Contribution of Leeds Group to the UK consortia.

Current activities

- Chemical speciation using the VACC system
- Stratocumulus modelling progress

•Planned work

- Stratocumulus modelling
- Regional-scale modelling
- Global-scale modelling

•

Mirek Andrejczuk, Mark Bart, Alan Blyth, Barbara Brooks, Alan Gadian, Patricia Krecl, Jim McQuaid, Ben Parkes & Laura Stevens

•Leeds' University

Photo: M. Bart

Chemical speciation and mass loadings during VOCALS-REx

Patricia Krecl & Barbara Brooks

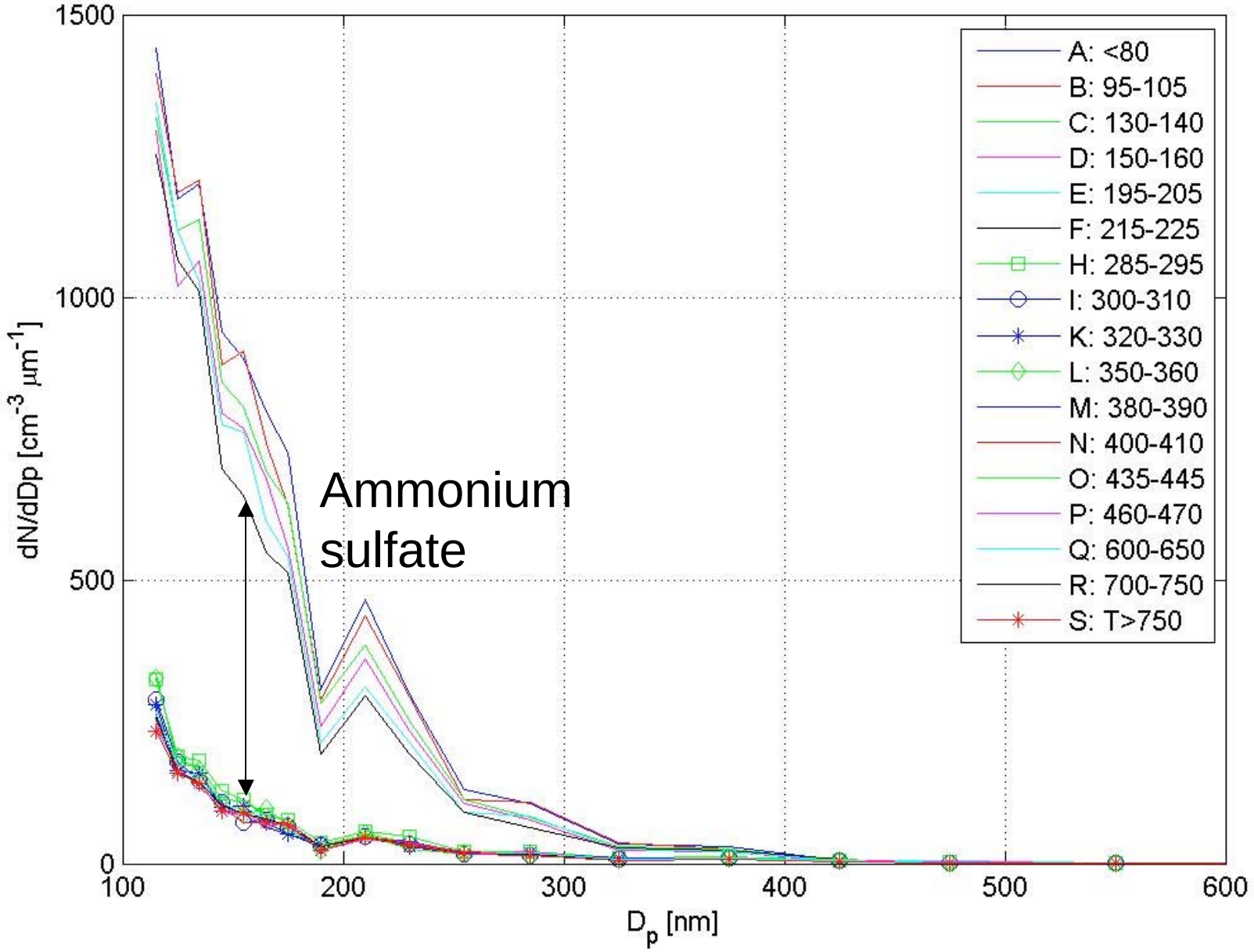
Volatile aerosol concentration and composition (VACC) system

- Identify and quantify chemical species by analysing the change of number concentration vs. temperature [ambient to 800ºC].

