

From Calm to Storm: Selected Details of Various Phases in the Evolution of a Hector Storm from a High-resolution Coupled Atmosphere-Biosphere Model Experiment

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AS 1.8/1.10 High Resolution Cloud Models/dynamics and chemistry of atmospheric convection
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Key ingredients ...

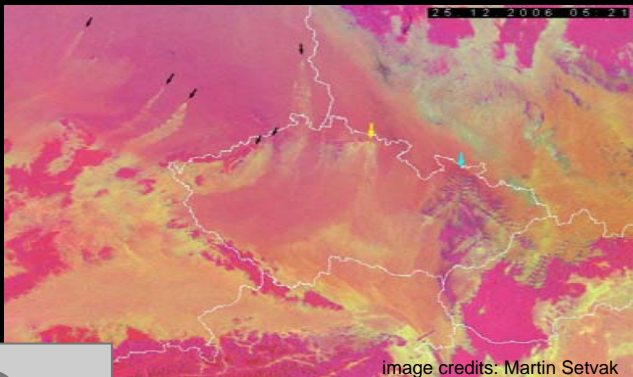
- a major convective thunderstorm, Hector
- a Cloud Resolving Model, ATHAM
- a lot of structure in convective cloud fields
- some ideas about geo-statistics and image processing

Influence of meso- and microscale diabatic processes on *structure* of convection

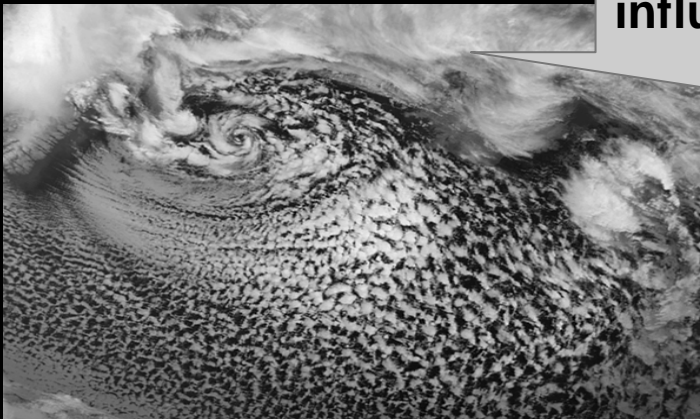
variable cloudiness across Australian bunny fence



power station plumes in central Europe affecting cloud microphysics



influence?



