UNIVERSITY OF LEEDS

# Coherent boundary layer structures

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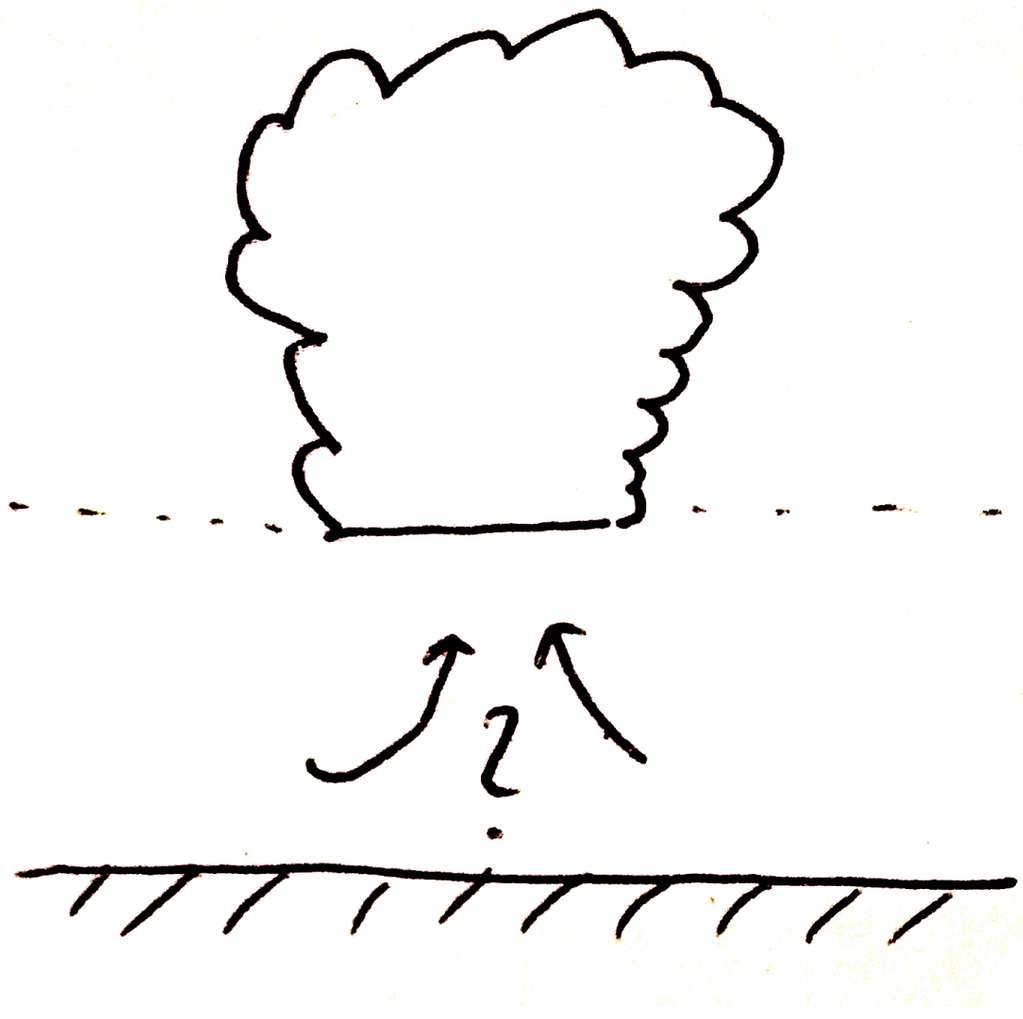
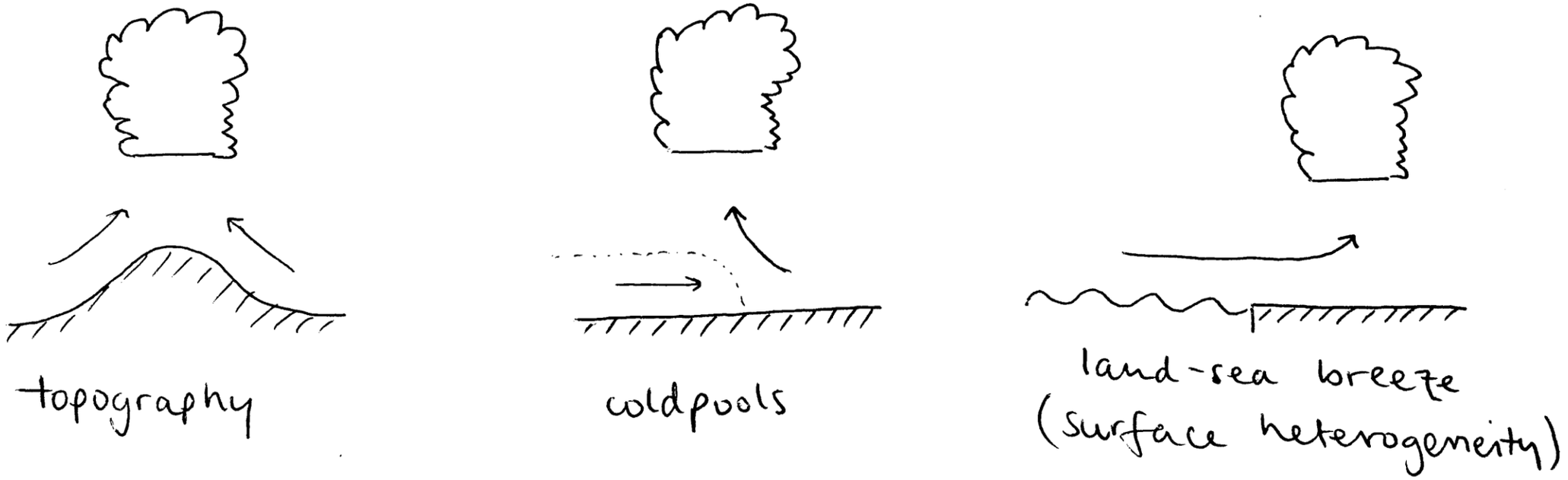
15/5/2019, ParaCon Plenary, University of Leeds

