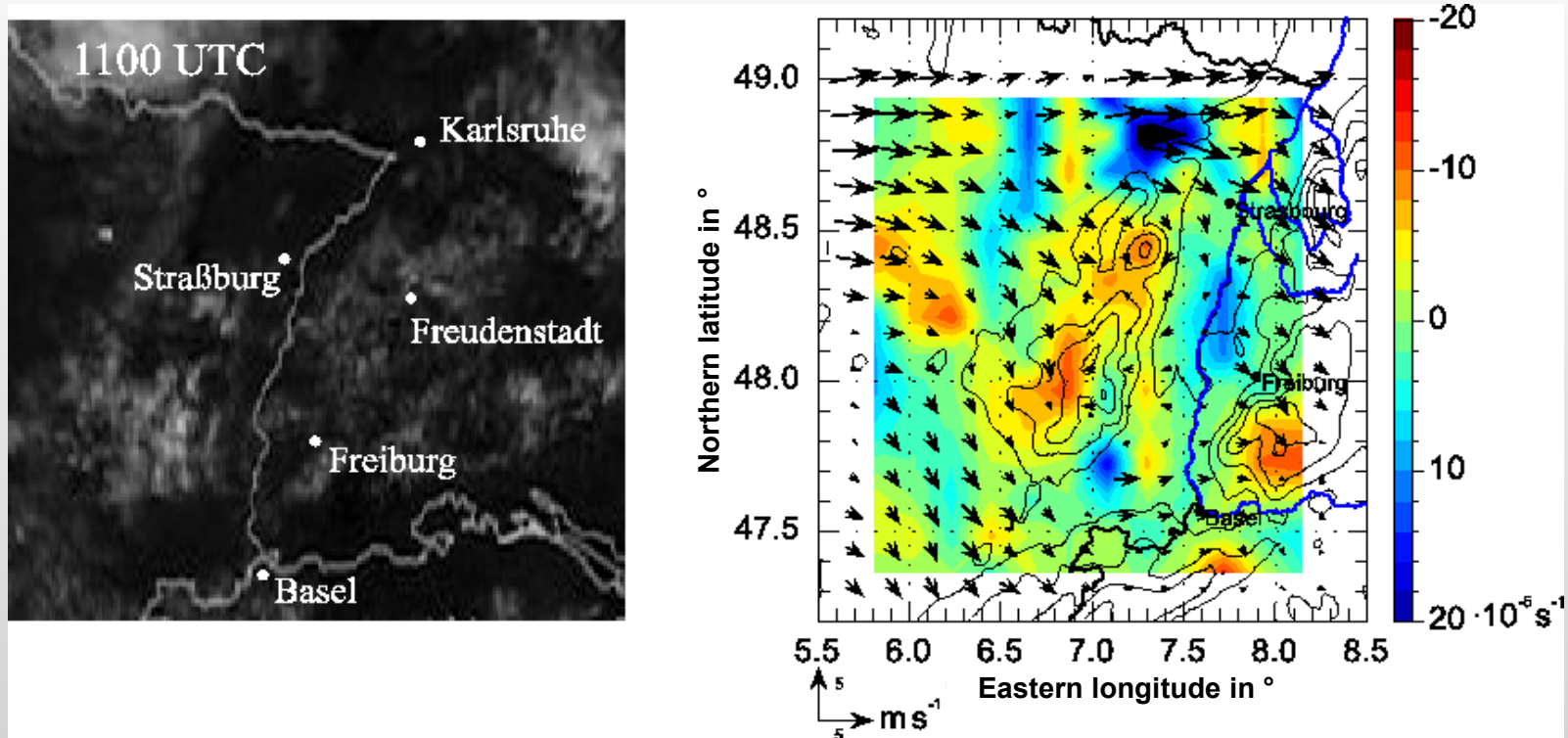
- Valley winds from 1100 UTC

Local winds in the Vosges Mountains



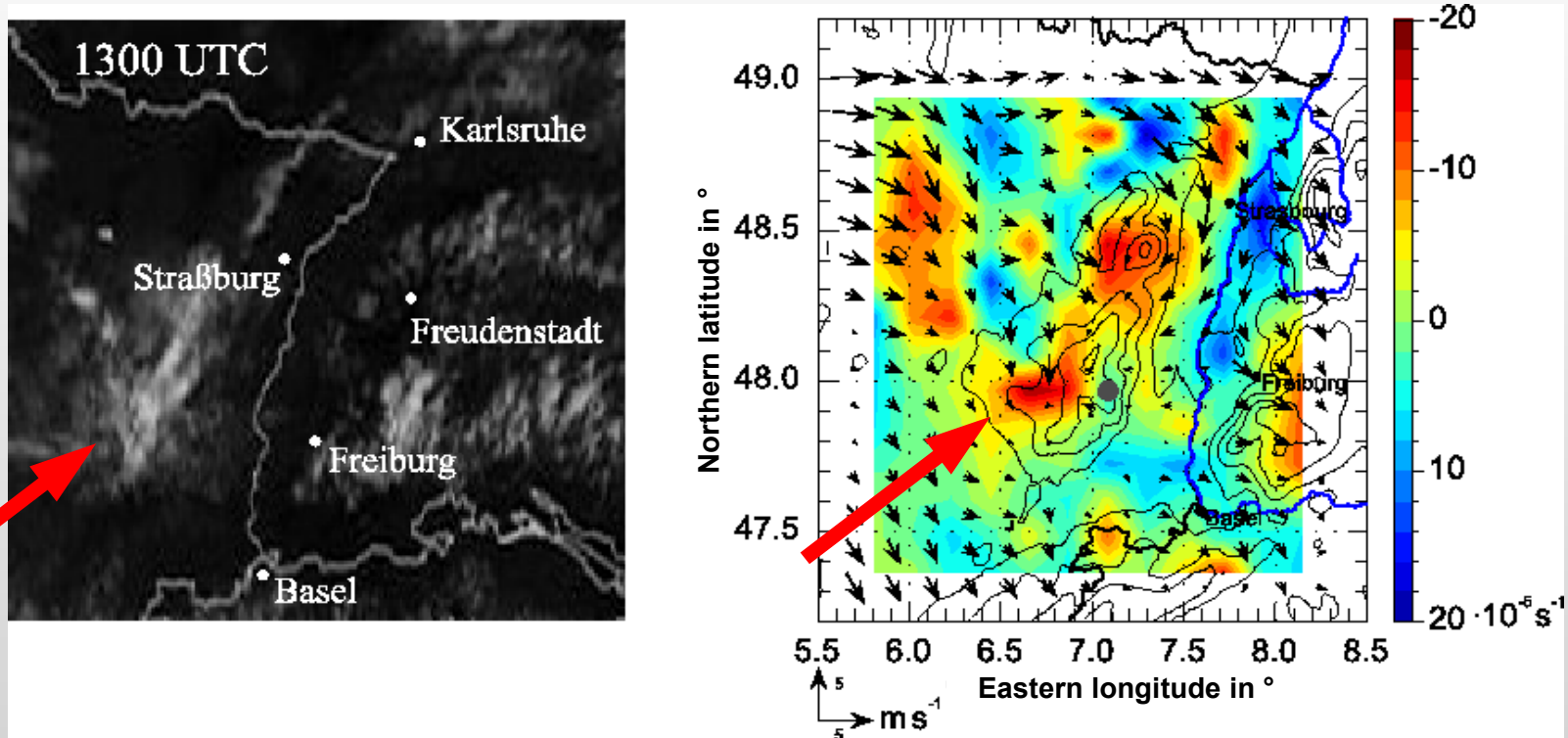
