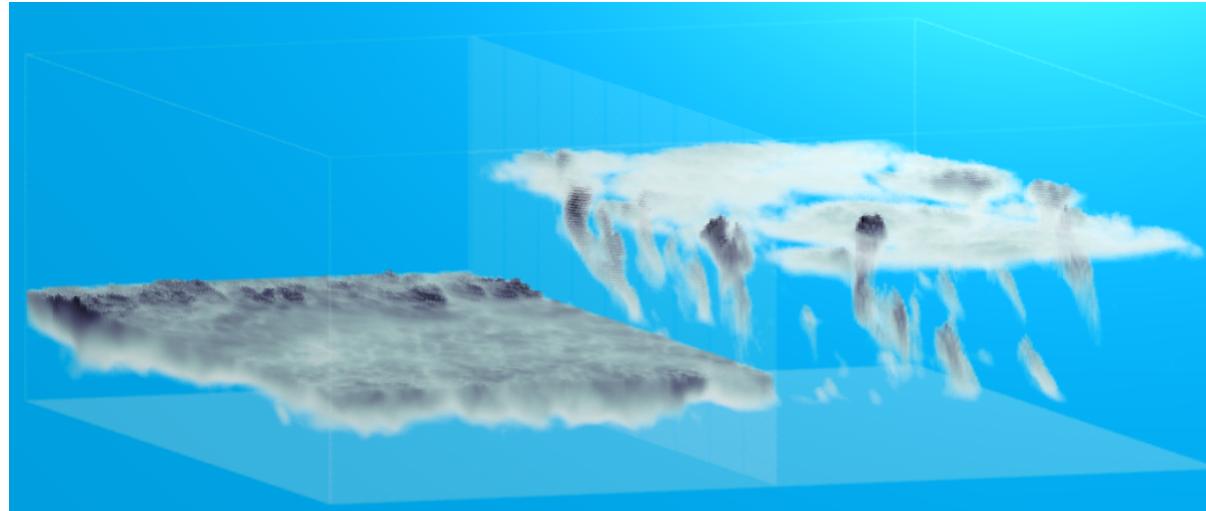
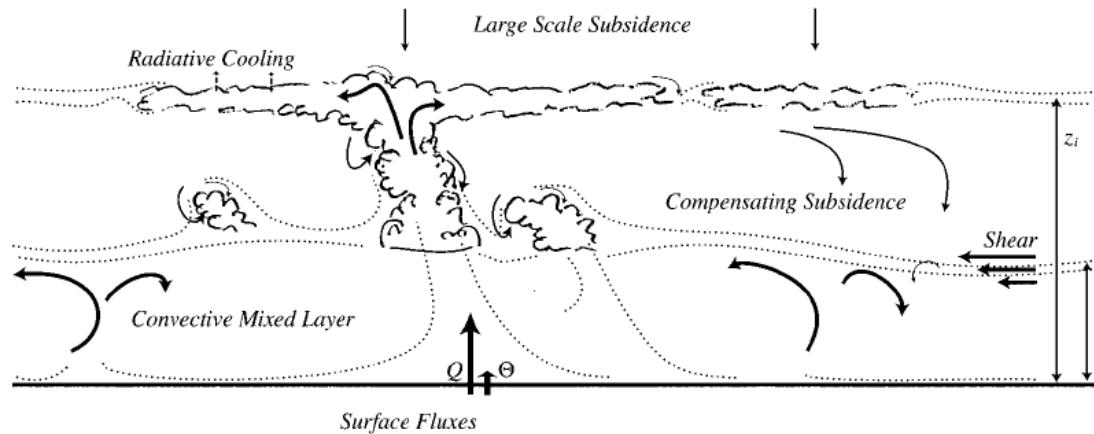


EUCLIPSE ASTEX and composite stratocumulus to cumulus transition cases



Irina Sandu, Johan van der Dussen, Roel Neggers, Stephan de Roode, Bjorn Stevens
LES & SCM participants

Previous GCSS boundary layer cloud studies



ATEX intercomparison,
Stevens et al. (2001)

FIG. 14. Conceptual diagram of intermediate trade cumulus regime.