# Aim



# Aim

- Describe statistics of boundary layer relevant to triggering convection and the sensitivity to presence of different phenomena



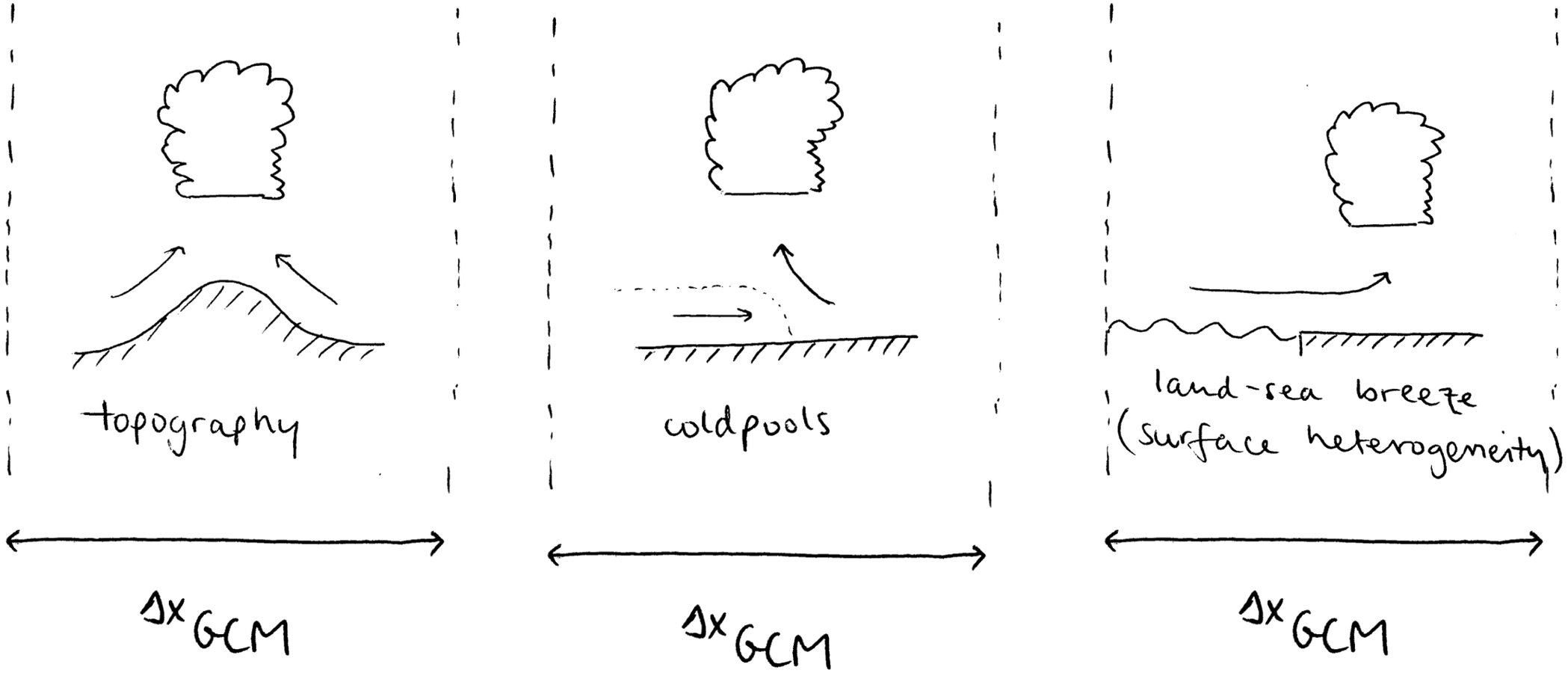

- *"What are the length-scales and magnitudes of perturbations which trigger convection?"*