- Slope winds from 1000 UTC

Divergence of the horizontal wind



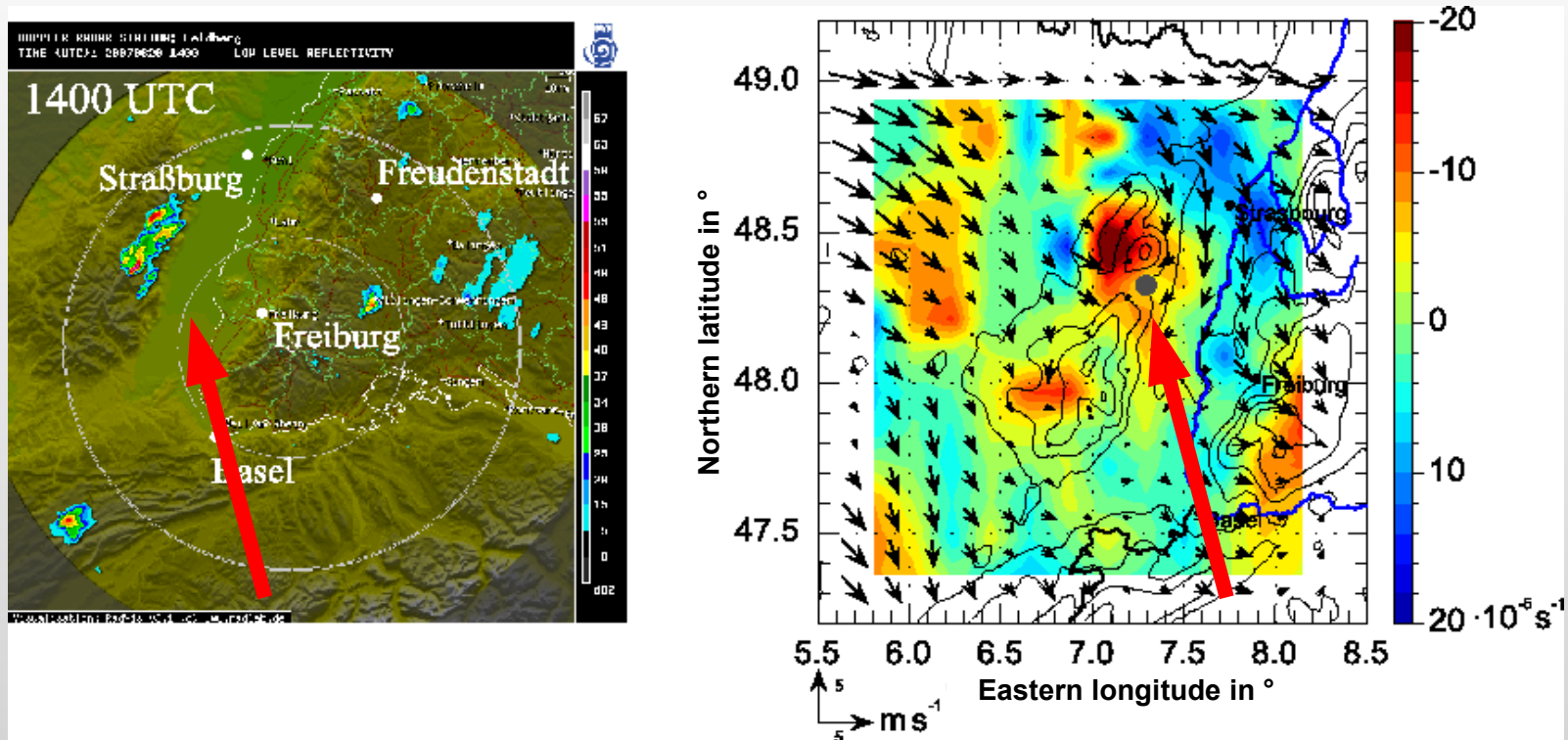
- First convergence – shallow convection