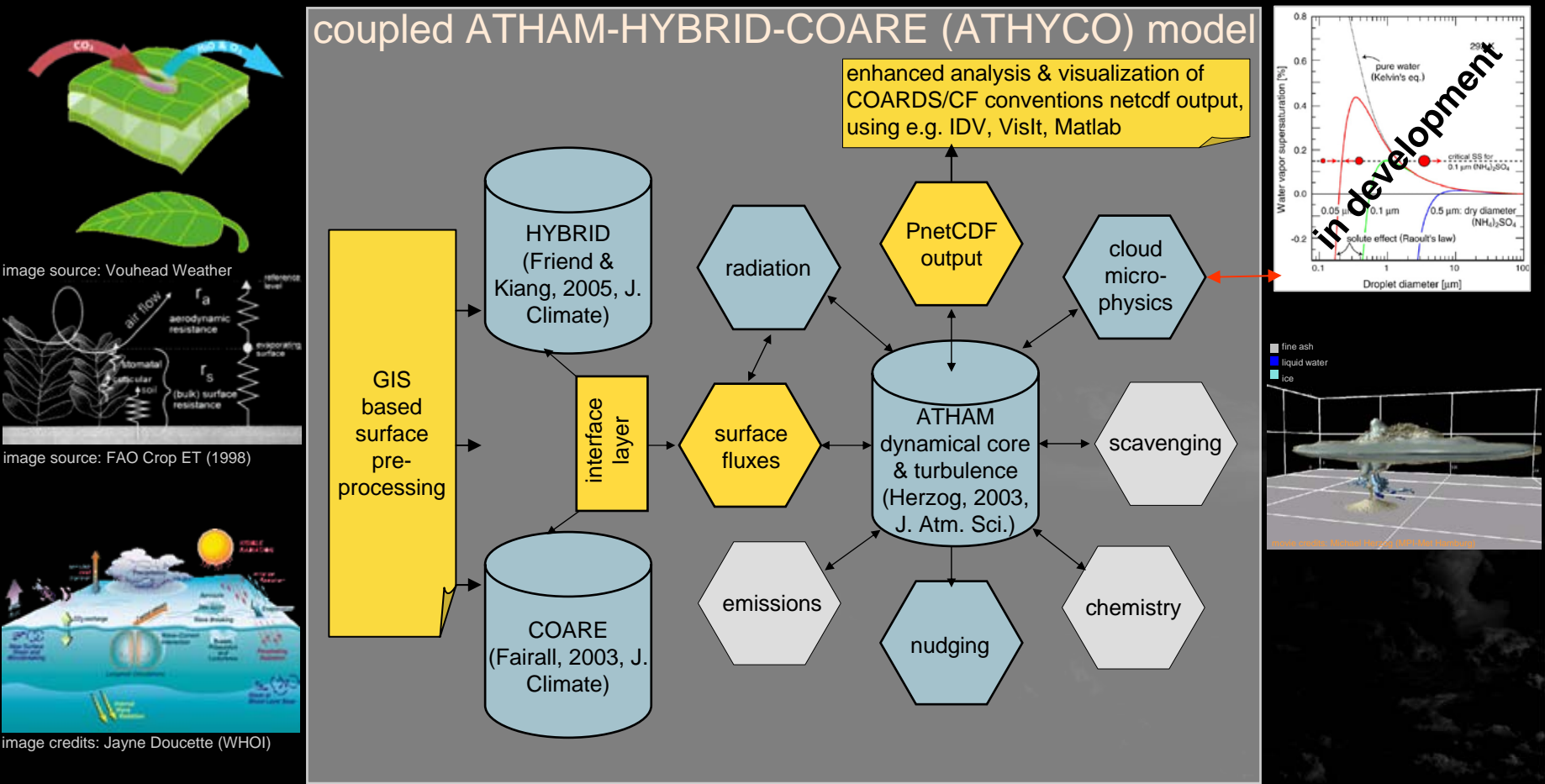
organized shallow convection in Greenland cold air outbreak



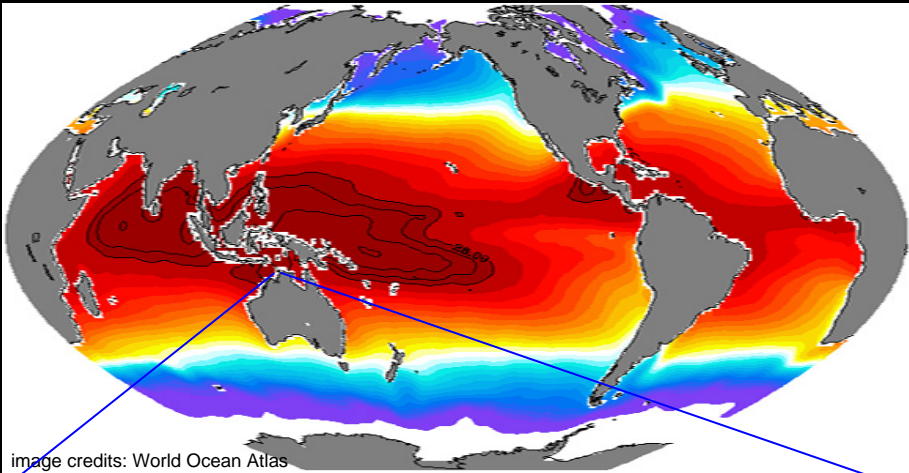
self-organizing deep convection over Africa

metrics & impacts?

Dynamic 'Earth-system' modelling of convective systems at the mesoscale



Hector: the 'ideal' tropical warm pool convective storm over the Tiwi islands



a well-structured storm in a simple environment
local circulation embedded in larger-scale context

- heat island triggering
- regular
- representative
- deepest convection
- well studied



