

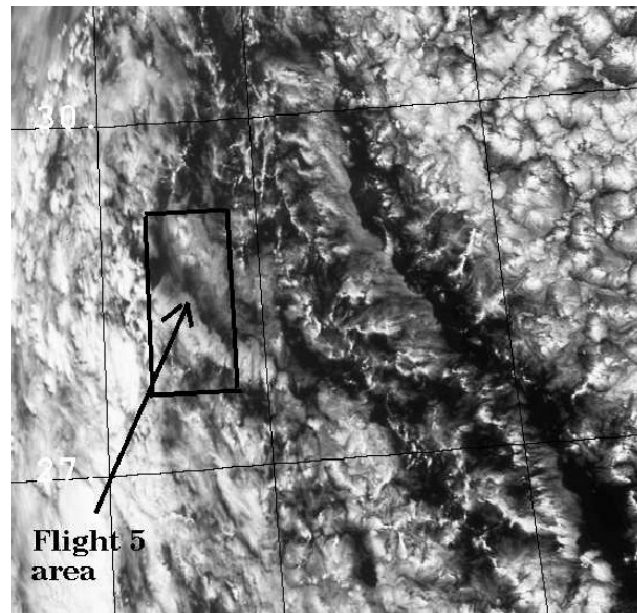
Scale Dependence of the ASTEX transition in DALES

Johan van der Dussen | *Clouds, Climate and Air Quality*

28-09-10

Research Goal

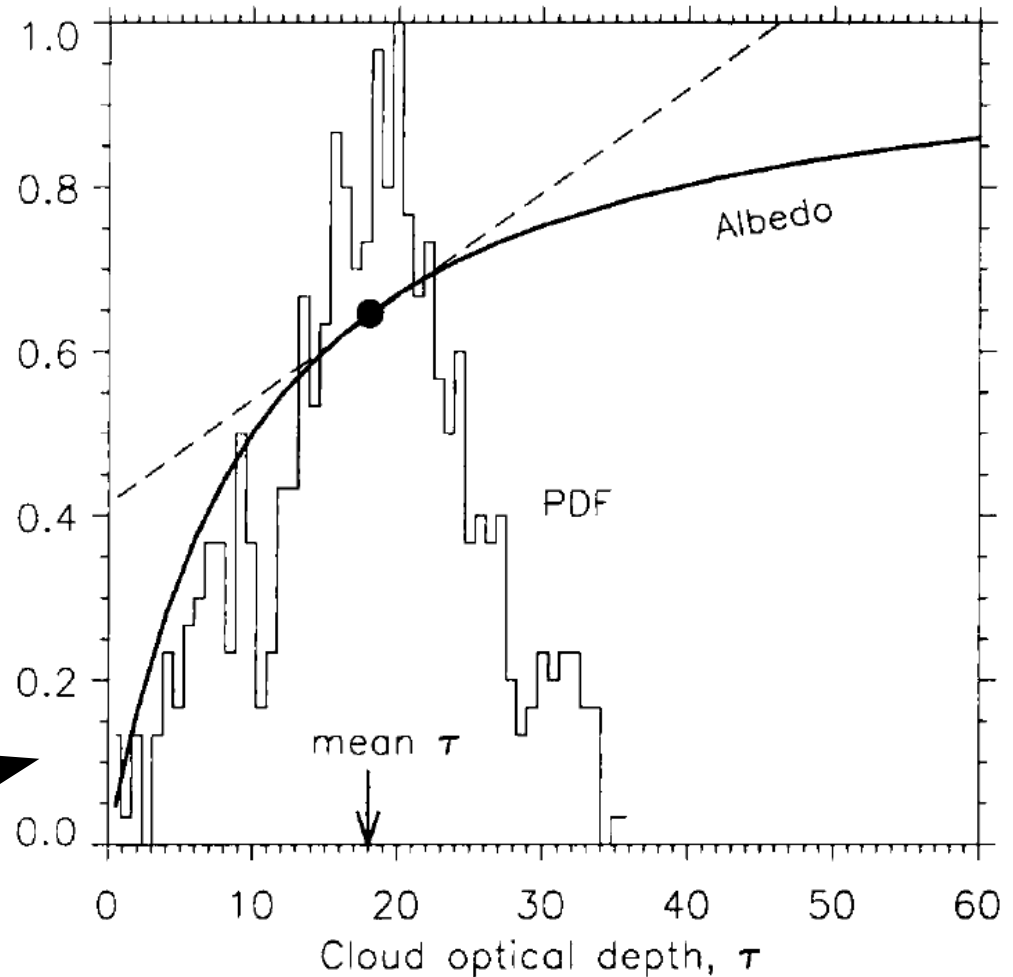
- Importance of large scale fluctuations → LWP
- LWP probability distribution important input (McICA) radiation parametrization



Albedo bias

- Correct albedo only with pdf of LWP

derived from observations from ASTEX flight 3



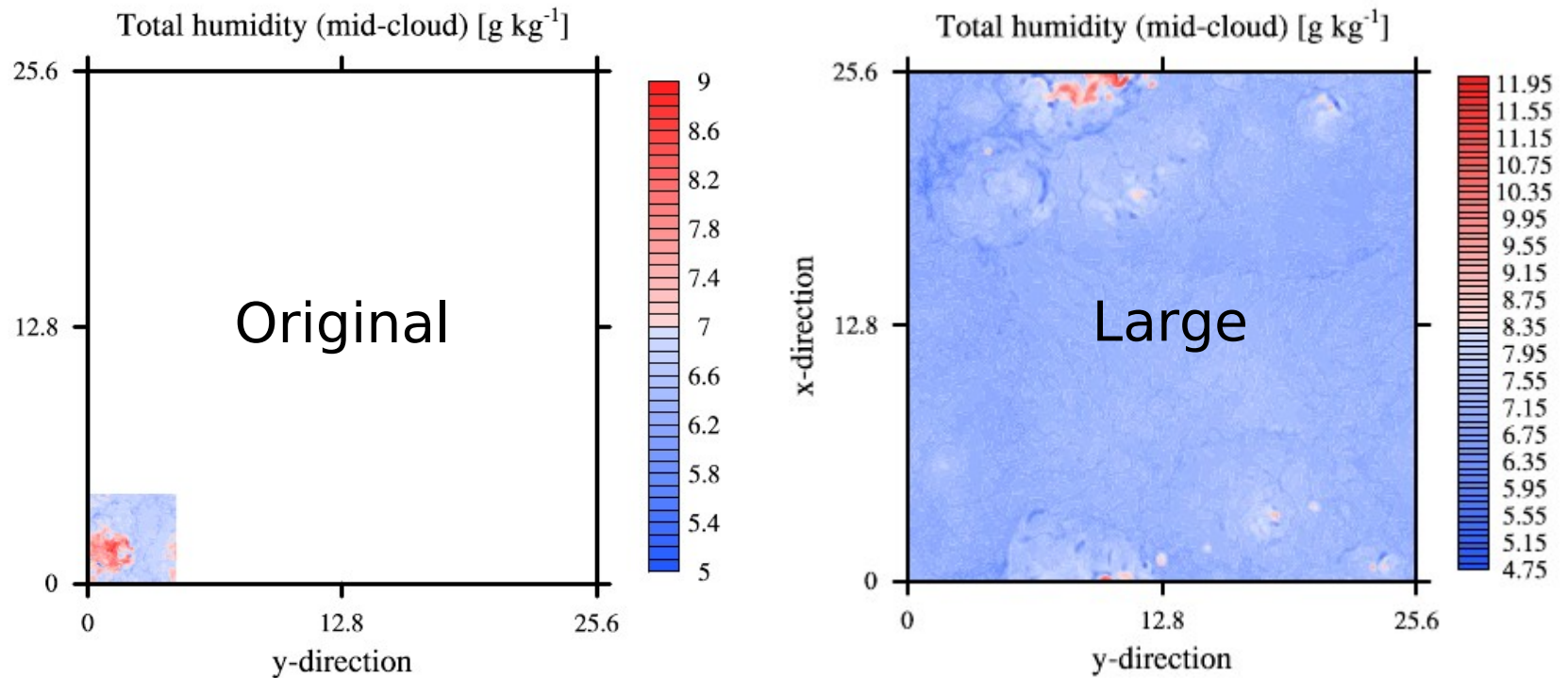
Los and Duynkerke (2001), Q.J. R. Meteorol. Soc., **127**