Divergence of the horizontal wind



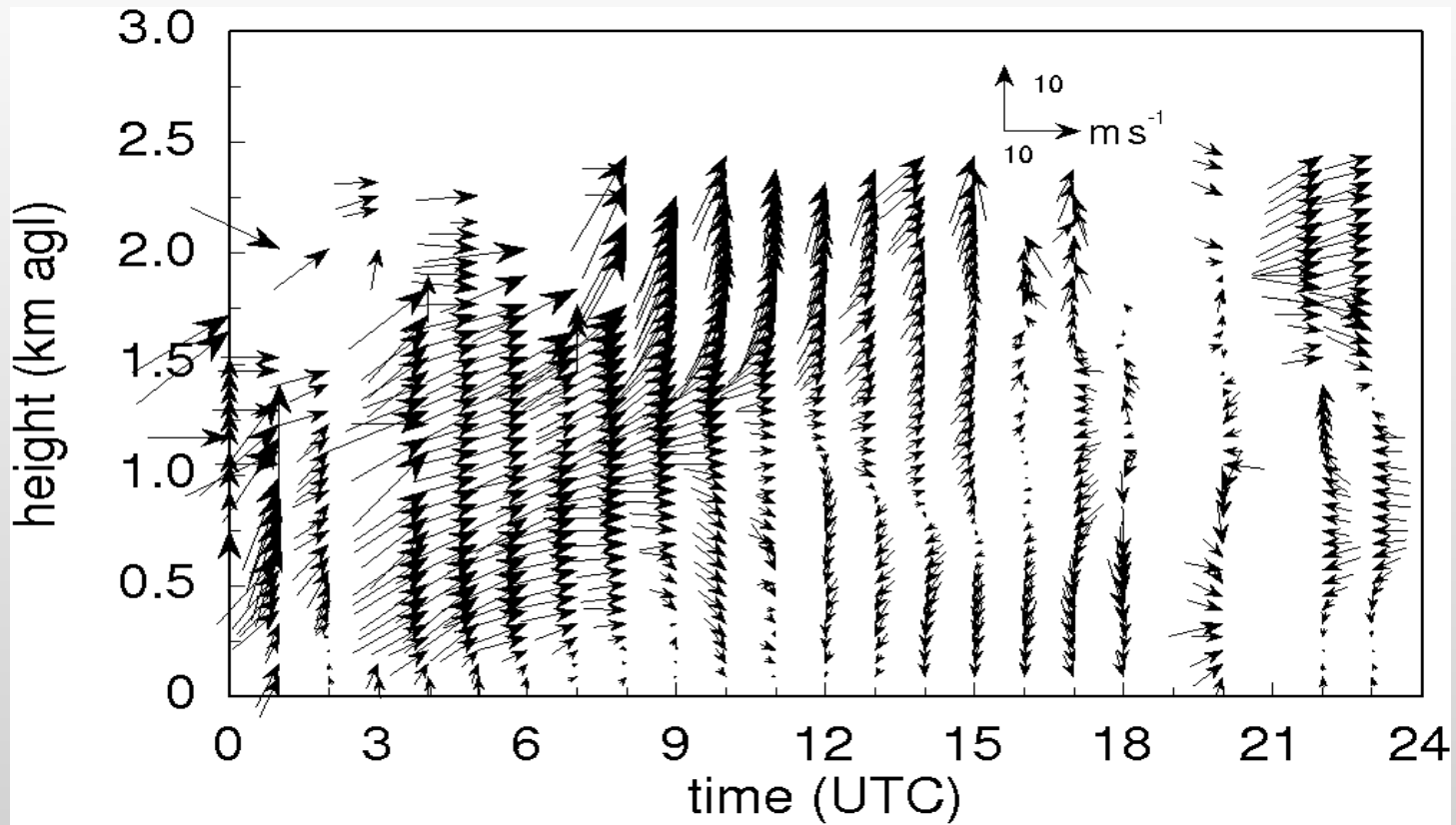
- Stronger convergence - first precipitation
- Approx. 2 hours after first convergence