Evolution of structure in a cloud field over a day of convection



insert:
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window

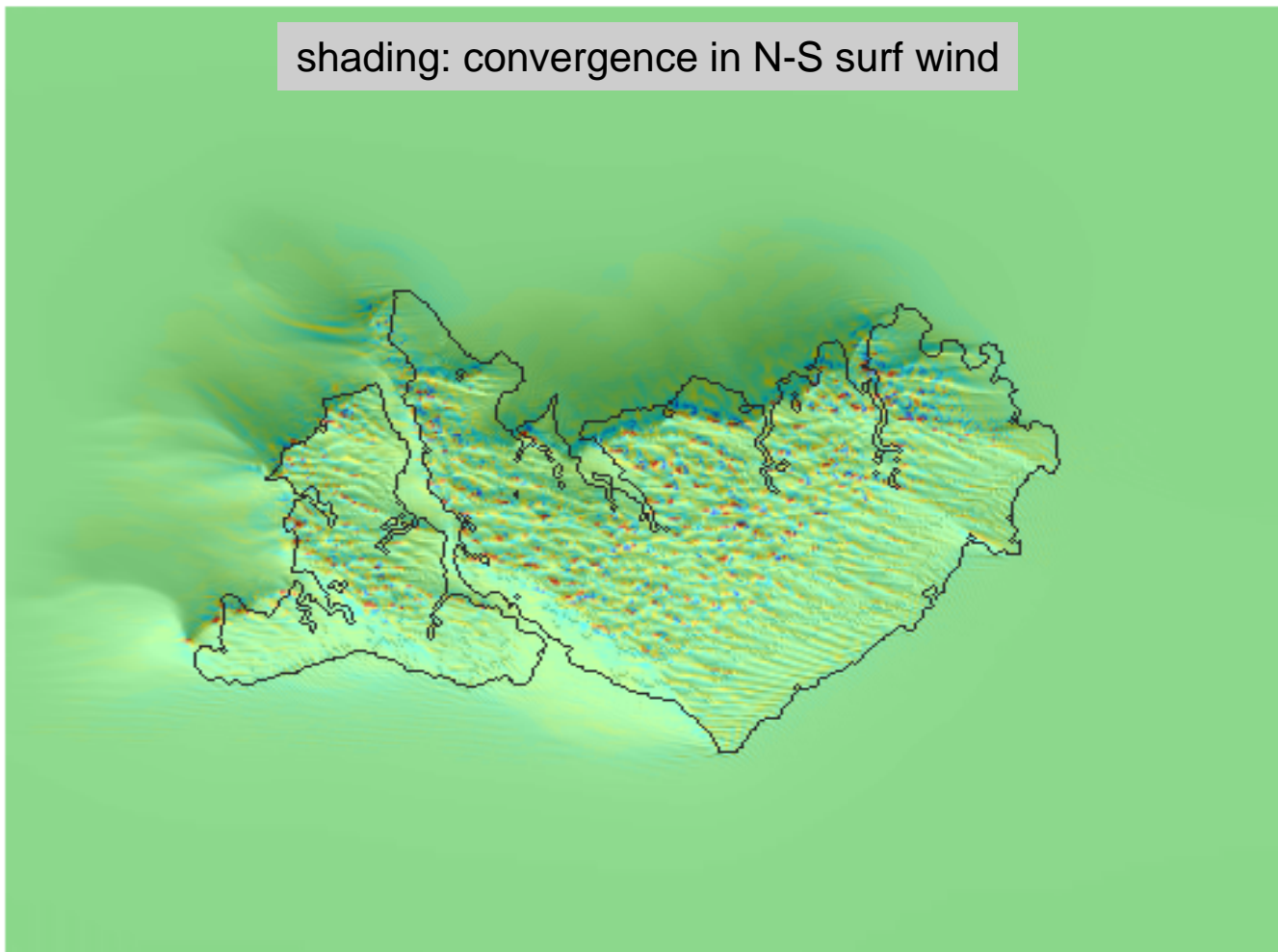
model
domain

- resolution: 500 m, domain: 250x180x25 km, simulated time: 16 h
- simulation time: 13 days on 48 cores or 15'000 CPU-h