Simulation specifics

	Original	Large Domain
$\Delta x = \Delta y$	35 m ($N_x=128$)	100 m ($N_x=256$)
Δz	05-15 m	25 m
Domain size ($x = y$)	4.48 km	25.6 km
CPU hours	~7000	~1000

- Large domain simulation much cheaper due to larger timestep

Simulation specifics

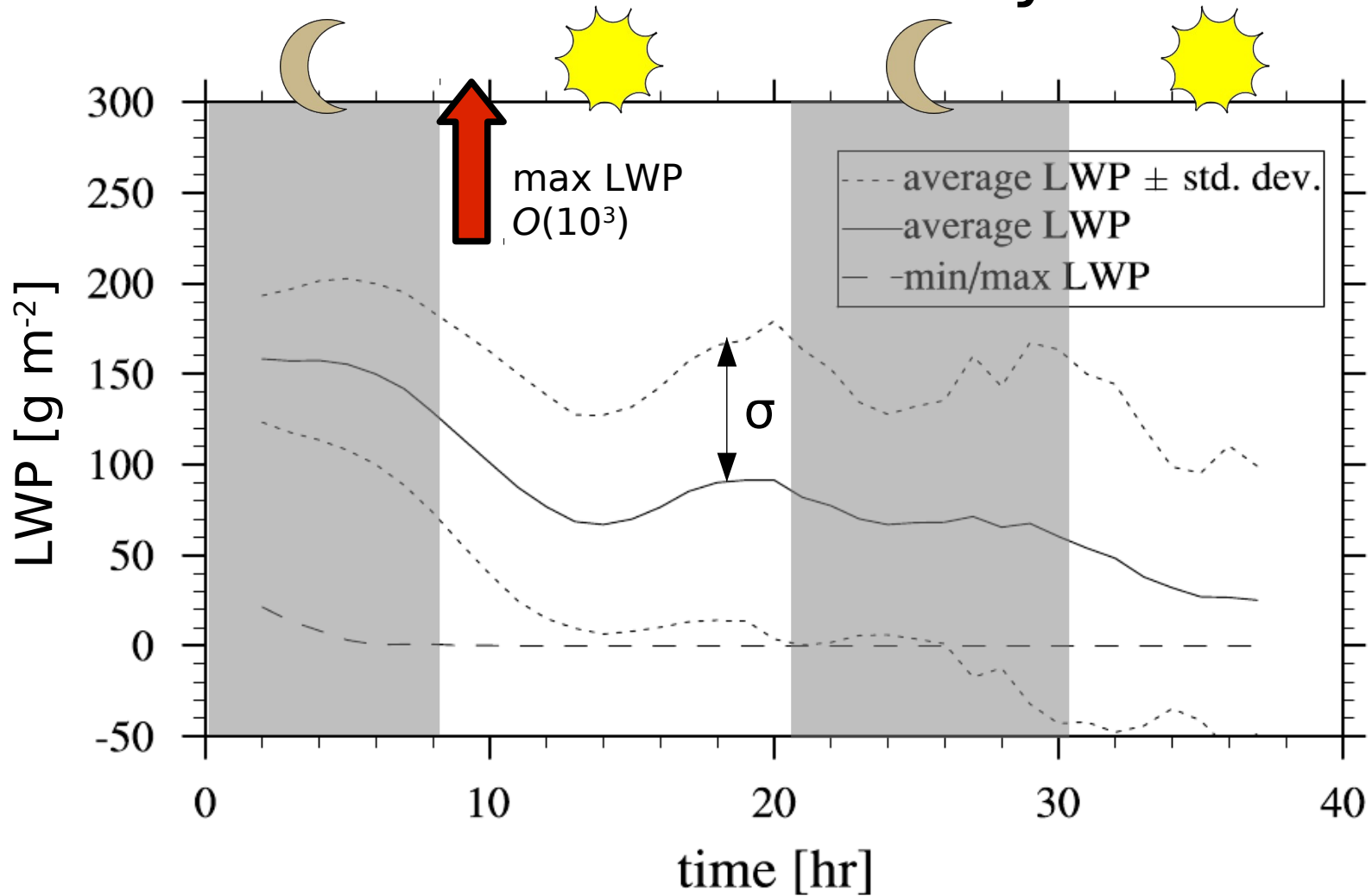


In-cloud snapshots hour 32

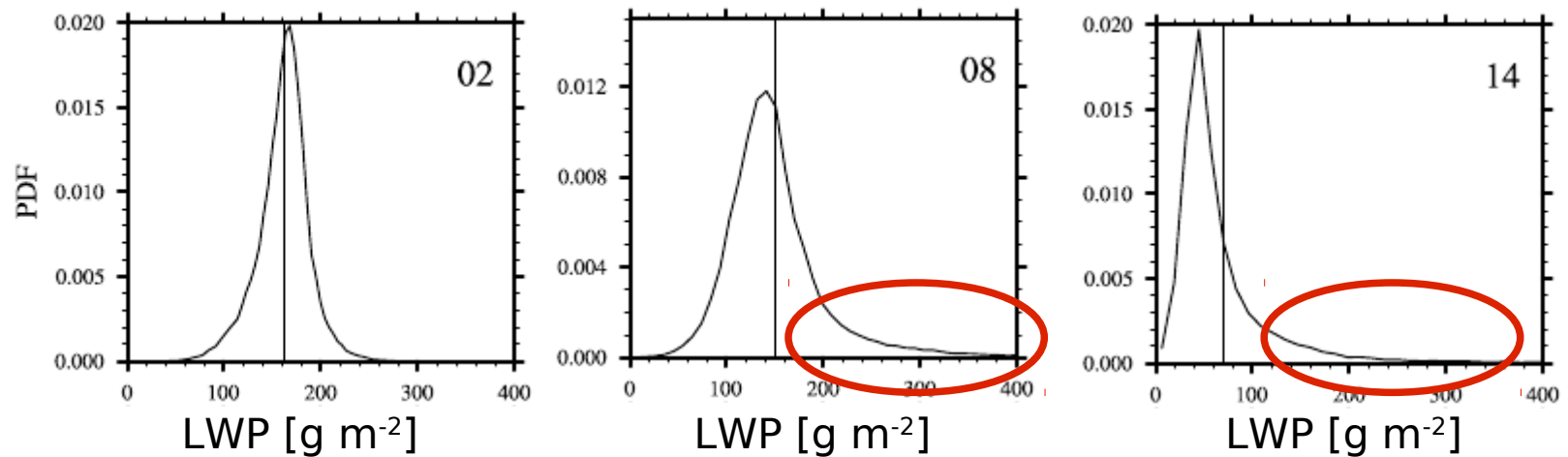
Data analysis

- Analysis of horizontal variances in and below cloud
- Following:
 - De Roode & Los (**2008**),
Q.J.R. Meteorol. Soc. **134**
- Based on the variances and their (spatial) distributions