Stratocumulus cases (ASTEX, EUROCS-FIRE, smoke cloud)

Cloud top entrainment, turbulent transport (e.g *Duynkerke et al. 2004; Bretherton et al. 1999*)

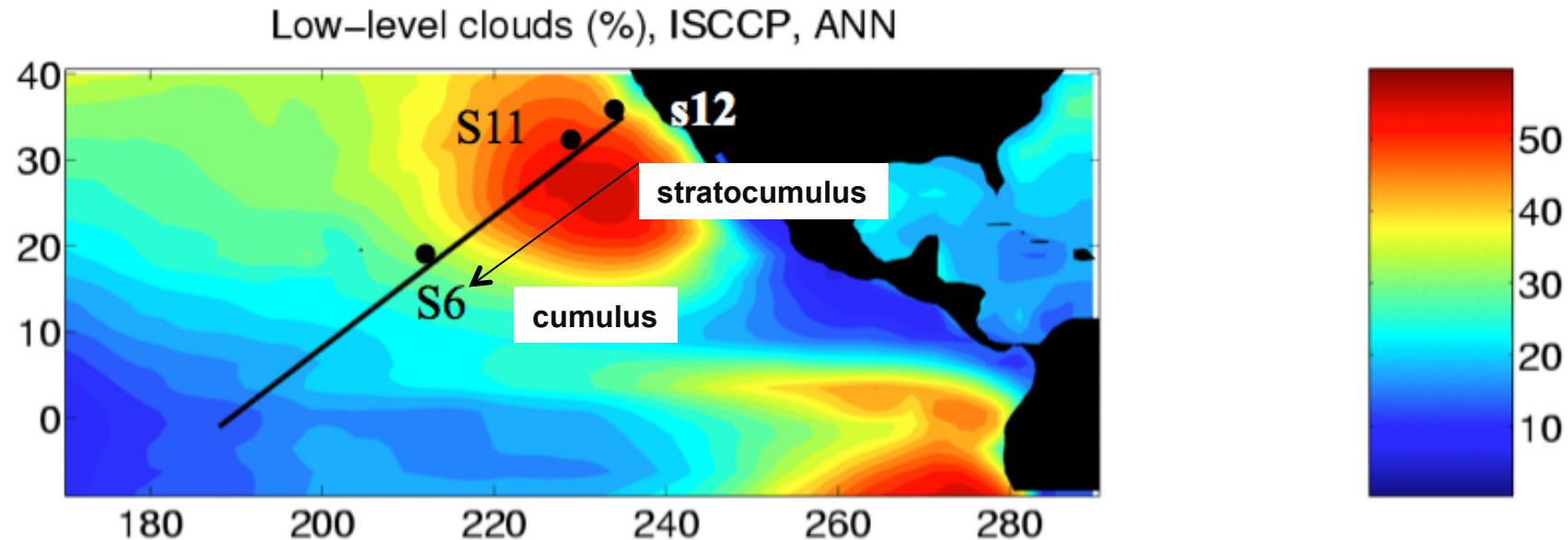
Cumulus cases (BOMEX, ARM, ATEX)

Lateral entrainment and detrainment, mass fluxes (e.g *Brown et al. 2002; Siebesma et al. 2003*)

Stratocumulus-cumulus transition case (ASTEX)

Comparison of SCM results against observations (e.g. *Bretherton et al. 1999*)