Divergence of the horizontal wind



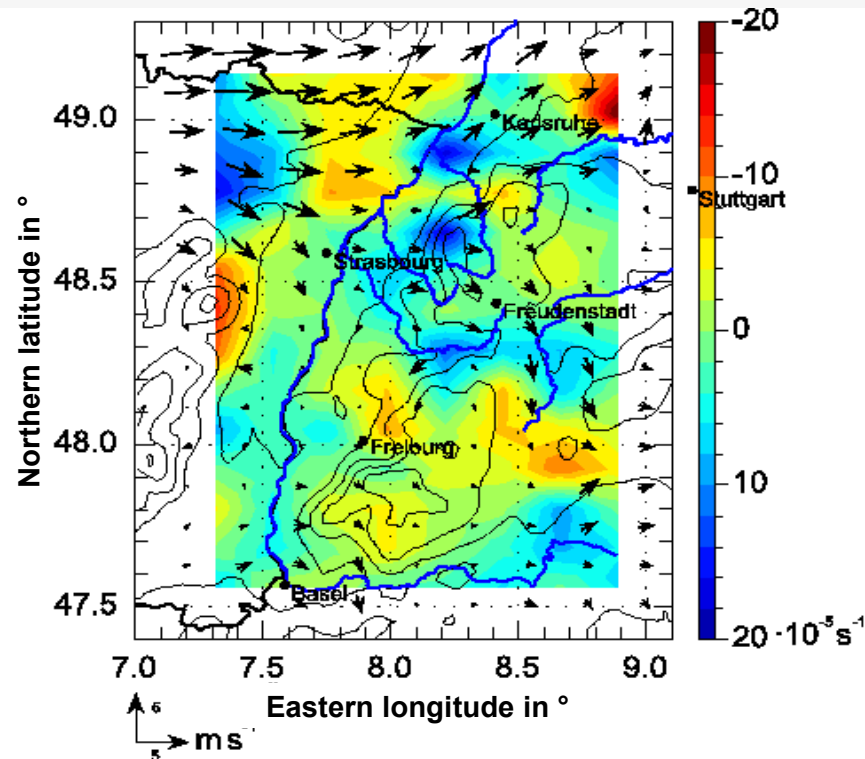
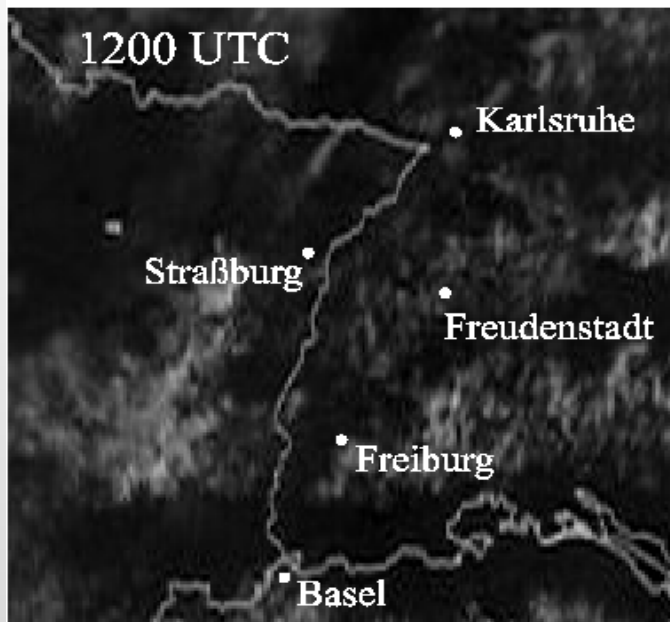
- Cell moved into region with stronger convergence
→ Stronger precipitation