# Why?

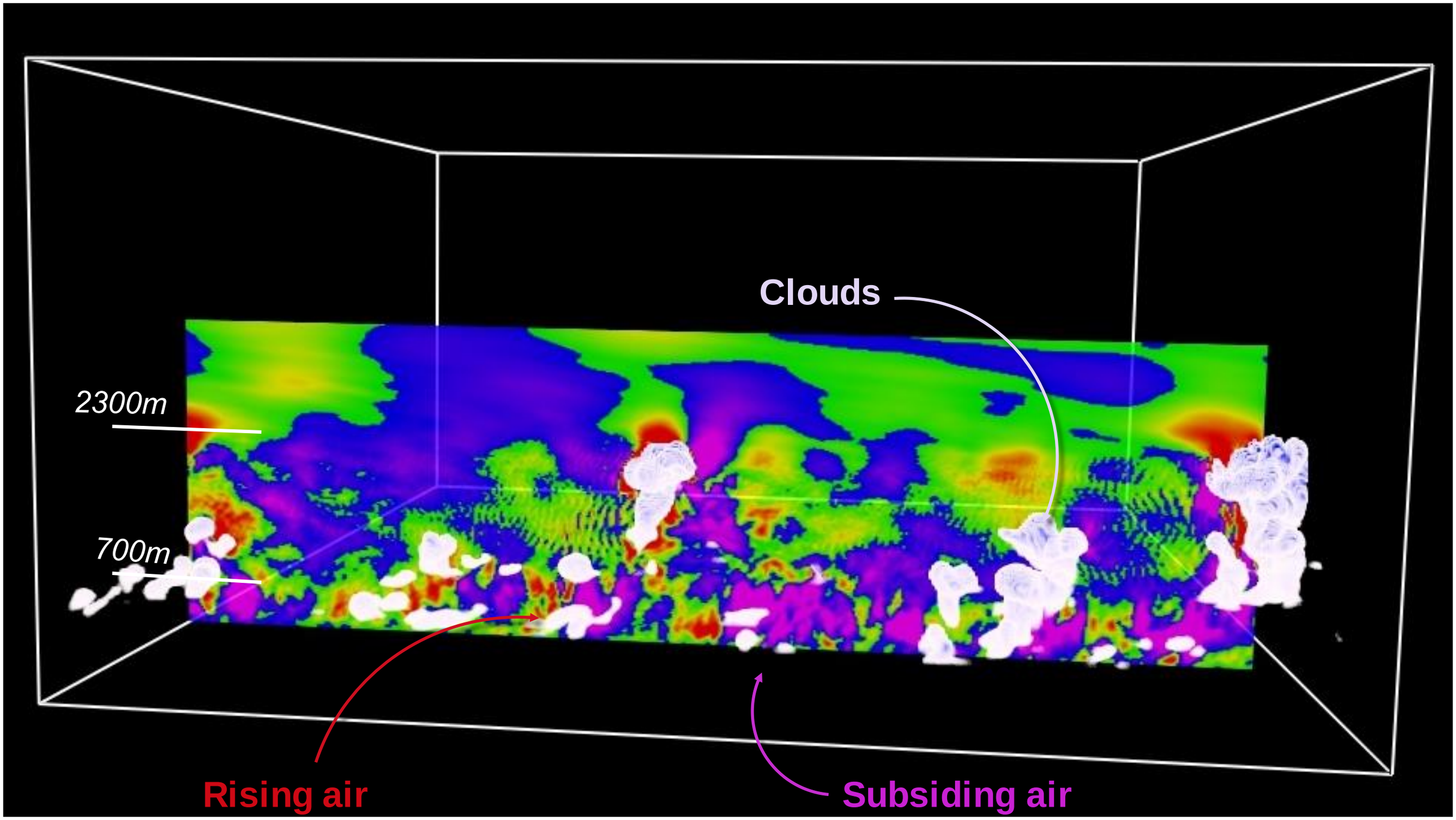
- GCMs have too coarse resolution to fully represent convection (O(km))

  ⊡→Trigger (and evolution) of convection must be parameterised

  ⊡→These *sub-grid* features are known to be critical in predicting formation of convection



# What are the length-scales of variability?




Δx=25m Large-Eddy Simulation, RICO test-case

Rendered with VAPOR

# 2 topics today

1. New method of unpicking joint distributions and spatial structures

2. Decomposition of boundary layer moisture flux into non-local (mass flux) and local (downgradient diffusive flux) transport