Time evolution of cloud layer

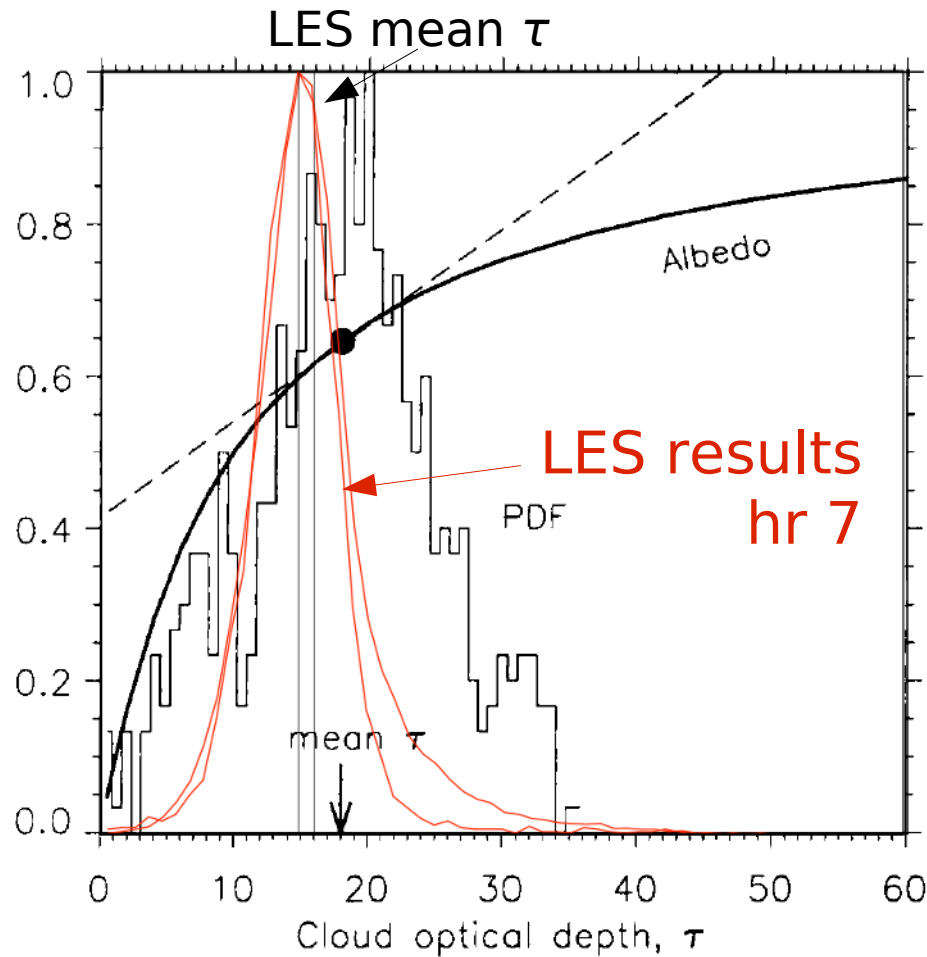


Probability density function LWP



- Longer tail caused by cumulus clouds

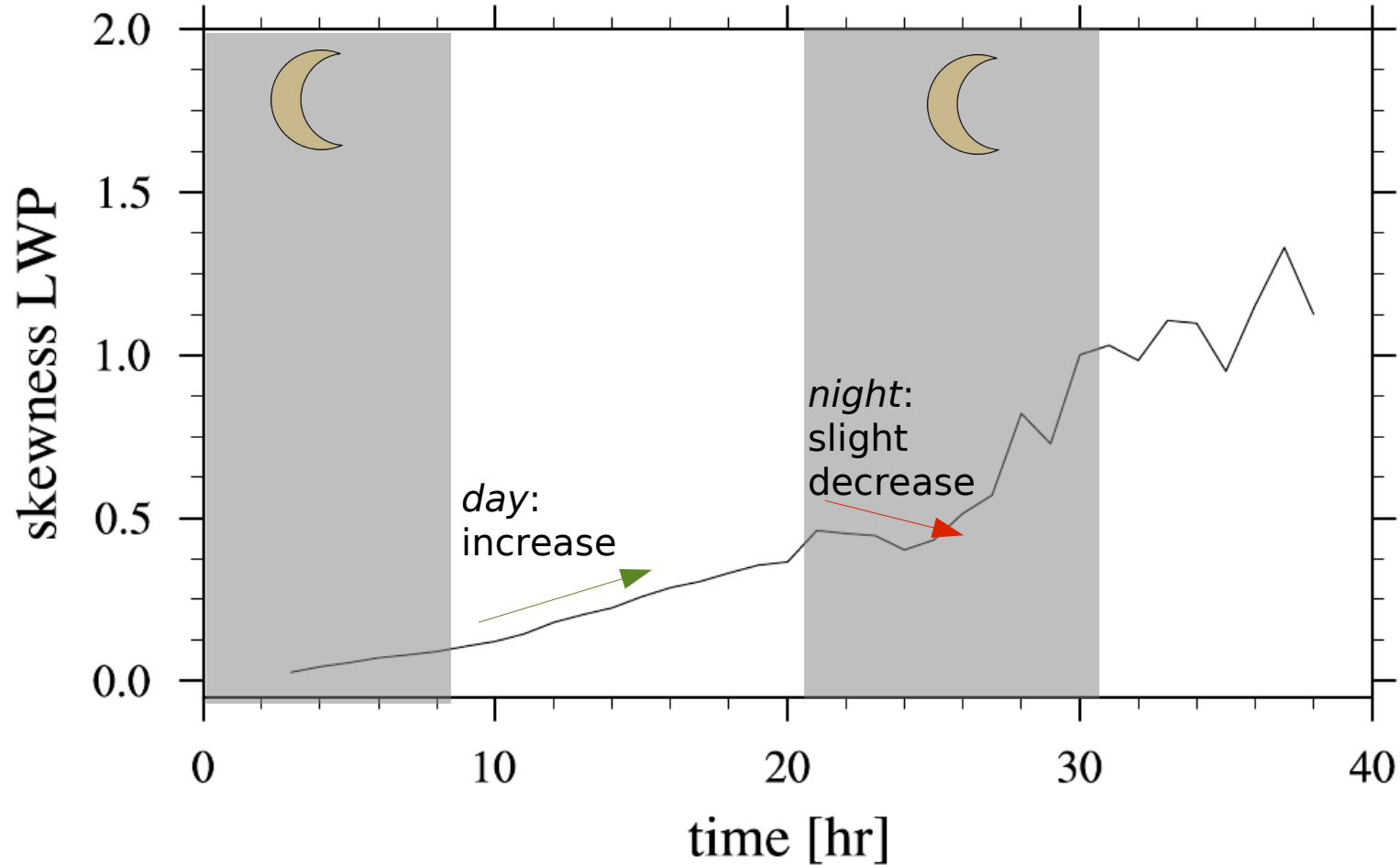