Valley winds – Heselbach



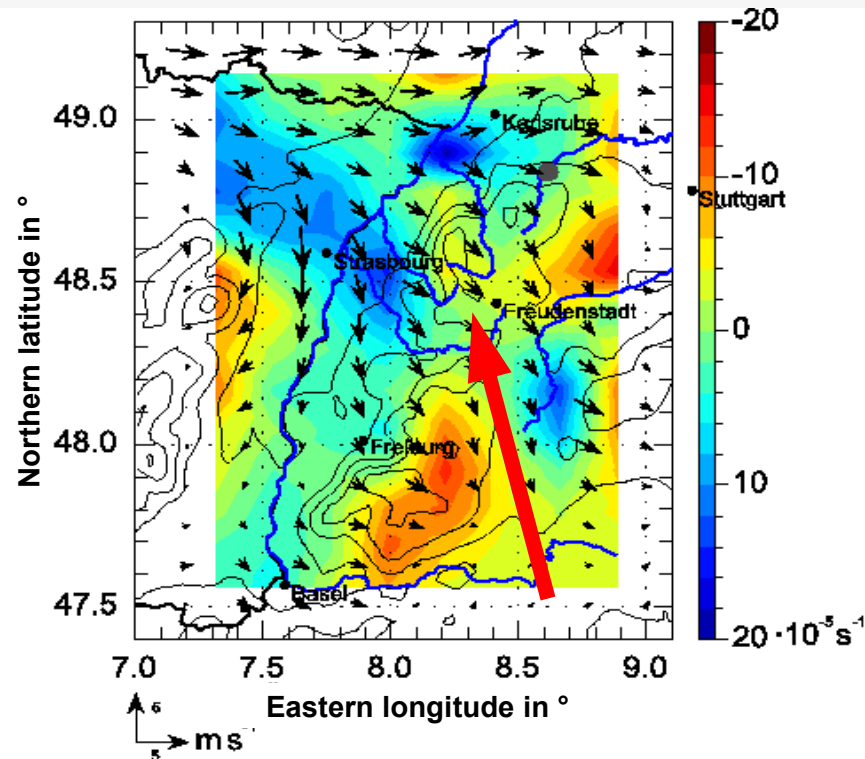
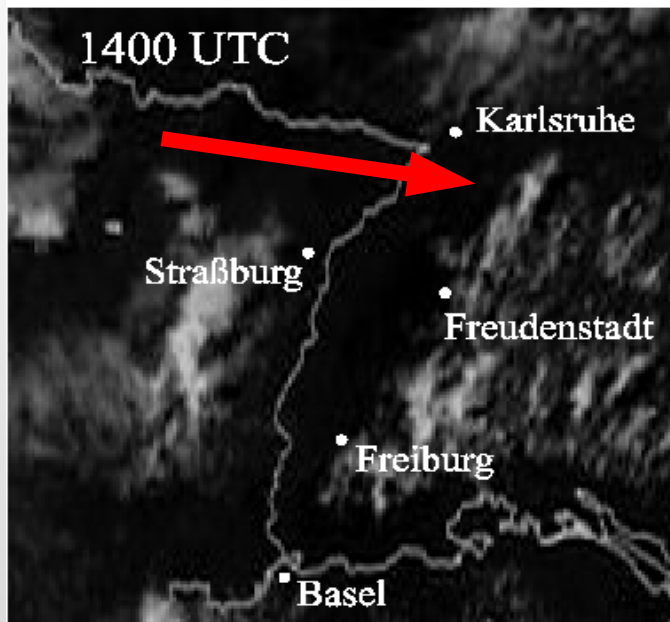
- Onset of valley winds at 1200 UTC