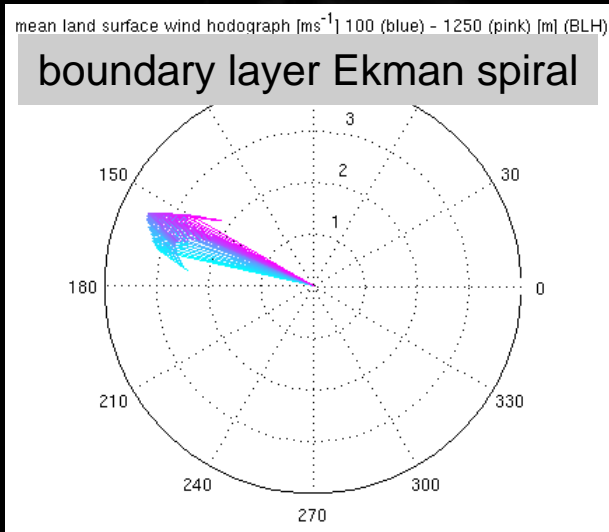
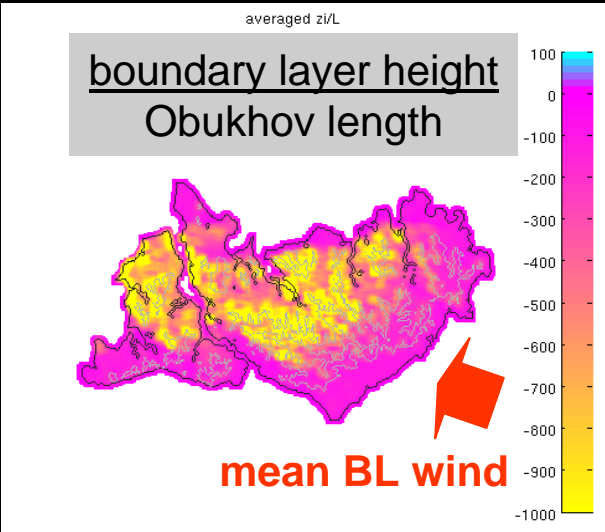
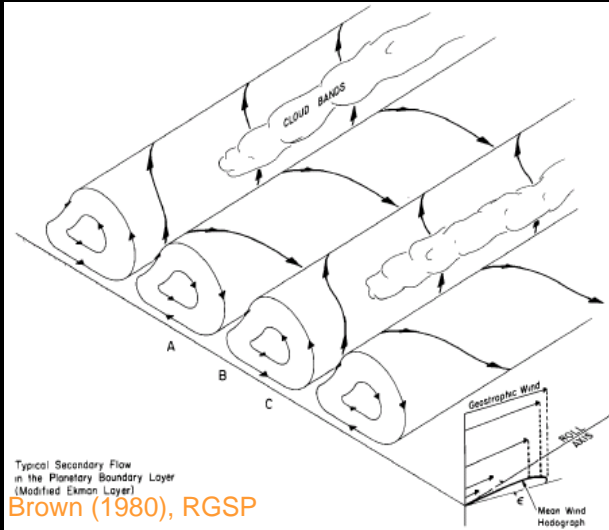
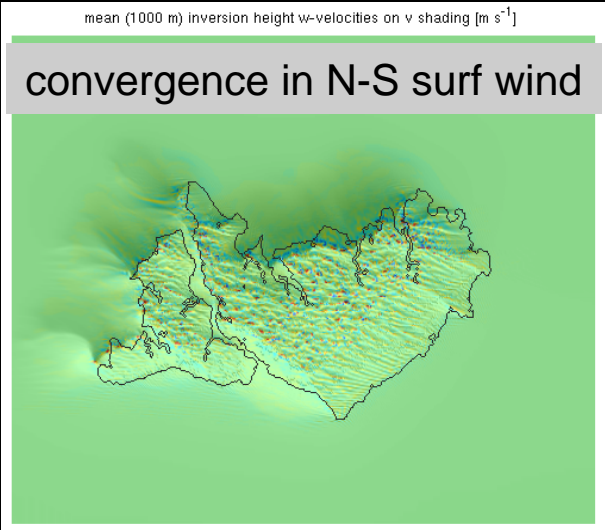
Structure in shallow convection: dynamic *versus* thermal instability

mean (1000 m) inversion height w-velocities on v shading [m s^{-1}]