Domain size influence on pdf



Large domain results in wider pdf and higher mean τ

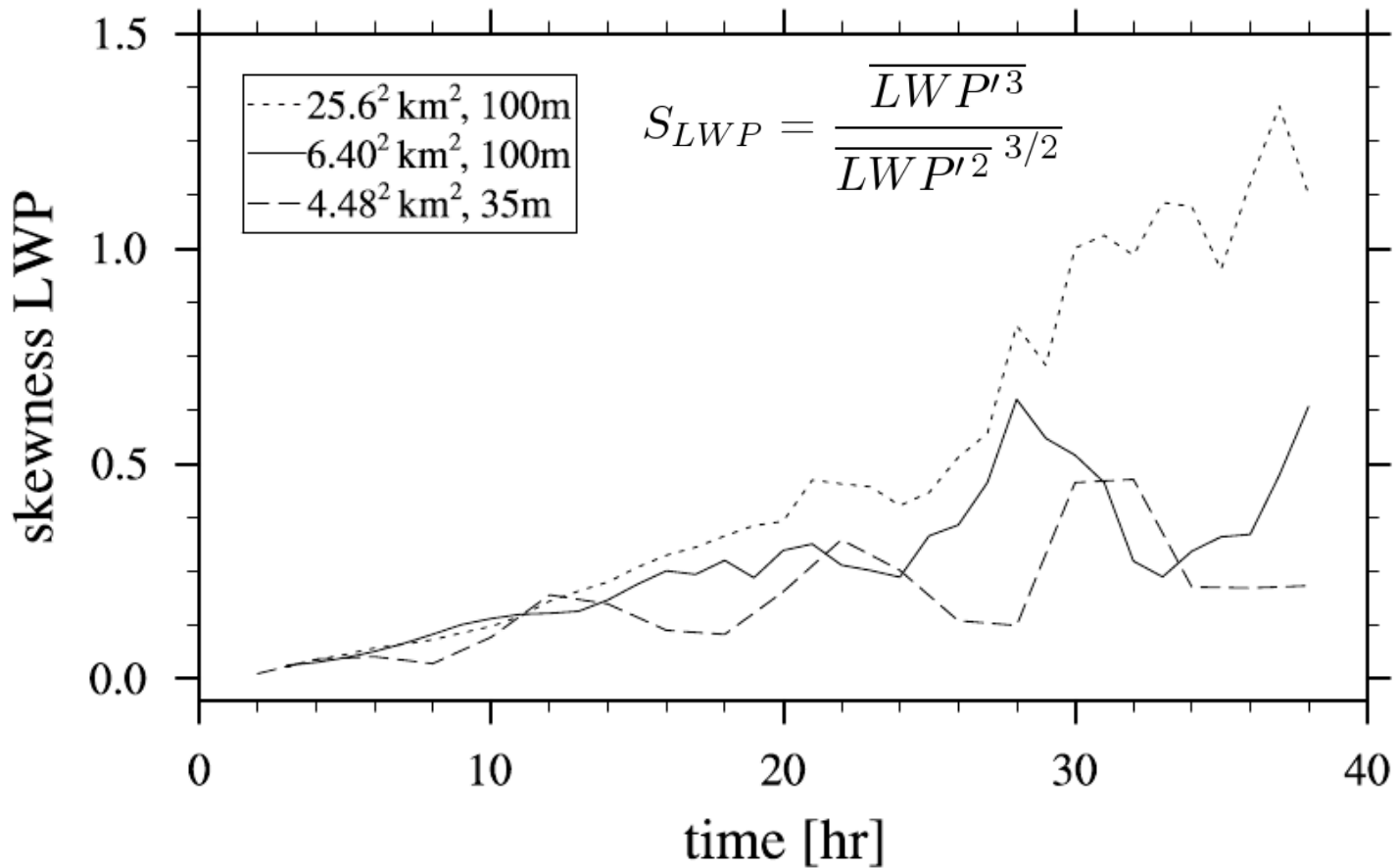
Skewness of LWP pdf

Transition causes increase

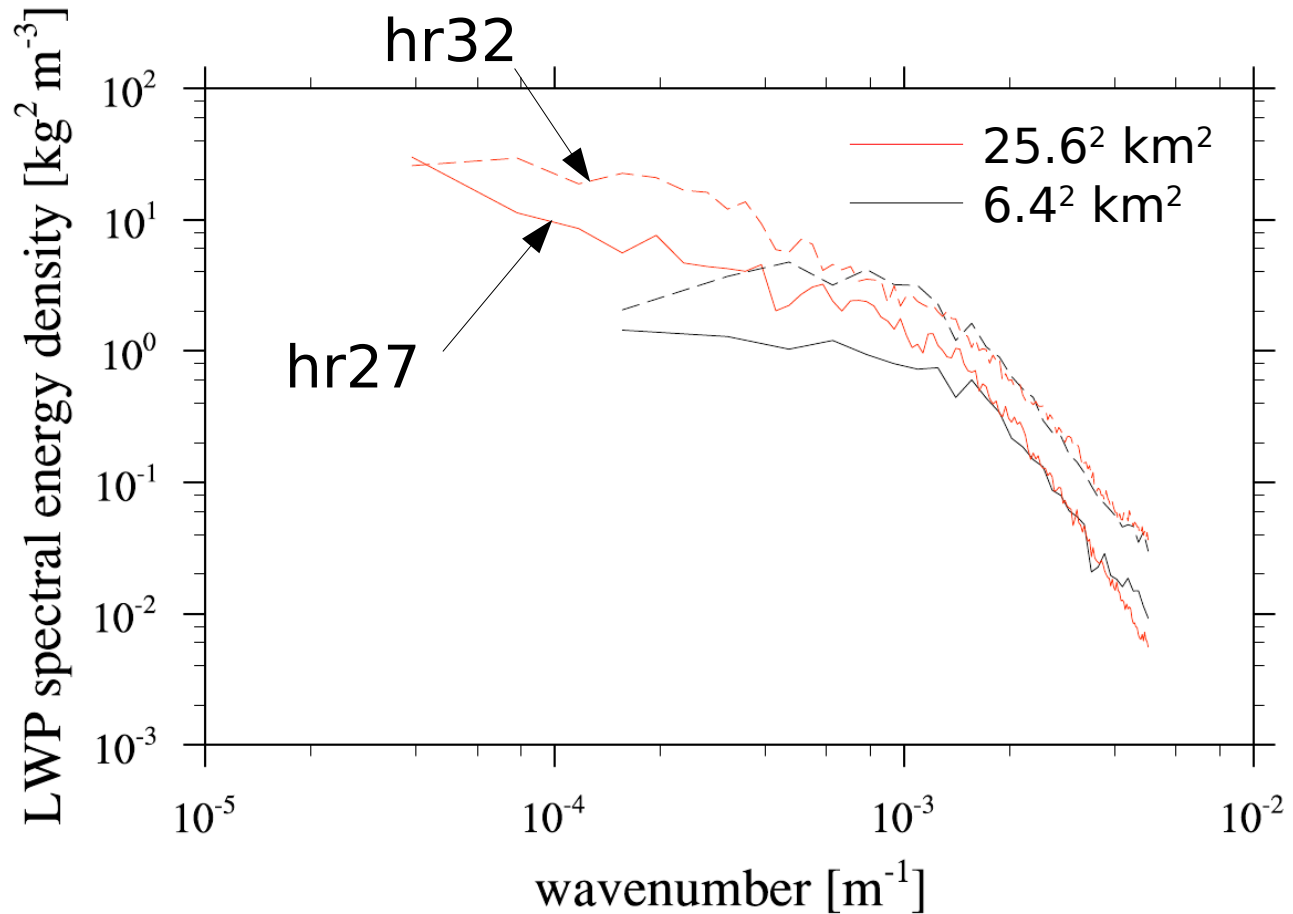