Divergence of the horizontal wind



- Divergence in northern Black Forrest
- No clouds

Divergence of the horizontal wind



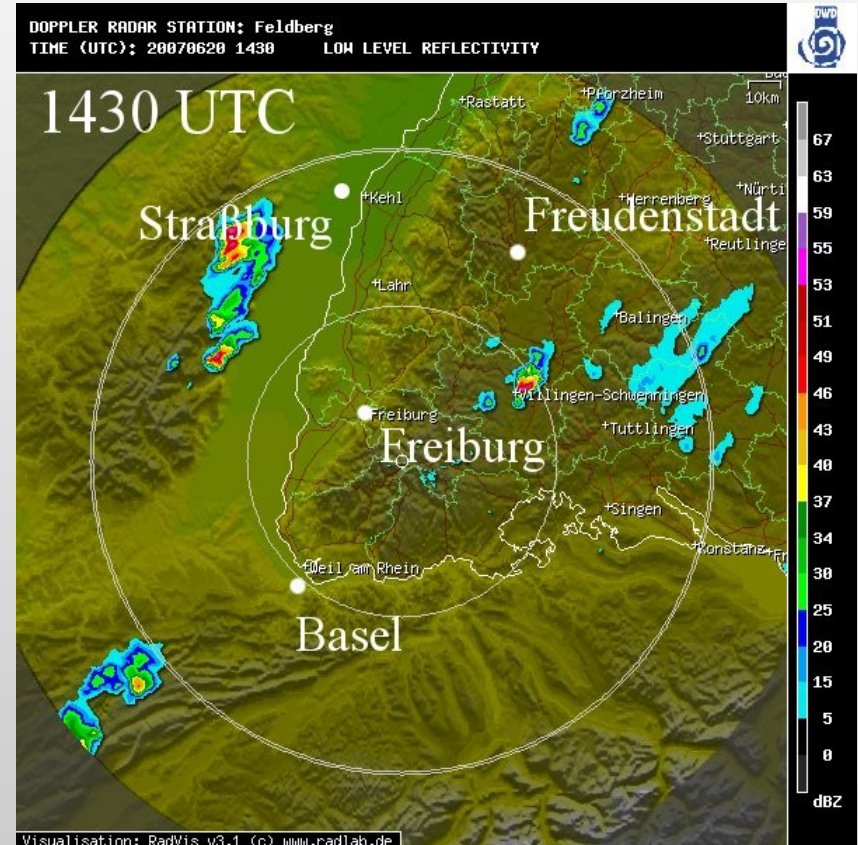
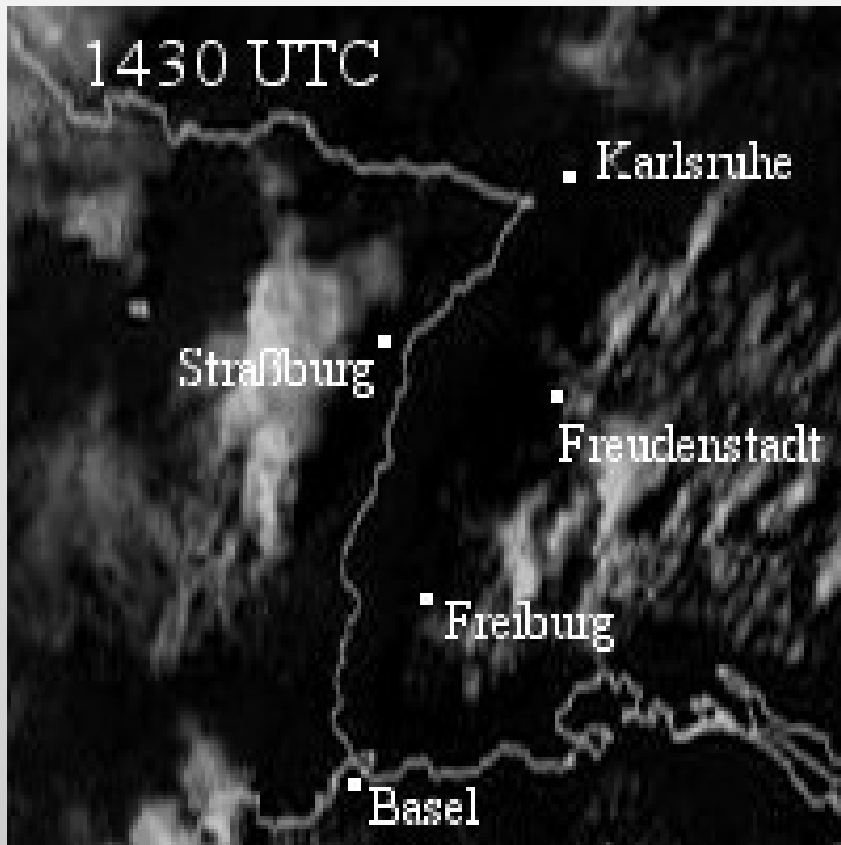
- Weak convergence in northern Black Forrest
- First precipitation

Summary

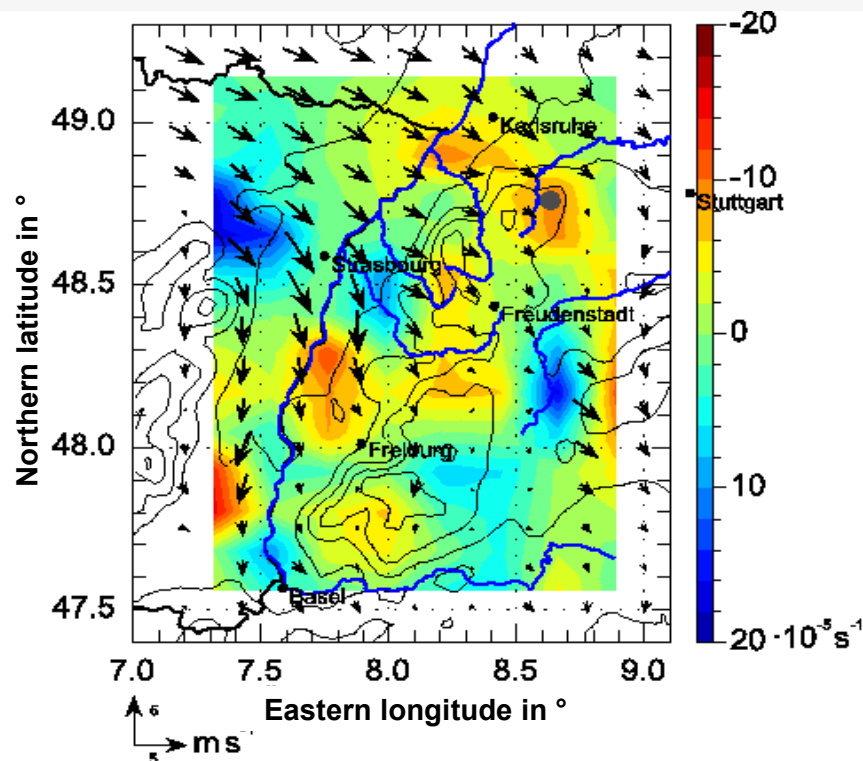