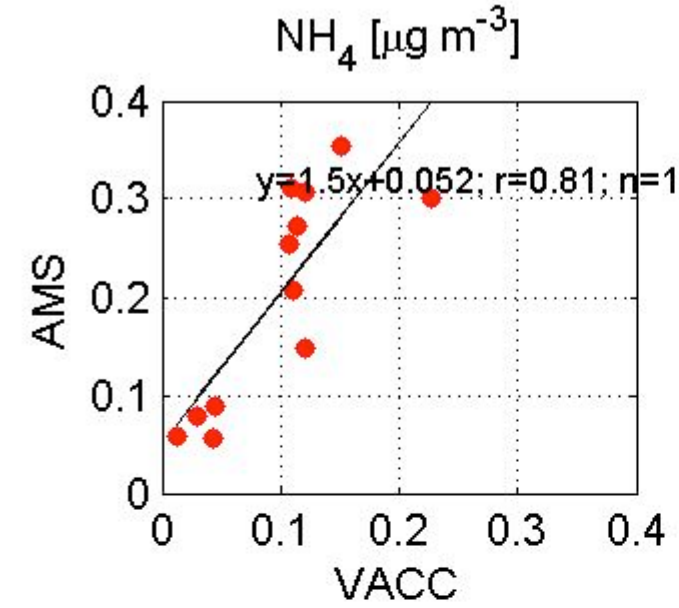
- Variation of particle size distributions also provides aerosol mixing state.

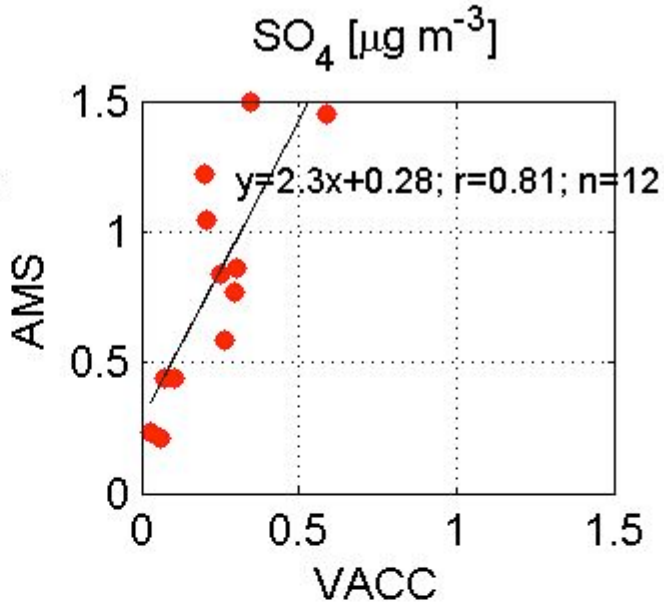
VOCALS-REx, b410, scan #1 start: 29-Oct-2008 10:35:25,

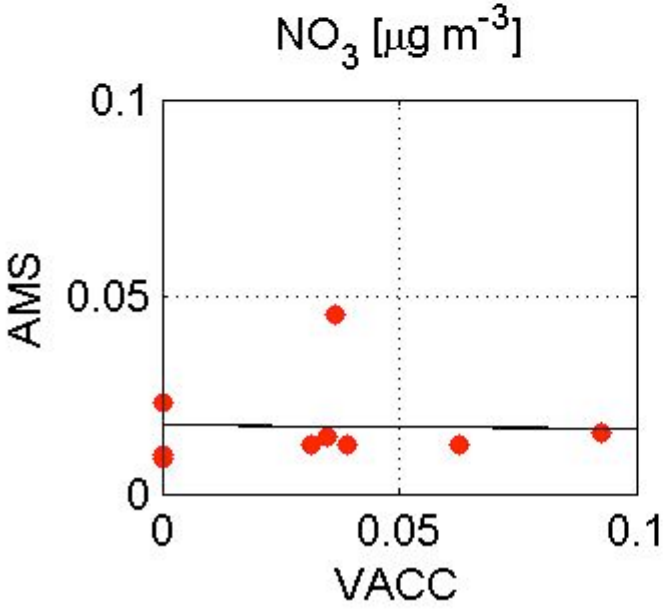
Fully externally or fully internally mixed