Skewness of LWP pdf

Influence of domain size

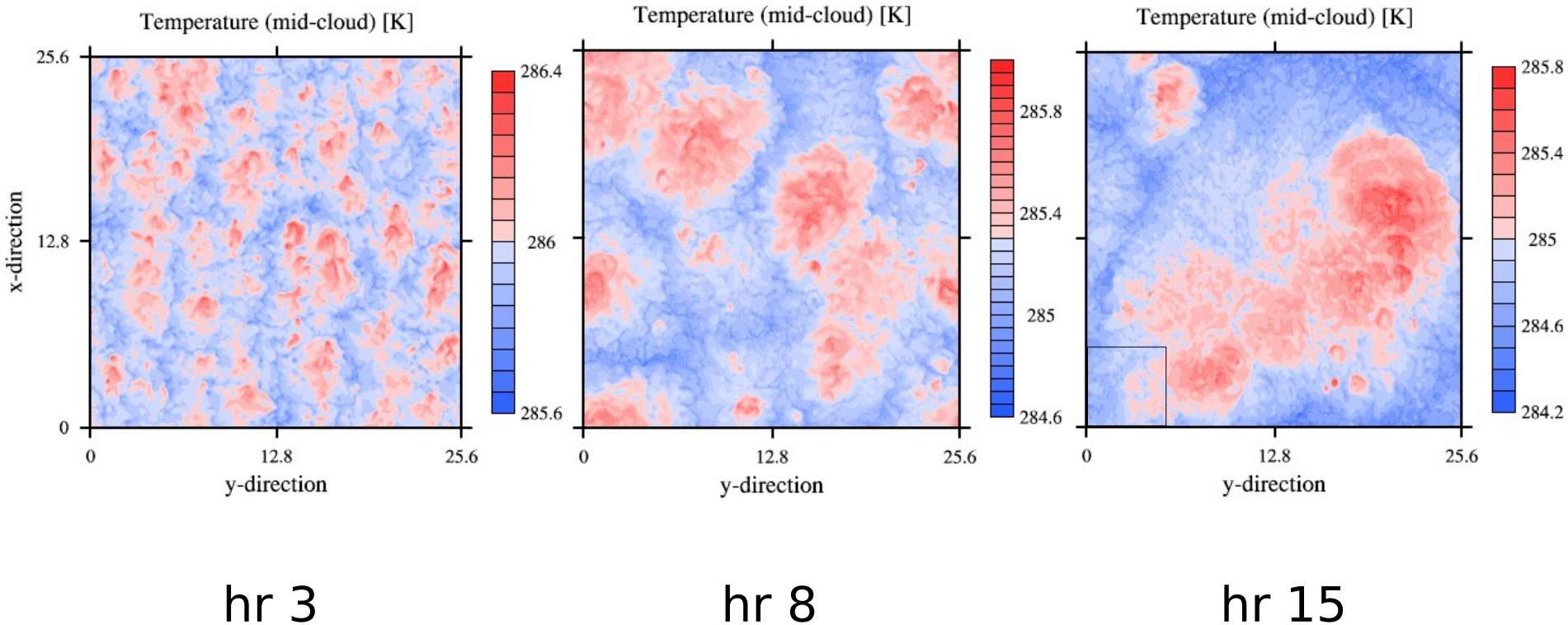


Spectral energy LWP



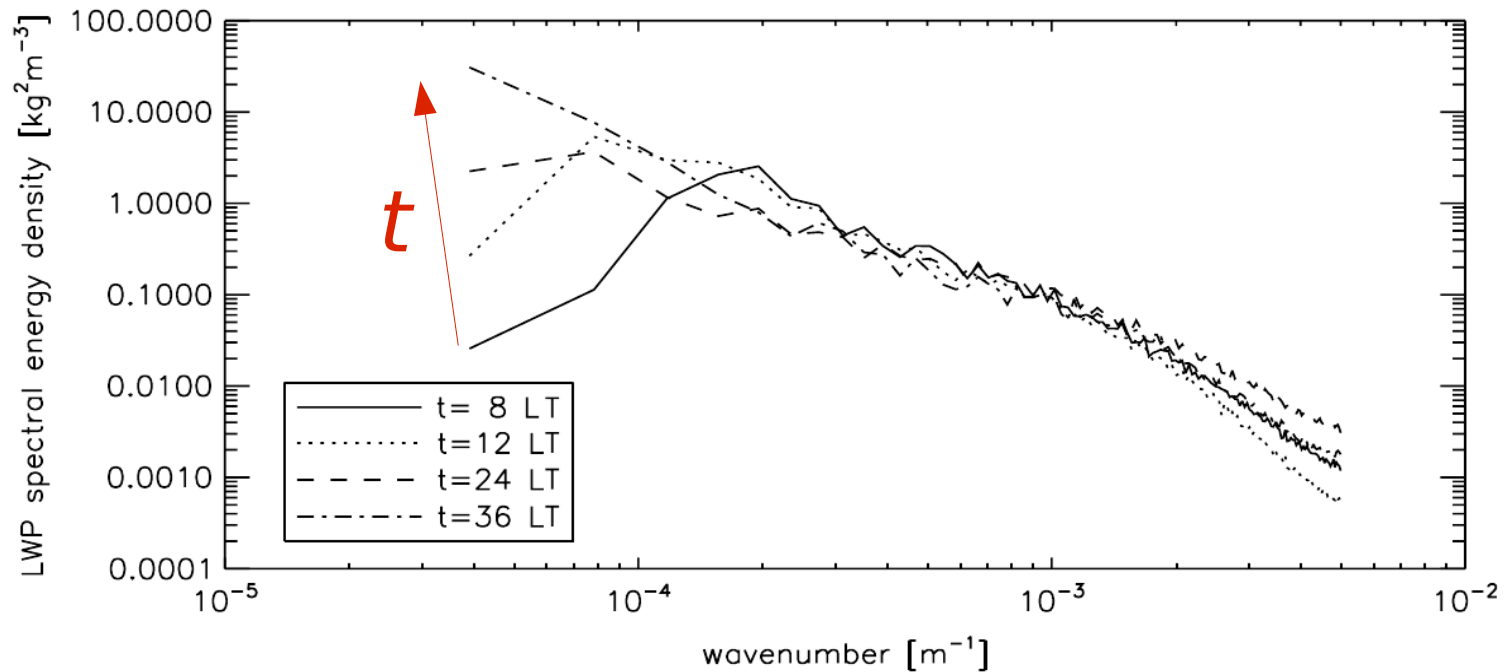
Growth of larger scales

Sign of transition ...