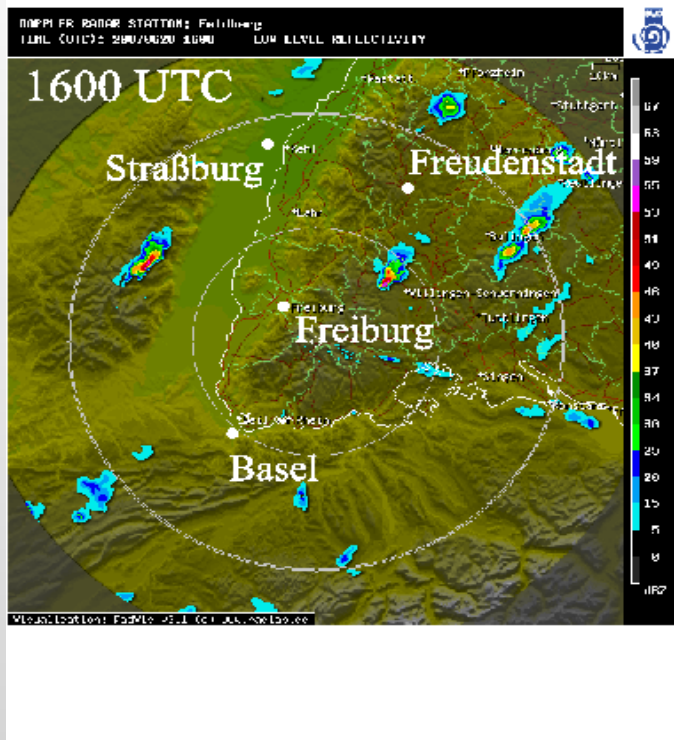
- Pronounced spatial distribution of convective instability
- Convergence caused by local winds was a trigger mechanism
- Convergence occurred 2 hours (Vosges Mountains) and 0.5 hours (northern Black Forrest) before deep precipitating convection