CGILS equilibrium states



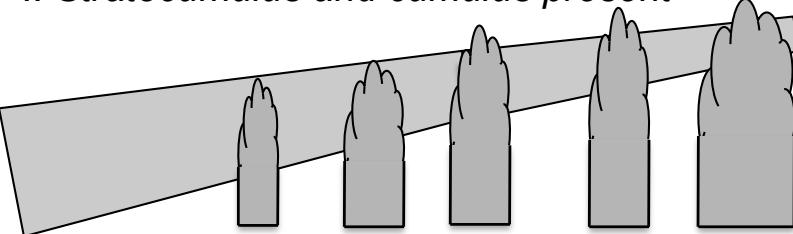
Equilibrium states (CGILS)

Cloud-climate feedback for shallow cumulus, stratus and stratocumulus (Zhang and Bretherton 2009)

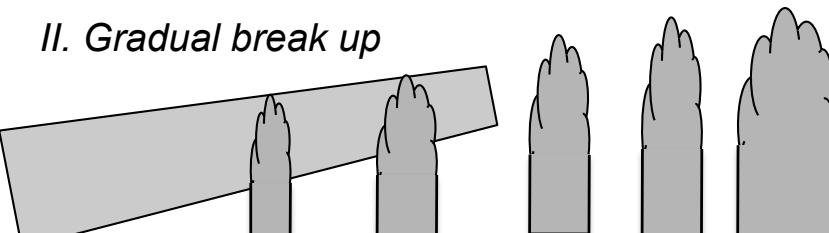
How well are stratocumulus-cumulus transitions represented in models?

Possible representations of a stratocumulus-cumulus transition from S12 to S6

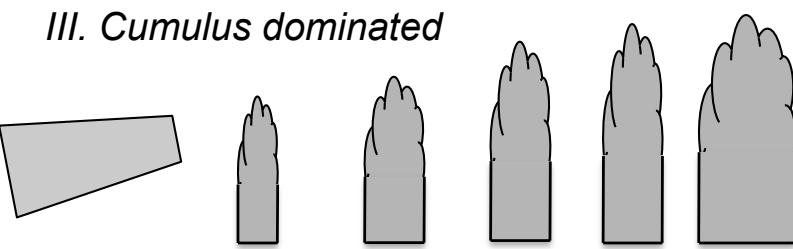
I. Stratocumulus and cumulus present



II. Gradual break up



III. Cumulus dominated



Research question for SCMs (Roel Neggers)

To gain insight into model behavior at process-level

What we ask the models to do right, and what often still goes wrong:

Thermodynamic state

Moment of cloud breakup

Cloud boundaries

Cloud vertical structure

Cloud & condensate amounts

Radiative transfer

Transport vertical structure (mass flux, TKE, PDFs)