Growth of larger scales

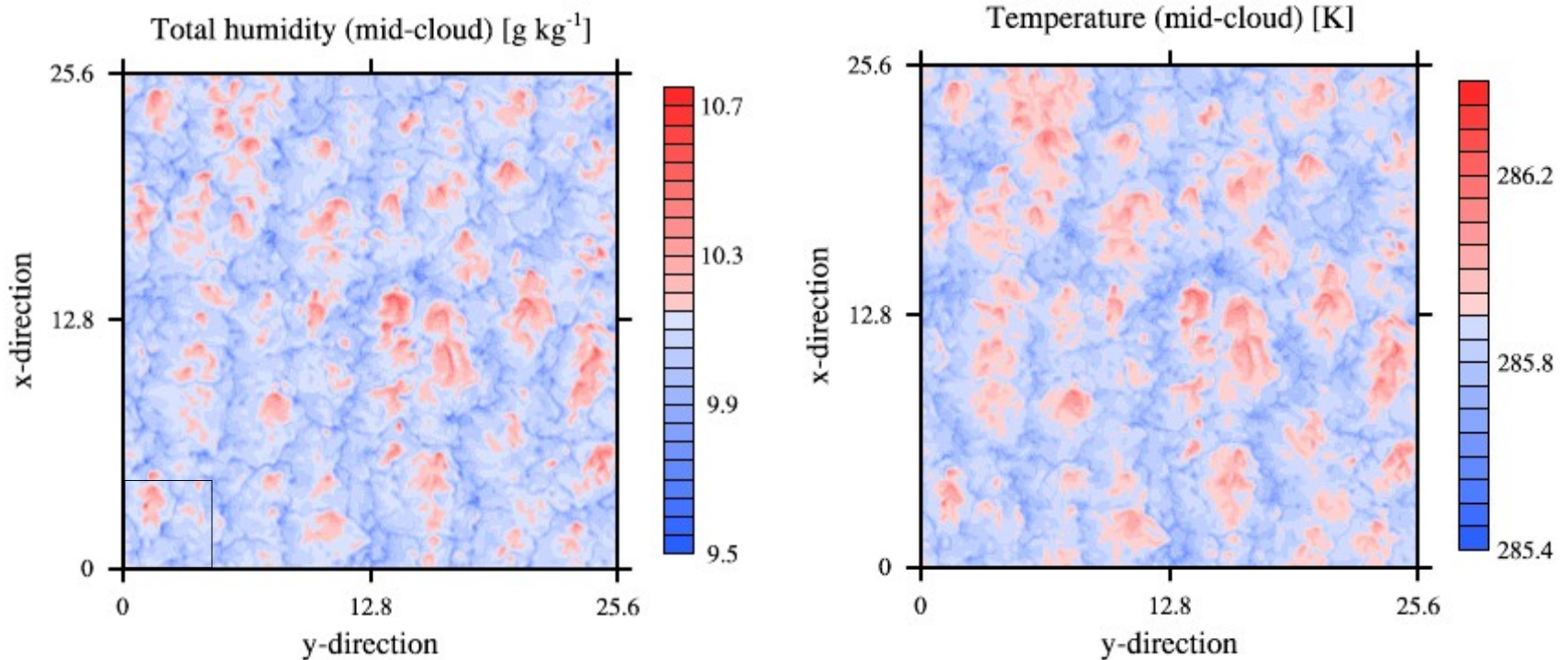
... or spin-up effect?



FIRE stratocumulus case (De Roode & Los, **2008**)

Correlation between q_T and T

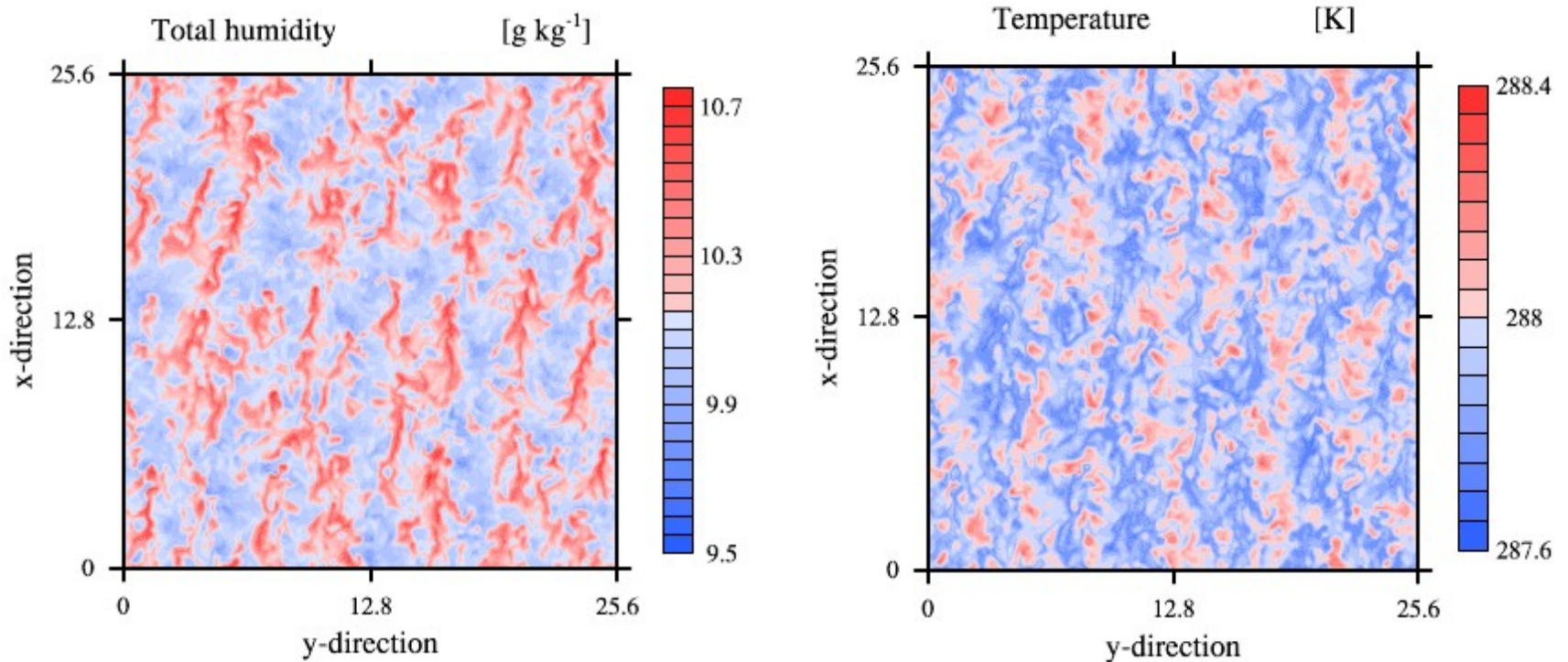
In-cloud (hr 3)