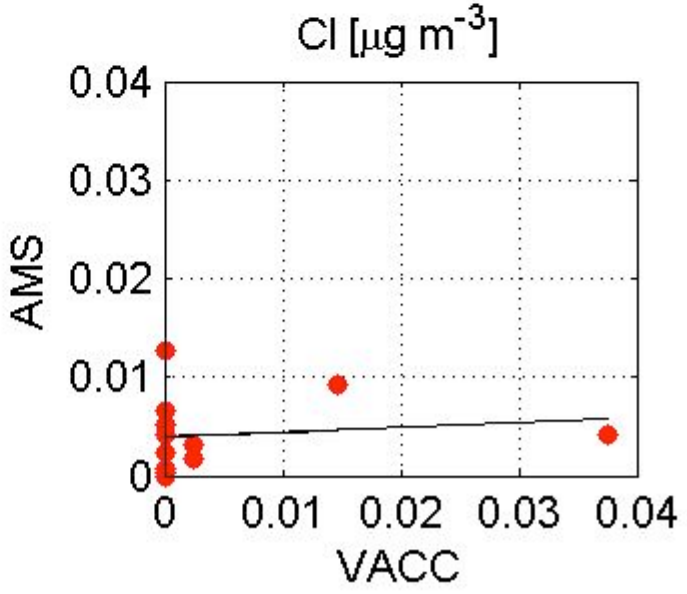


Flights B410, B412, B414: 500 ft runs









To Do:
- More cases.
- Comparison with AMS data.
- c.f. related microphysics data.
- Metadata with ion mass

Needed:
- AMS data
- Filter data

Novel Lagrangian Trajectory Model for Stratocumulus

M. Andrejczuk, Alan Gadian & Alan Blyth

- New Approach
- Lagrangian Microphysics
- No bin representation & numerical diffusion
- Full condensation model
- Coalescence processes aerosol
- Warm rain processes

November 13 Case Study

2D run

80x200 dx=40 dz=10

Simple radiative cooling

5h 20 min, with last 3h 20 min with collision

Profiles saved every 20 minutes.

Paper where Lagrangian approach to microphysics is described:

Andrejczuk M., J. M. Reisner, B. Henson, M. K. Dubey, C. A. Jeffery (2008), The potential impacts of pollution on a nondrizzling stratus deck: Does aerosol number matter more than type?, J. Geophys. Res., 113, D19204, doi:10.1029/2007JD009445.

Nov 13th Case Study

- Solution 5hr 20 min

Red < 8 : **Green** 8-12 : **Blue** 12-18 : **Magenta** > 18 : Yellow > 60 microns

Contours of vertical velocity , 0.1m/s

- **To do:** November 13th Case Study
  - **Make cloud deeper – closer to observations**
  - **Verify cloud droplets concentration and radius against observations**
  - **Investigate effect of mixing scenarios homogeneous/inhomogeneous/interpolation on cloud**
  - **Can mixing explain differences between observations and model?**

Look at other case studies

Vary aerosol loadings, and concentrations (250 / 120 / 60 per cc)

Can model get right relation aerosol -> cloud droplet concentration?

Idealised Large Eddy Modelling.

Currently:

Modifying the UK Met Office Anelastic Large Model to use an iterative solver.