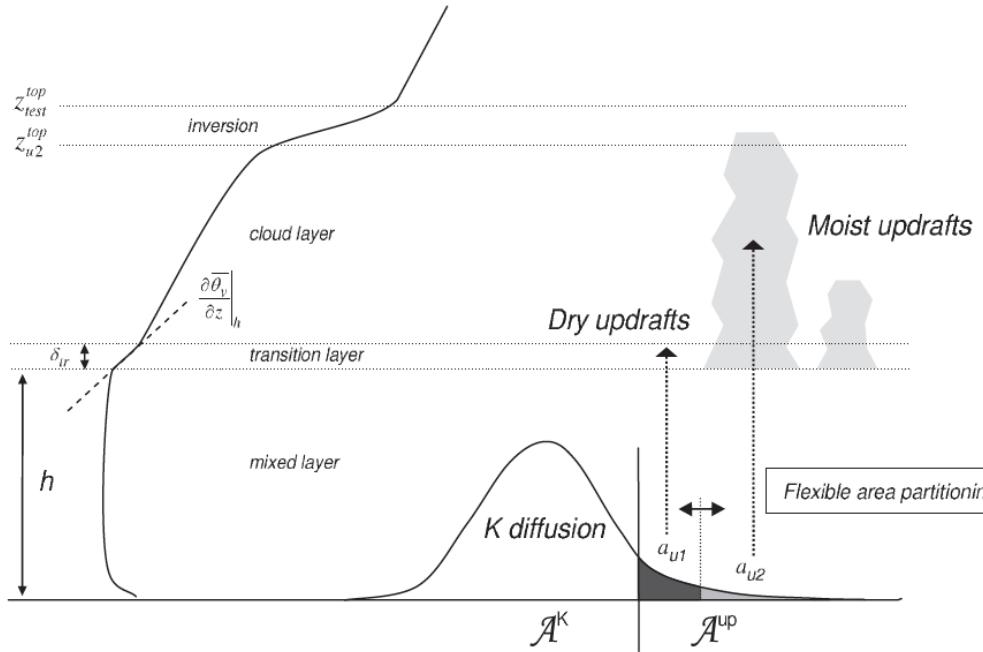
Decoupling

Momentum transport

Time-development of transition (discrete or smooth?)

Stability (numerics)

Many new approaches to model turbulent transport in cloudy boundary layers



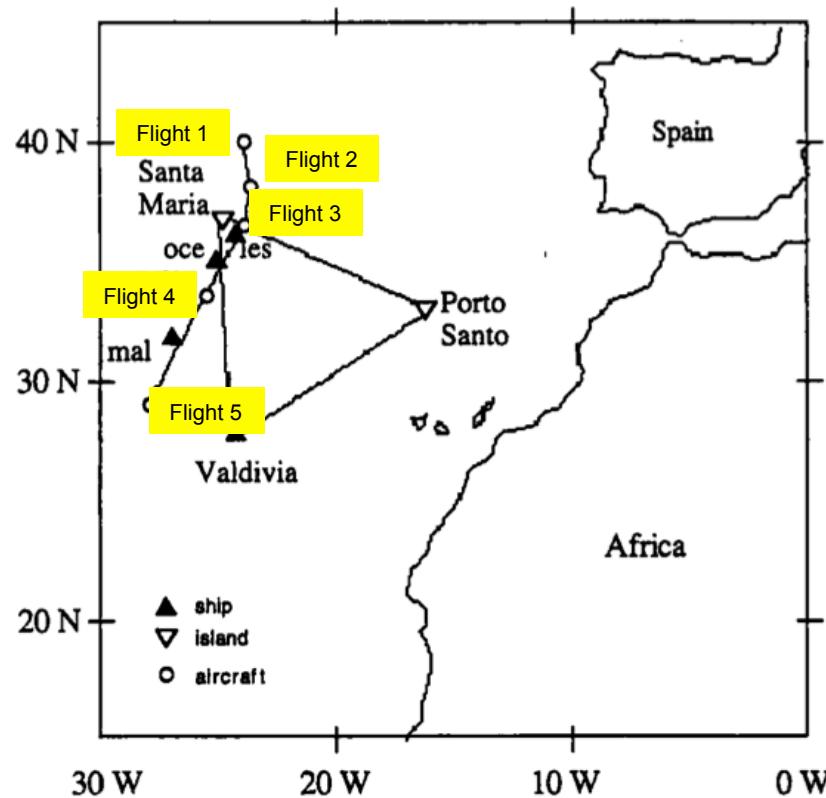
Neggers et al. 2009

Objective: Store 3D LES fields to provide tailor made statistics for the SCM community