Strongly correlated

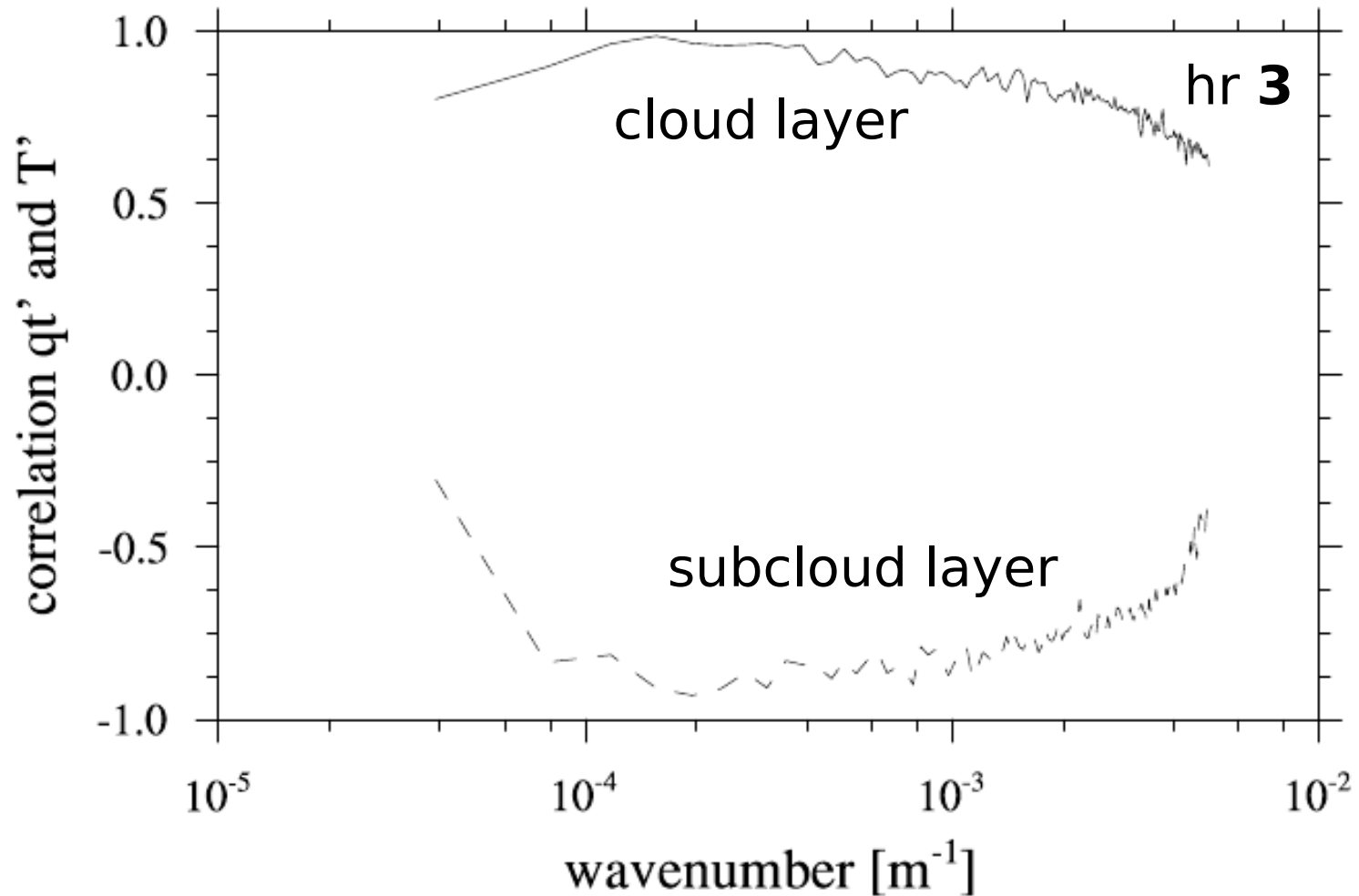
Correlation between q_T and T

Subcloud (hr 3)



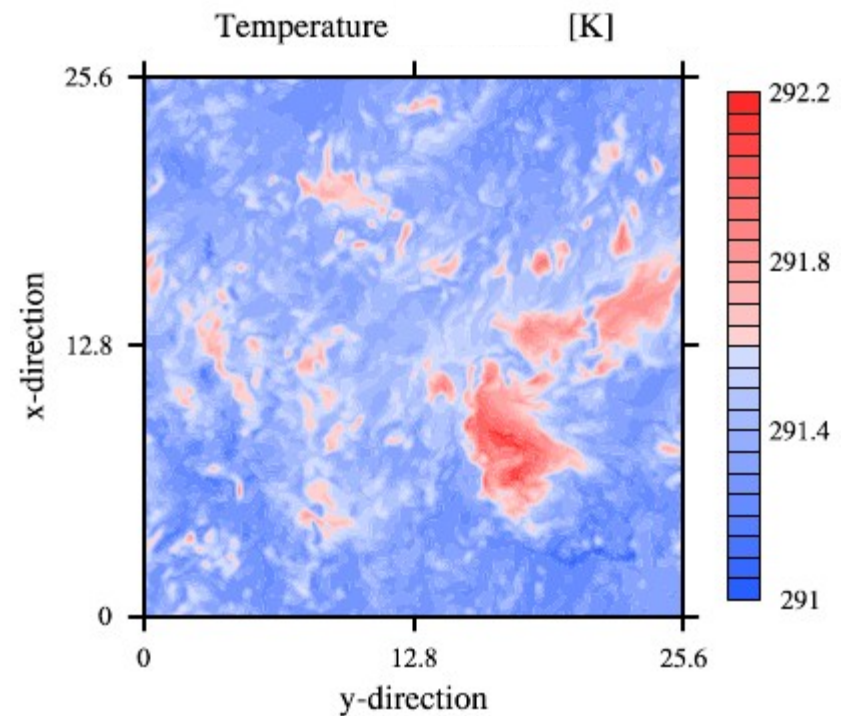
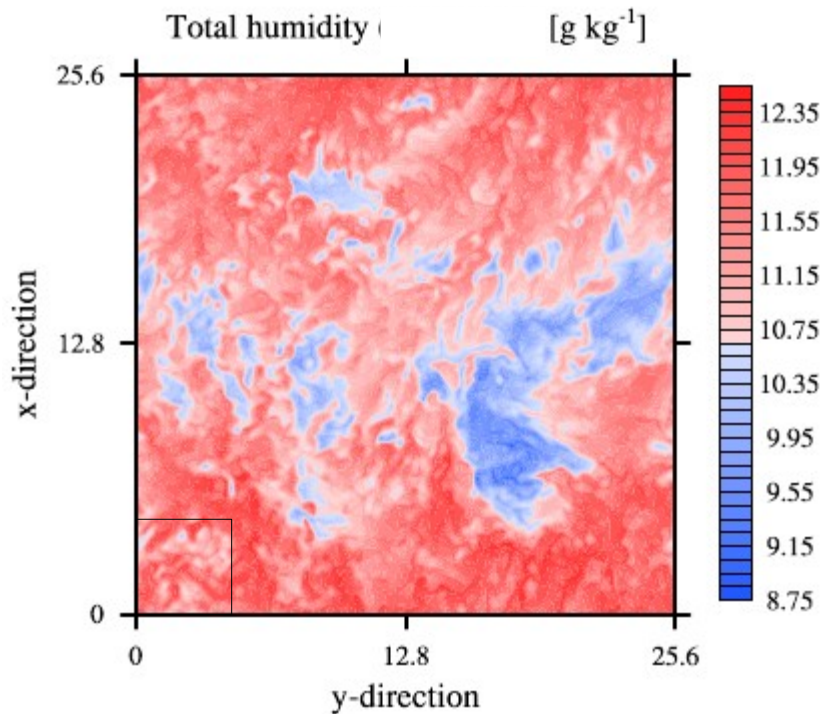
Strongly anti-correlated

Correlation between q'_T and T'