To Do:

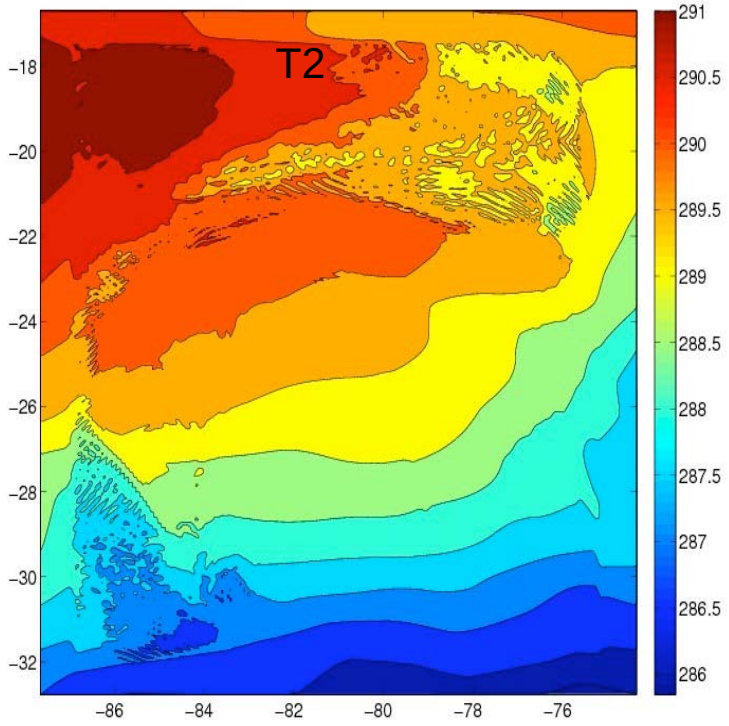
Specific case studies: October 31st or November 12th

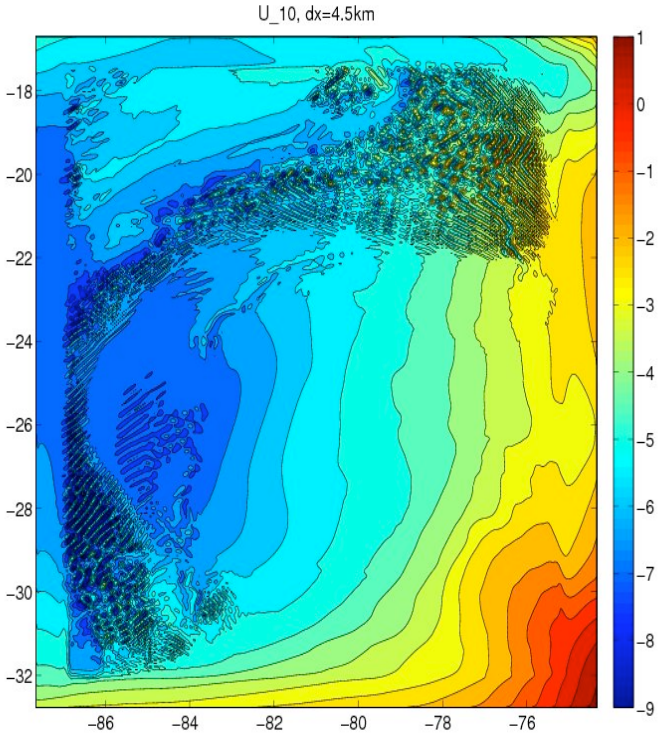
Sensitivity Studies with varying No initial, looking at radiative balance and dynamical effects. Vary aerosol loadings, and concentrations (250 / 120 / 60 per cc)

Compare with the use of bin model (if time) – Adrian Hill

HiGEM -> WRF

- WRF 18h forecasts over the ocean no nesting:
  - dx=4.5 km: very noisy





Mirek

To do:

To determine the causes of high frequency noise (not found in mid-latitude regions) in velocity fields.