List of SCM participants

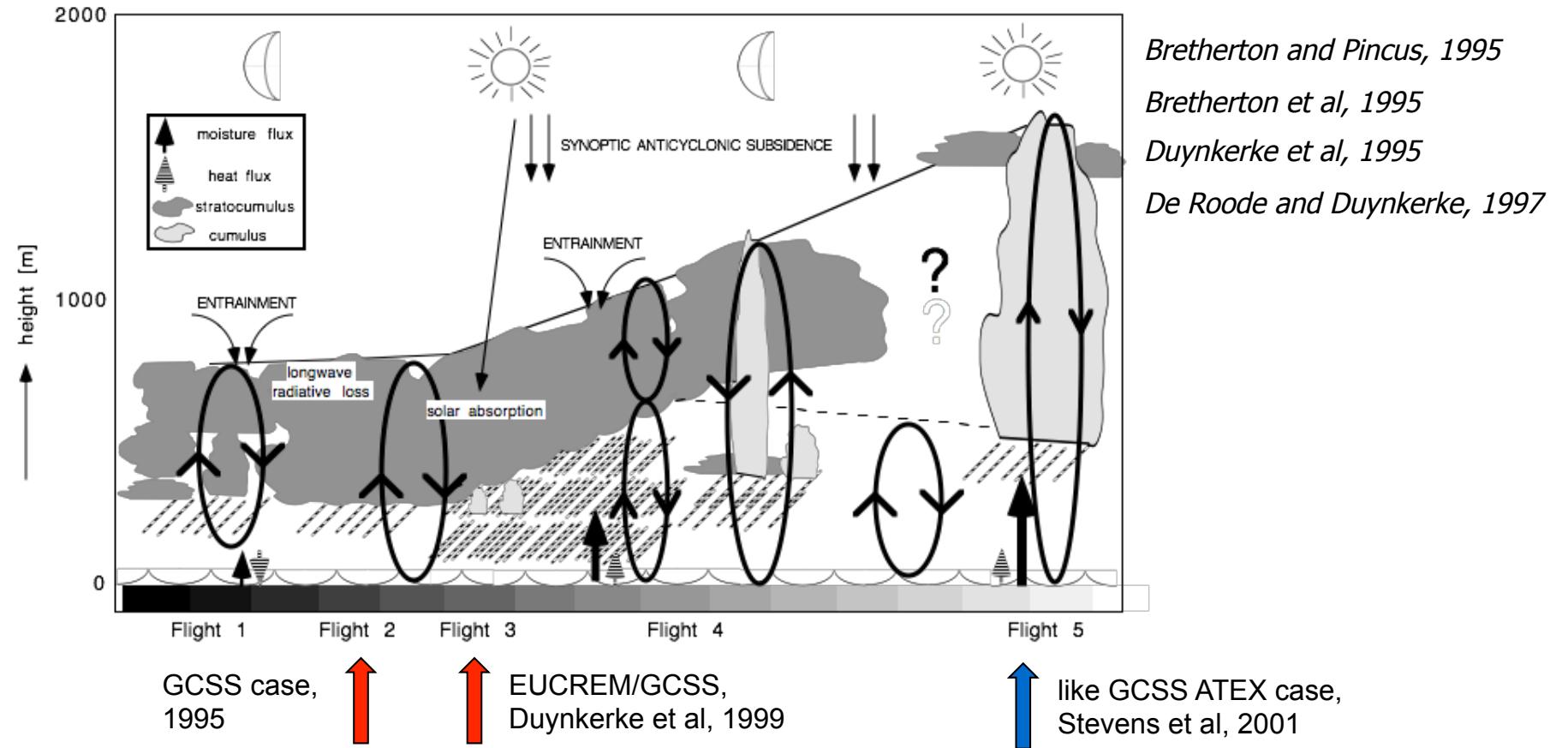
Name	Affiliation	Model	ASTEX	Composite cases
Eric Basile	Meteo France	AROME	✓	✓
		ARPEGE-NWP	✓	✓
Isabelle Beau	Meteo France	ARPEGE-CLIMAT	✓	✓
Vincent Larson	UWM	CLUBB	✓	✗
Sara dal Gesso	KNMI	EC-Earth	✓	✓
Roel Neggers		RACMO	✓	✓
Suvarchal Kumar	MPI	ECHAM6	Expected soon	Expected soon
Irina Sandu	ECMWF DWD	IFS cy36r1	✓	✓
Martin Köhler				
Hideaki Kawai	JMA	JMA	✓	✓
Anning Cheng	NASA LaRC	LaRC	✓	✓
Heng Xiao	UCLA	UCLA-AGCM	✓	✓
Ian Boutle	UK Met Office	UKMO	✓	✓