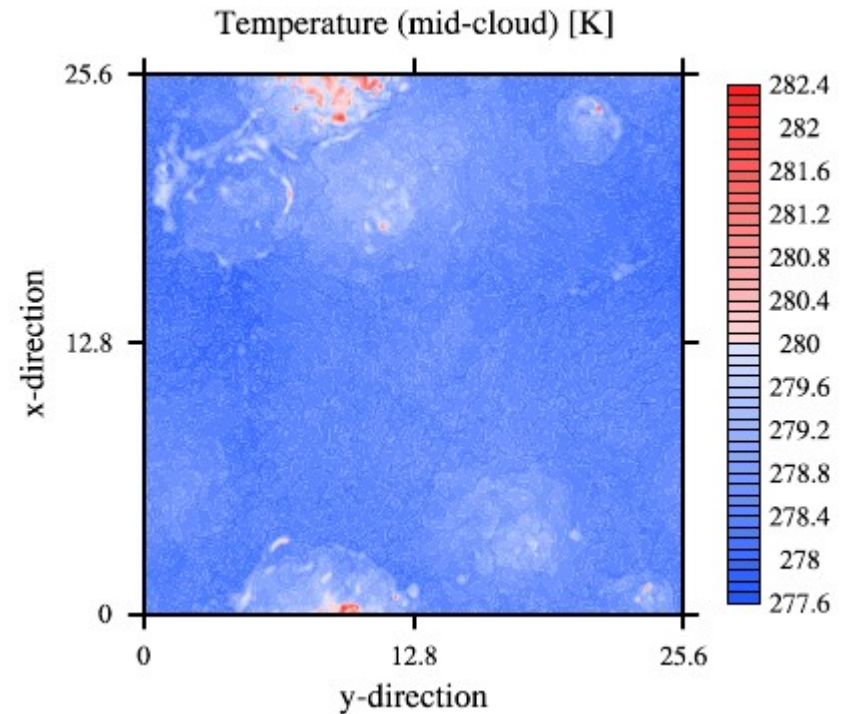
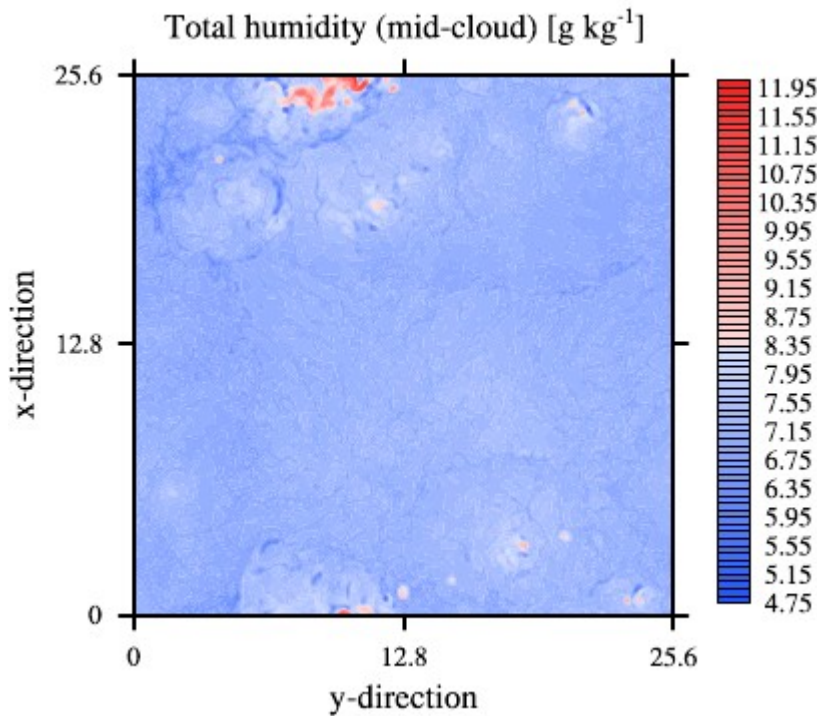
Correlation between q_T and T

Subcloud (hr 32)

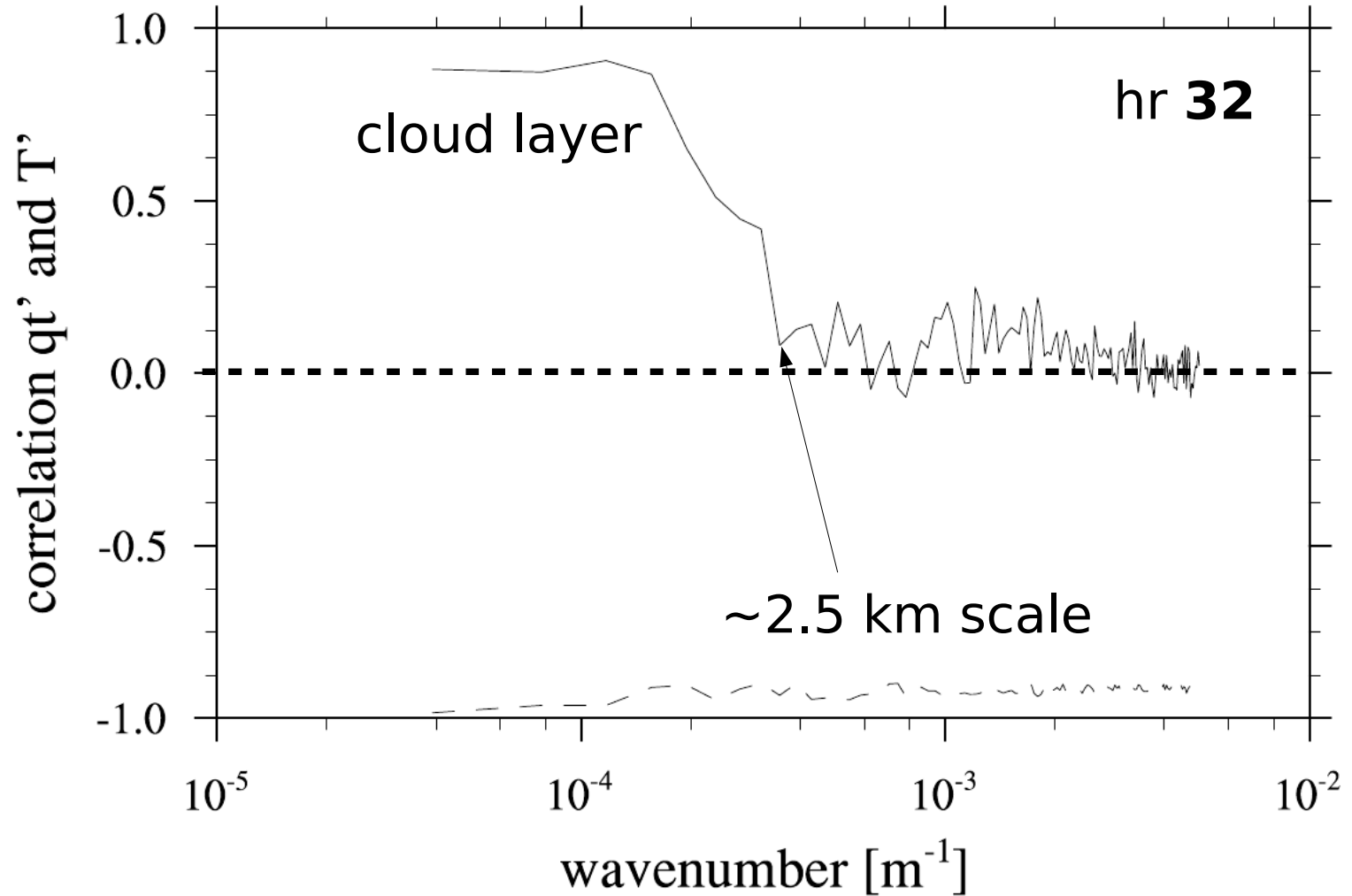


Correlation between q_T and T

In-cloud (hr **32**)



Correlation between q'_T and T'



Further research

- Further analyse pdfs of LWP, q_T' and T' for the transition case
- Test parametrization of subgrid scale LWP variability in GCMs
- Investigate breaking of correlation between q_T' and T'
- Decrease of entrainment rate due to stronger horizontal variances?

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