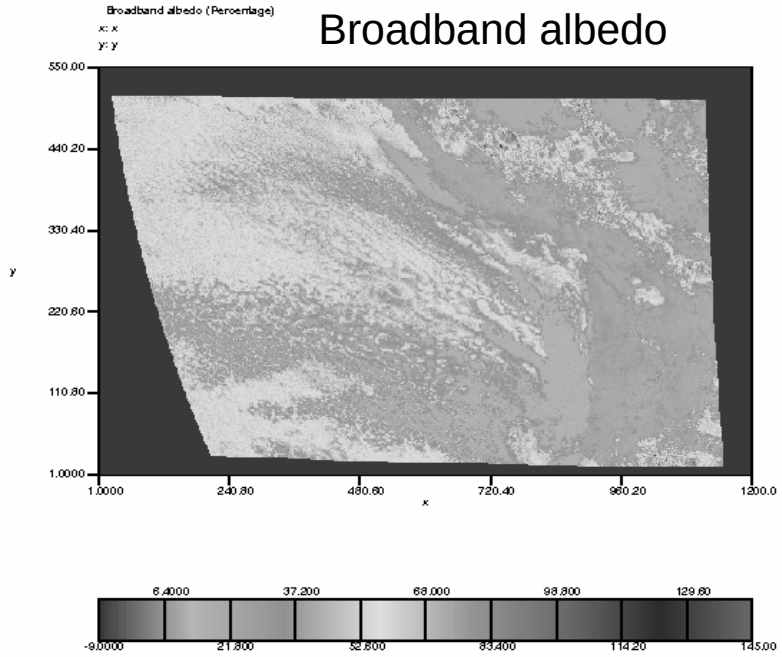
To ensure that the model initialisation fields (UM) are balanced when driving regional scale models.

To drive regional scale WRF with global UM to look at the growth of Regional structures

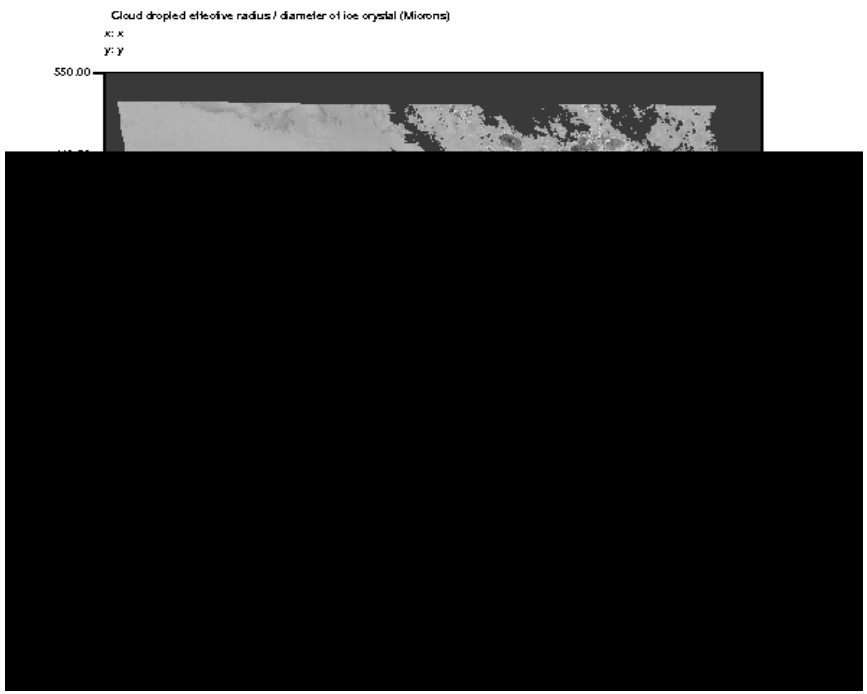
To run semi-idealised WRF simulations to examine replication and development of Open Cells

WRF as a tool to explore the diurnal opening and closing of POC regions.