The ASTEX First Lagrangian (June 1992)



- Lagrangian evolution of cloudy boundary layer observed
- Five aircraft flights
- Duration: two days

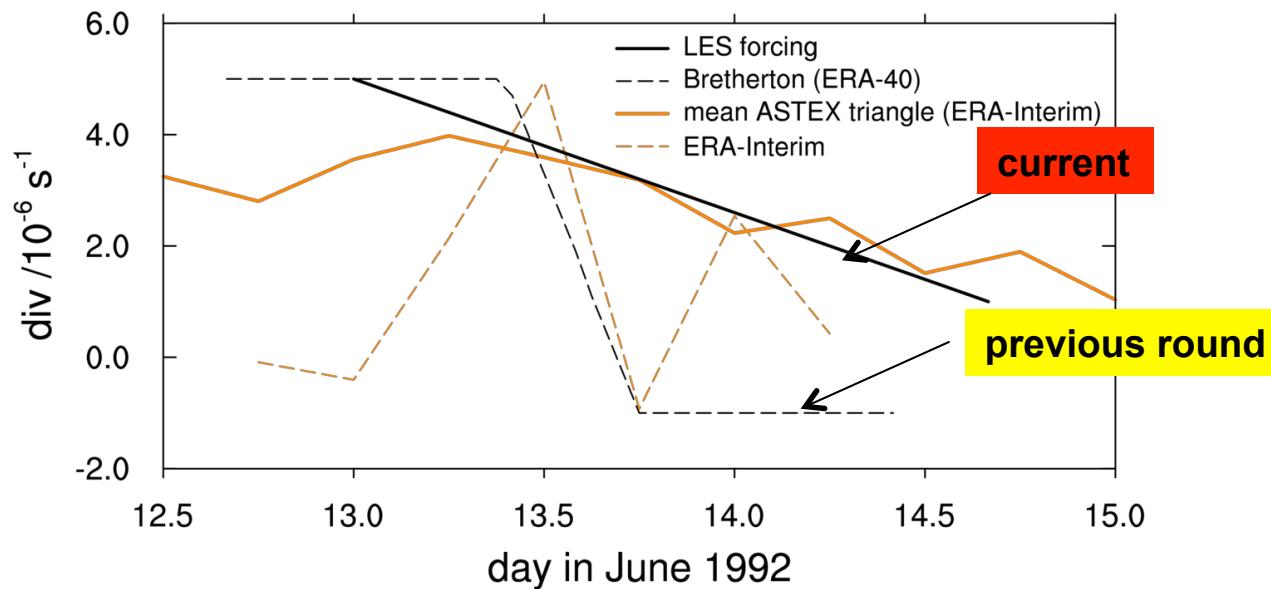
Observed stratocumulus to cumulus transition during ASTEX