# Live demo: "Visualizer 9000"

- Written by PhD student Peter Hristov, Leeds
- Hypothesis to being tested:
  - Coherent structures defined through the radioactive passive tracer exist in a unique space in the joint distribution PDF(q,θ) of moisture (q) and temperature (θ). If region is selected in PDF(q,θ) then this will **uniquely** define the same coherent structures
- Examining LES simulation based on RICO without shear
- Submitted to IEEE SciViz 2019

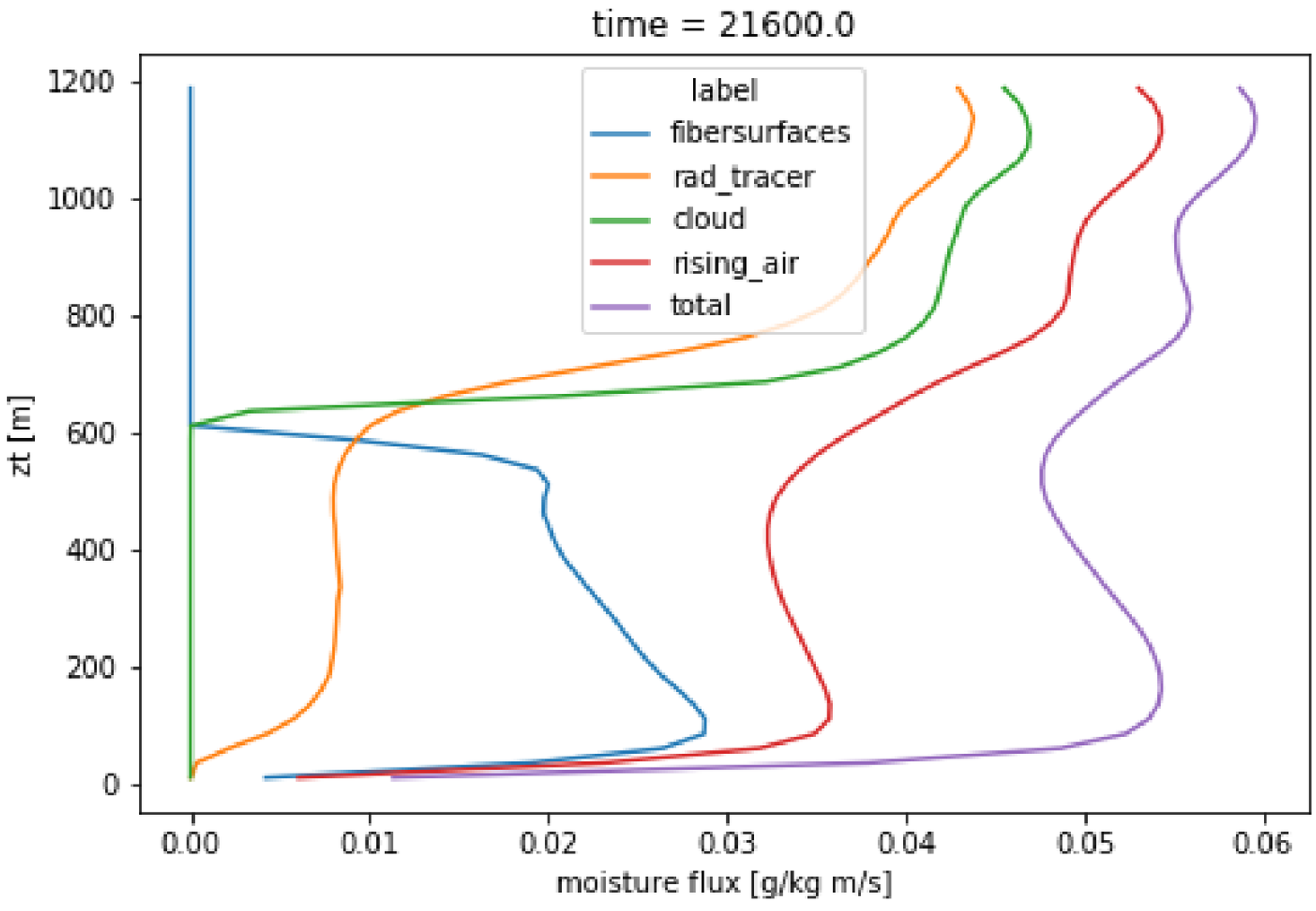
# Summary

- Individual objects appear to create linear features in PDF(q,θ) - may ease modelling

- Near-surface and near-cloudbase regions appear is distinct linear regions in PDF(Δq,Δθ) - suggests something about mixing with environment in these regions?

- Coherent structure cannot be uniquely defined using only limits on q and θ, a linear combination may provide limit but includes surface layer without coherent transport

# Decomposition of moisture flux




- Radioactive tracer flux near-constant with height
- Flux from region selected by fibersurfaces much larger than rad tracer – includes local transport

# Thank you!

Questions?