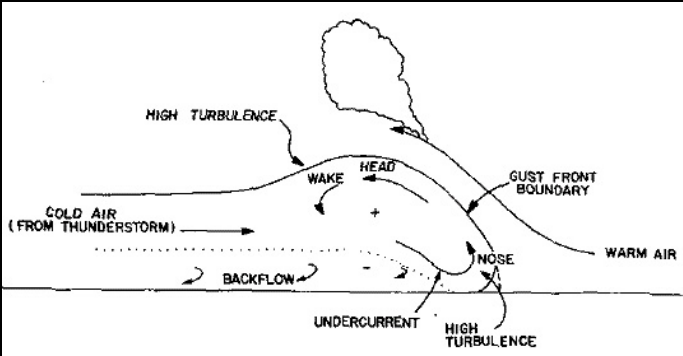
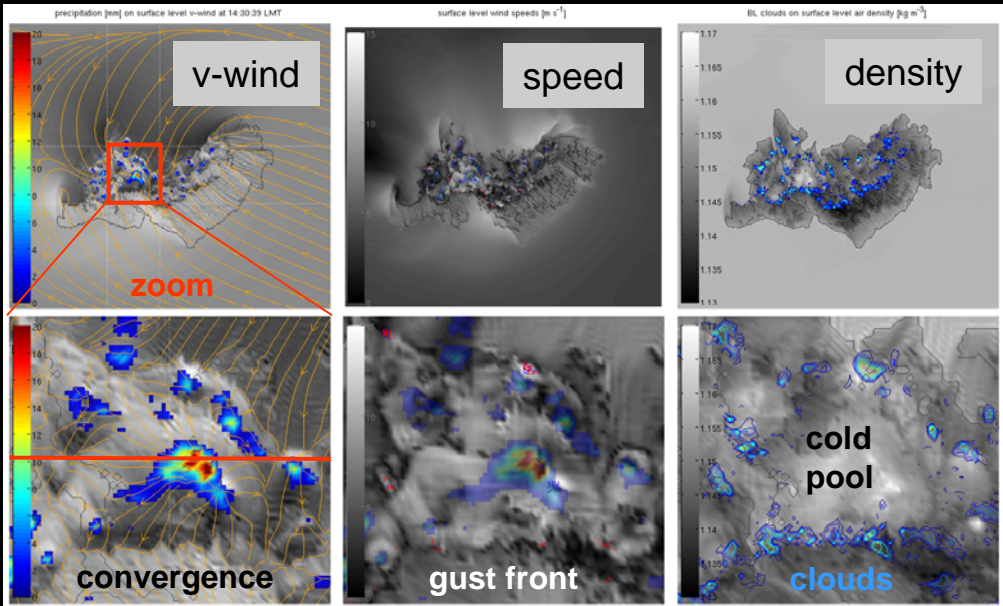
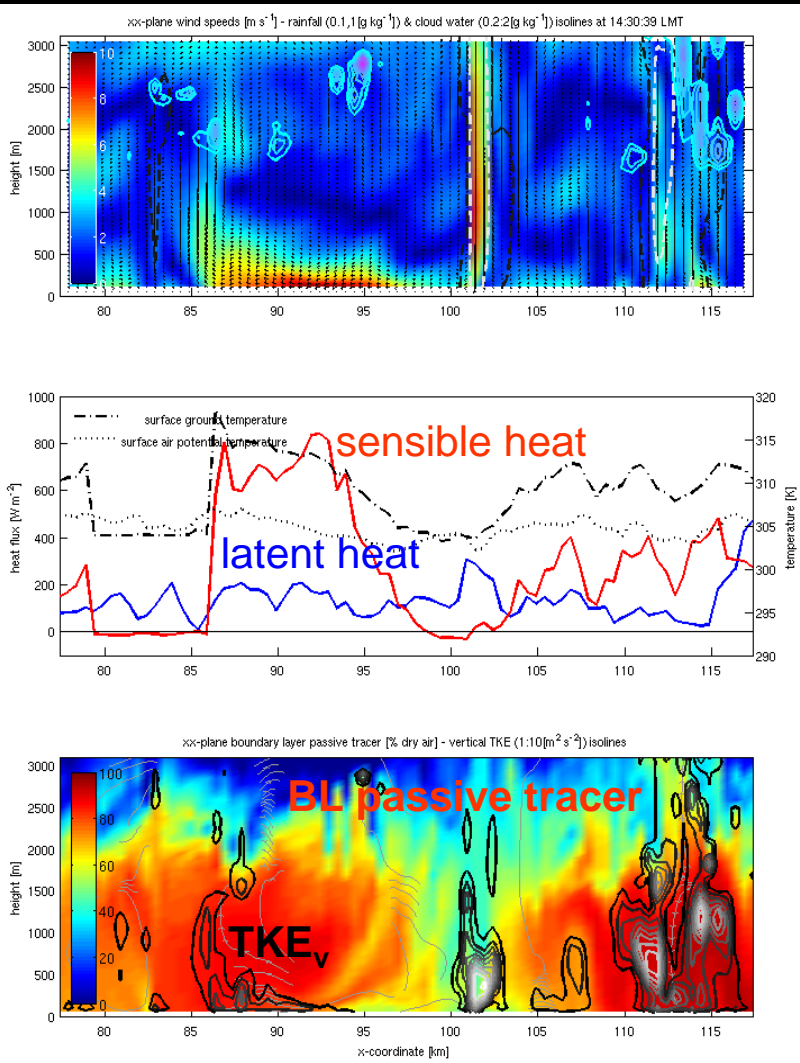
shading: convergence in N-S surf wind