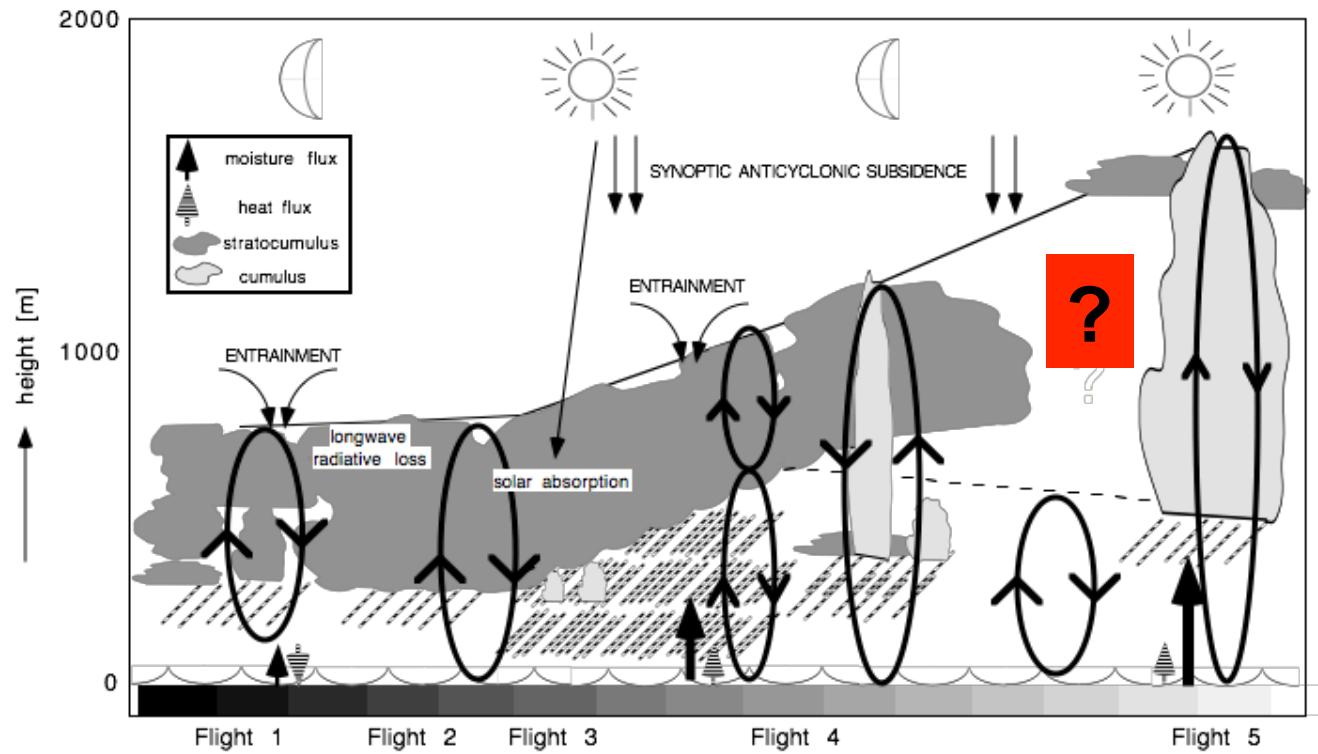
ASTEX transition has not been simulated with LES

Model initialization

- prescribed SST increase
- Large-scale divergence decreases linearly with time
(changed in the last round, see *Sigg and Svensson 2004*)
- Initial thermo profiles identical to first GCSS ASTEX "A209" modeling intercomparison case



