Boundary layer clouds working group

Chair: Adrian Lock

- Very brief summary of recent activities
- Future plans

DYCOMS II: LES case studies

Nocturnal stratocumulus
No drizzle, drizzling

- Stevens et al (2005), Ackerman et al (2008, ~ accepted)
  - *LES-derived entrainment rates in stratocumulus should be treated with caution – numerical challenge of sharp inversion*
  - It is possible for LES to get realistic drizzle rates and maintain cloud layer
  - LES sensitive to cloud droplet sedimentation
    - But usually ignored
    - Reduces entrainment rate, increases LWP
  - Drizzle gives (small) reduction of entrainment, increased stratification, decreased LWP
  - Variance between models dominated by dynamics, not microphysics
    - no signal from using bin vs bulk

DYCOMS II: SCM results

Zhu et al 2005, Wyant et al 2007

- SCM all capable of maintaining a well-mixed boundary layer capped by stratocumulus cloud
  - **Progress**
  - Still significant variation in clouds (ie. LWP, precip)
  - Not enough precip at cloud base; not enough subcloud evaporation
  - Variation between SCM much reduced at consistent, higher vertical resolution

RICO intercomparison = current case
Precipitating shallow cumulus

Pier Siebesma, Margreet van Zanten

- Composite case, fixed forcing, run for 24 hours
- 14 LES, run with and without precipitation
- 3 bin resolved, plus 1 and 2 moment bulk schemes
- Precipitation damps growth of cloud layer top; stabilises cloud layer T profiles; increases surface SH, reduces LH
- Ensemble mean precipitation rate ~ half radar
- Single moment schemes are more efficient at generating precip
- Bin schemes sample almost the full range of LES
  - LES dynamics still dominates over microphysics?
- Paper in preparation

Future activities
Continue with RICO

- More work still to be done on the RICO intercomparison
  - Draft paper on LES in preparation
  - Strong links to the new GCSS microphysical cross-cutting theme
  - SCM results still to be analysed in detail, including full 3 week period with varying forcing
    - Eg, do SCM reproduce observed variability in precipitation?
  - Potential to run (some) LES for full period too
  - Pier to (continue to) lead

Future activities
CFMIP case study

- First step towards looking at climate cloud feedbacks
  - Simple forcing
  - Run ***control and perturbed climate*** for different steady state PBL cloud regimes (shallow cu, stratocu, intermediate)
  - Principles already tested (Zhang and collaborators)
  - Participants: SCM from BLC group, plus all CFMIP participants, and volunteer LEM (3 already involved, others welcome)
- Final iterations to set up case by autumn, workshop in spring 2009
- Led by Minghua Zhang

Future activities
Lagranian transition

- Lagrangian stratocumulus to cumulus transition
  - Can LES and SCM succeed?
  - Are theories for the cloud transition borne out
  - 6-9 months to investigate options, ideally to include observational constraint (eg ASTEX based)
  - Led by Irina Sandu

Future activities
GPCI collaboration

- Maintain links with GPCI
- Several CRM/LES interested in pursuing Eulerian case studies along GPCI
- Issues to be addressed with GCM-generated forcing in regimes with strong inversions
  - potential to formulate a recommended protocol for general use

Future activities
LES database

- Create database of modern LES results for past cases
  - Rerun at high resolutions
  - Establish consistent output, in netcdf format
  - Include 3D snapshots
  - Data and details to be stored centrally on DIME site
  - Provide resource to parametrization developers
  - 3 LES already expressed interest
  - Need to coordinate with other GCSS groups

Future BL clouds group activities
Summary

- Further work on RICO case studies (Pier)
- Initiate cloud-feedback case studies (Minghua)
- Investigate lagrangian transition case (Irina)
- Create database of modern LES results for past cases (Thijs)
- …plus numerous other collaborations

- Aim for group meeting in Spring 2009 to discuss progress