Evolution of convection

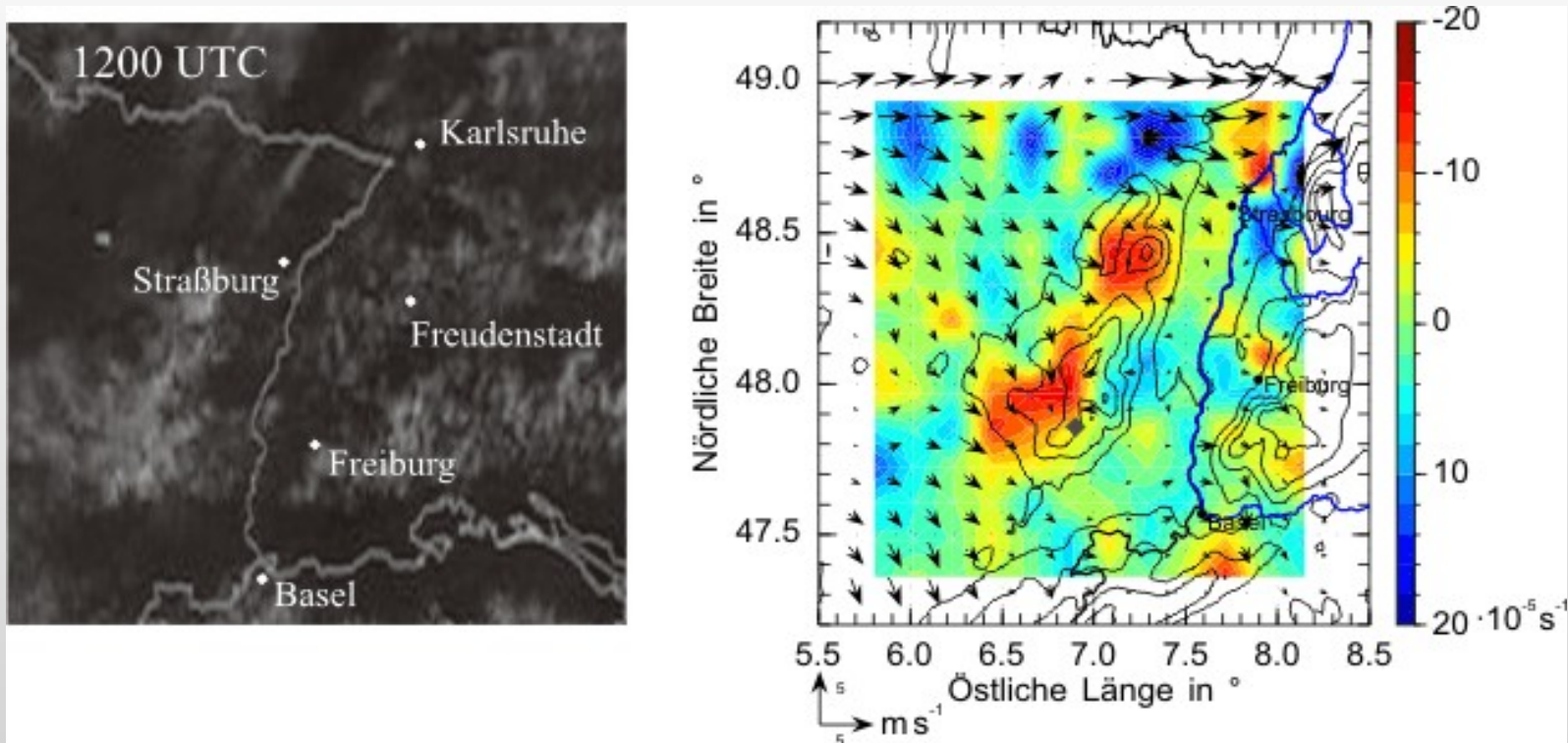


Divergence of the horizontal wind



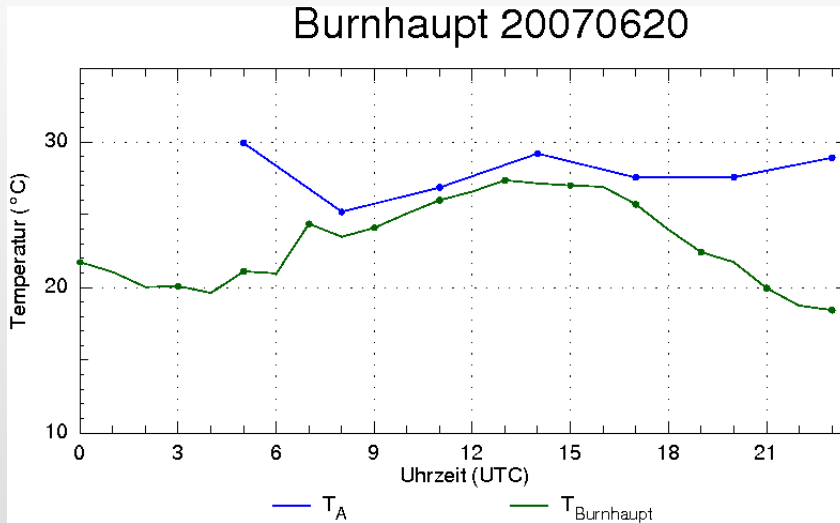
- Cell in region of moderate convergence

Divergence of the horizontal wind



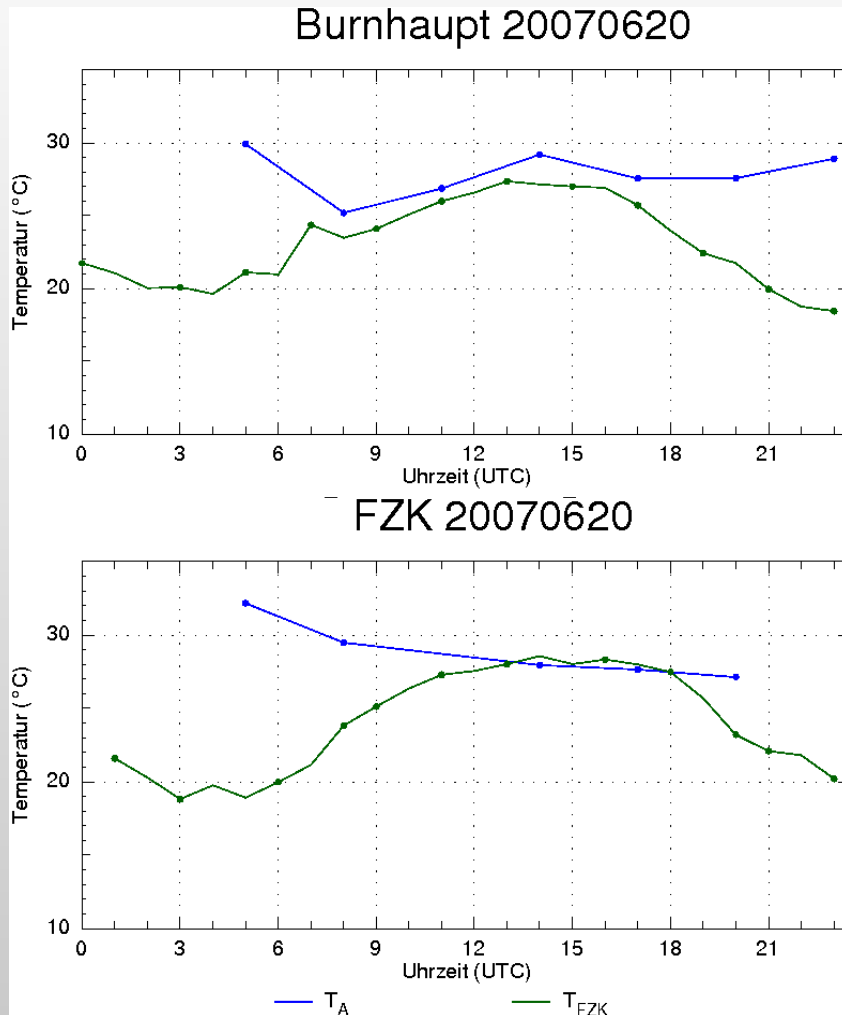
- Stronger convergence – first convective cell

Convective Temperature



- Convective Temperature not reached

Convective Temperature



- Convective Temperature not reached

- Convective Temperature reached in the afternoon