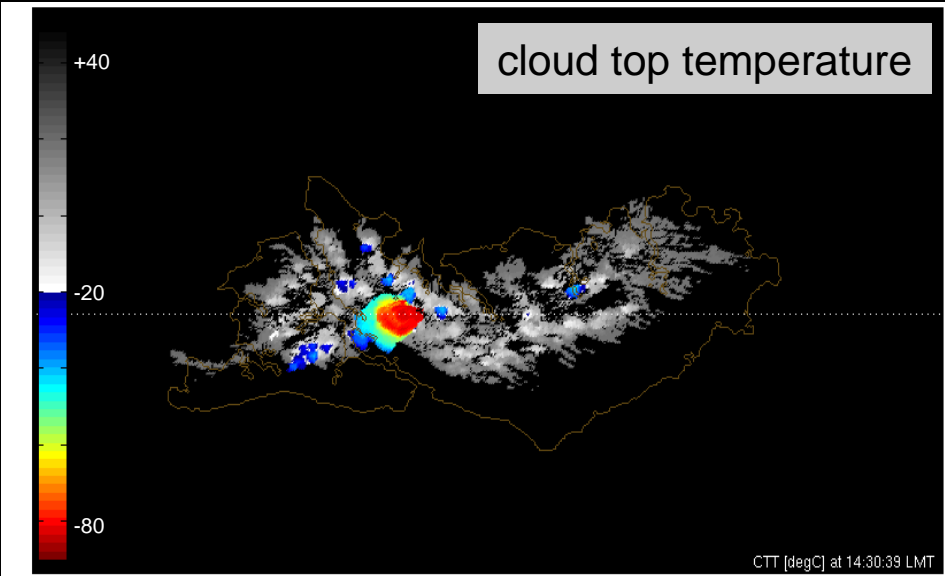
Structure in shallow convection: dynamic *versus* thermal instability



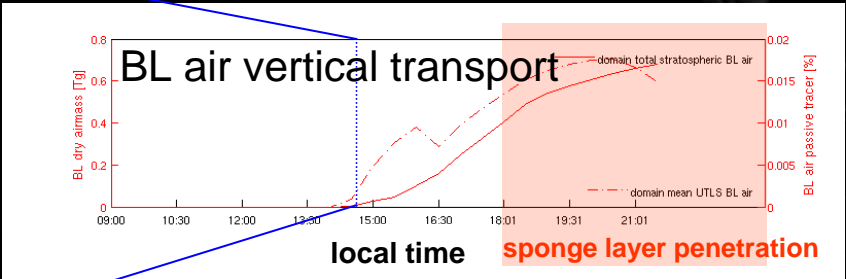
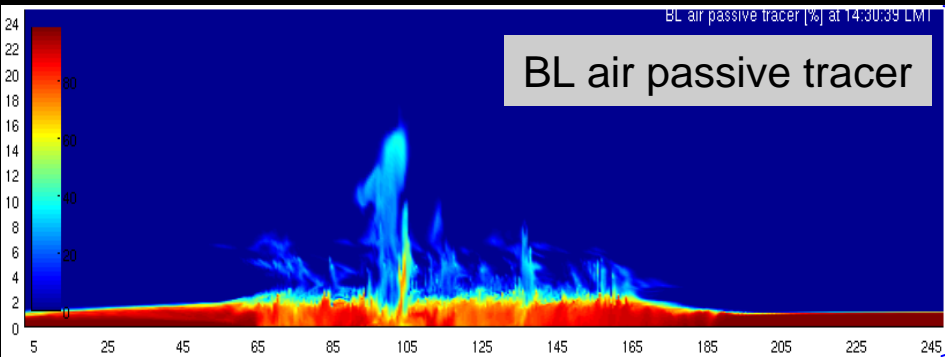
Structure in deep convection: storm propagation on cold pool gust front



