LES sensitivity to divergence during the ASTEX transition





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ASTEX model intercomparison





Results obtained by : A. Ackerman, P. Blossey, A. Lock and I. Sandu

Prescribing large scale divergence

FUCLIPSE

Uncertainty in prescribing the large scale divergence due to:

- 1) difficulty of directly measuring it
- 2) spacial and temporal variability in ECMWF reanalysis data





Sensitivity experiments: divergence



Transitions were previously shown to be slowed down by lower divergence (De Roode and Van der Dussen, 2010; Sandu and Stevens, 2011)

Three additional simulations were performed using DALES





Delayed cloud break up by lowering divergence





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$$\frac{\partial z_i}{\partial t} = w_e + \overline{w}$$

Inversion height increases due to:

- smaller
$$|\overline{w}|$$
 (~ 2/3)

- increased
$$w_e$$
 (~ 1/3)





⁽Wood and Bretherton, 2004)







$$\Gamma_{q_L} \frac{\partial h_c}{\partial t} = \left(\frac{\partial q_L}{\partial q_T}\right)_{\theta_L, z_i} \frac{\partial q_T}{\partial t} + \left(\frac{\partial q_L}{\partial \theta_L}\right)_{q_T, z_i} \frac{\partial \theta_L}{\partial t} + \left(\frac{\partial q_L}{\partial z_i}\right)_{\theta_L, q_T} \frac{\partial z_i}{\partial t}$$

- Budget equations for q_T and θ_L tendencies

$$\frac{\partial \varphi}{\partial t} = -\frac{\partial \overline{w' \varphi'}}{\partial z} + \frac{\partial S_{\varphi}}{\partial z}$$

- Inversion height evolution is sum of entrainment and subsidence

$$\frac{\partial z_i}{\partial t} = w_e + \overline{w}(z_i)$$





Tendency of cloud layer thickness

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Thermodynamics



Result: analysis of cloud thickness tendency during ASTEX





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