EUCLIPSE ASTEX case objectives

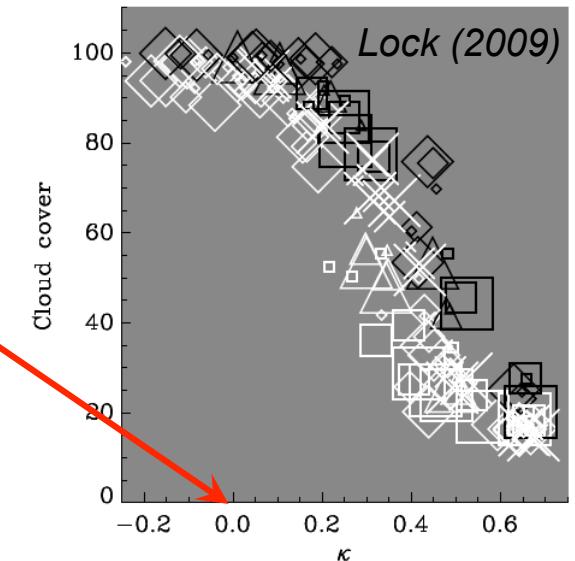
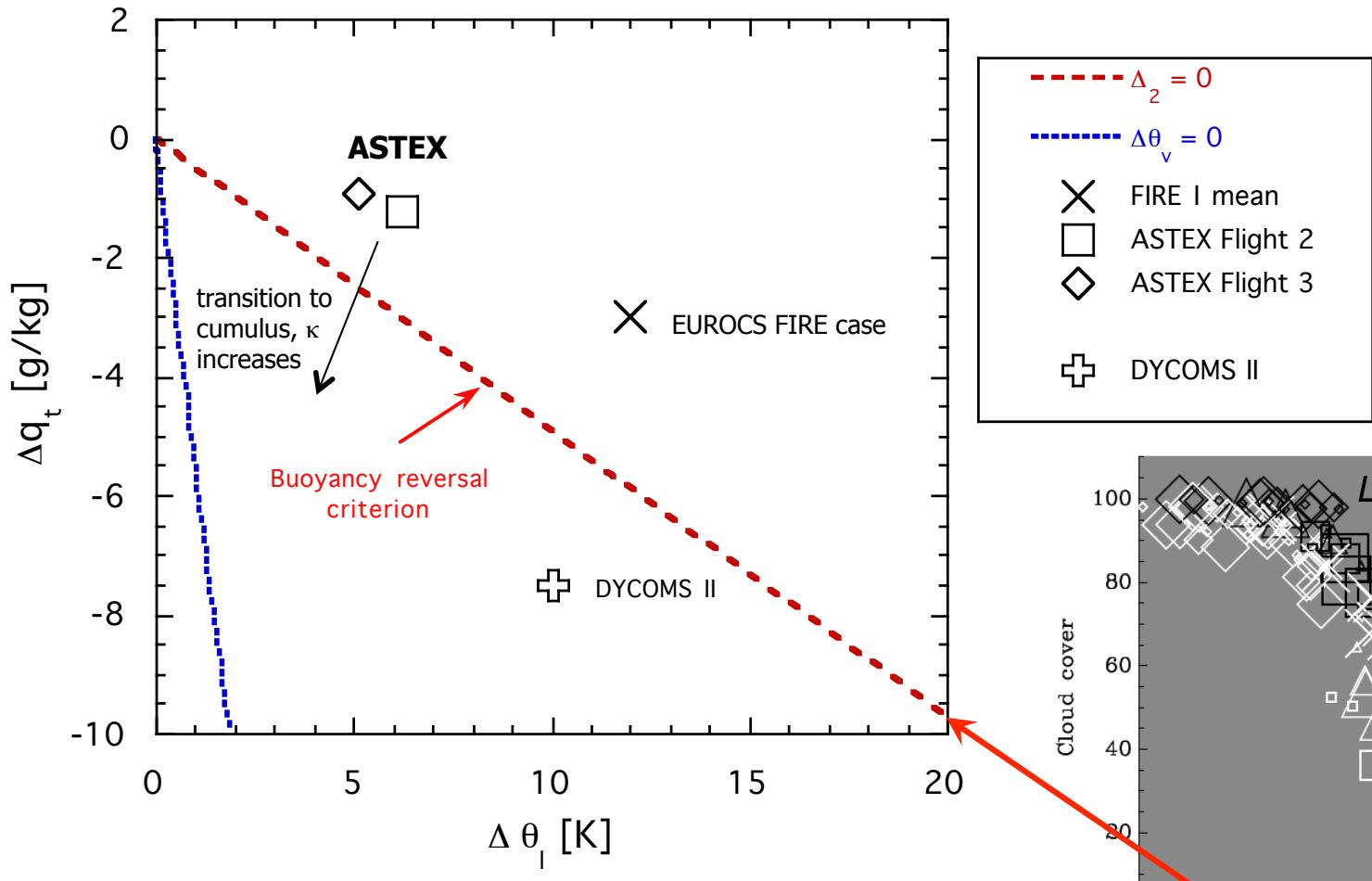


Science questions:

1. Weaker subsidence, more rapid transition?
2. How does entrainment affect the timing of cloud break up?

Why four new intercomparison cases?

Inversion jumps, cloud fraction, and transition time scale



Inversion jumps