Diagnosing storm intensity and new framework for quantifying BL air entrainment

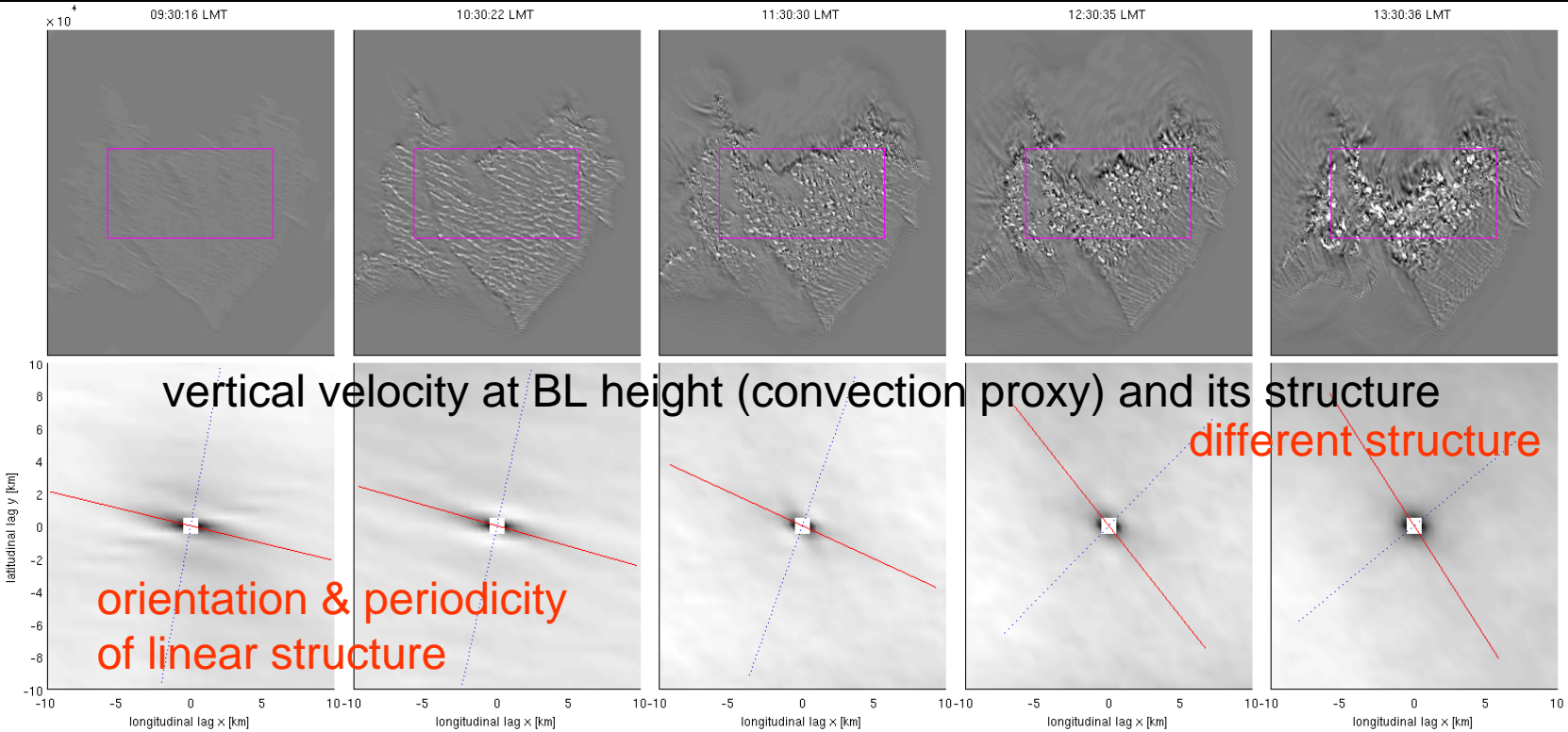


- cloud top height and temperature
- maximum up- and downdrafts
- total accumulated rainfall
- vertical transport of moisture
- vertical transport of tracers



Diagnosing storm organization and *quantifying structure*

... or, how to extract quantifiable and inter-comparable information about convective structure from 10^2 - 10^3 GB of 4D data fields



multiscale statistical properties as defined in Harris, *et al.*, 2001

Towards incorporating structure in convective cloud field parameterizations ...