Broadband albedo



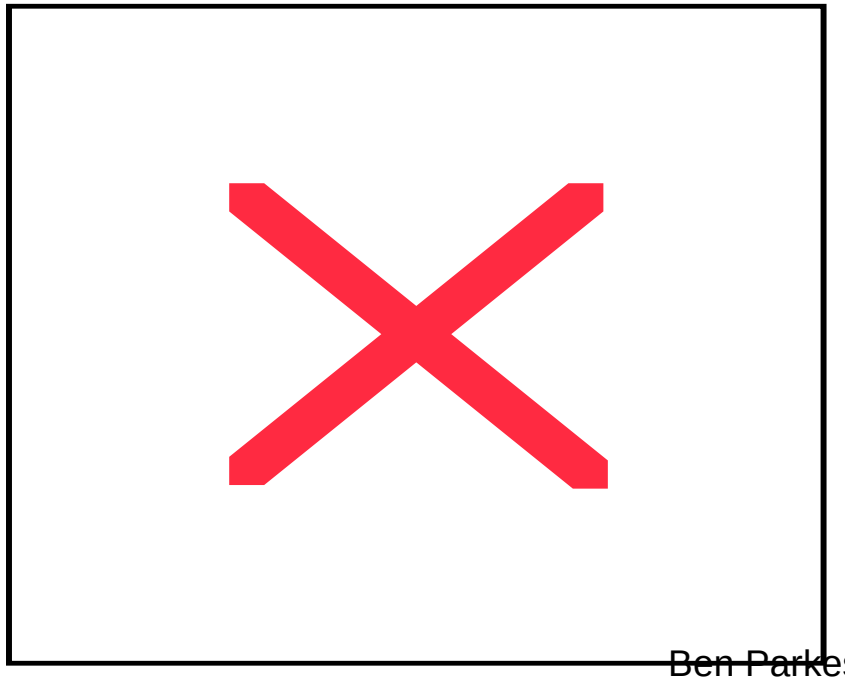
Cloud drop effective radius



Analysis of the albedo for different optical depths and effective radii

Satellite photos from
25th October 2008
12:15 UTC

Optical depth

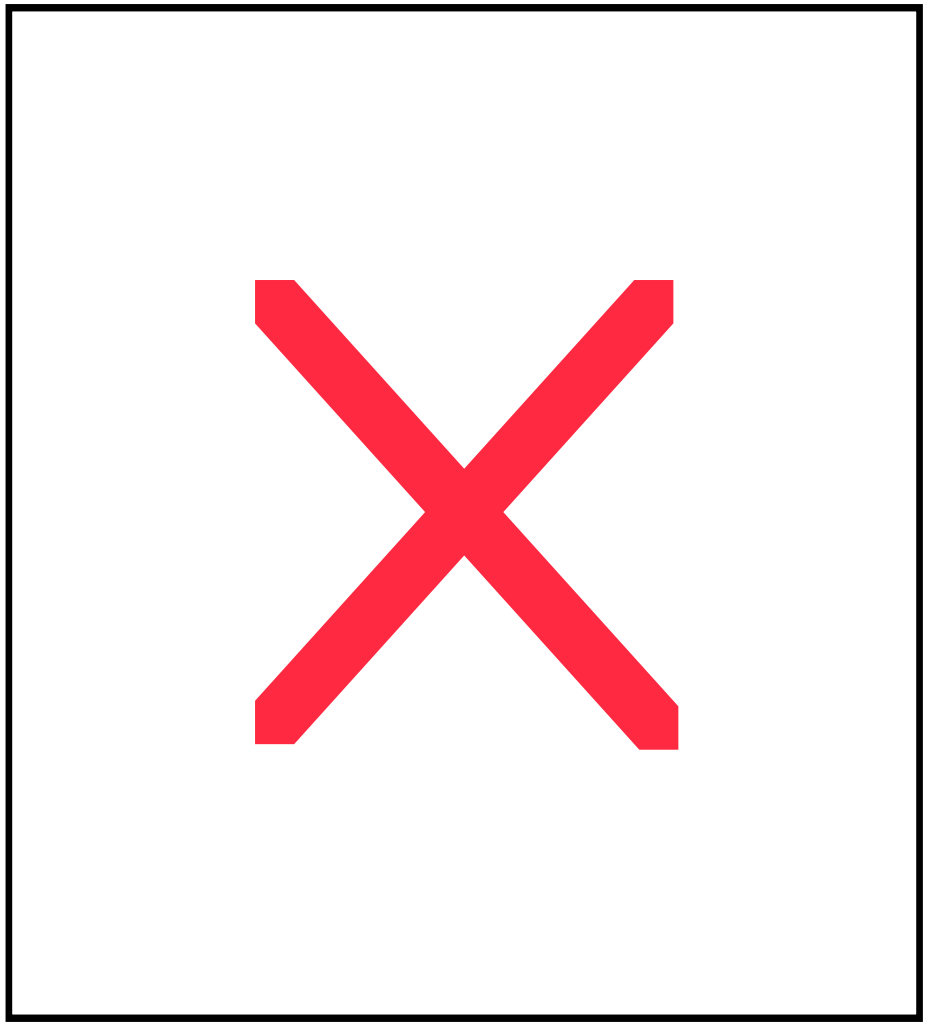


Ben Parkes

Time series: Number of particles in the 21.3 micron bin on the BAE 146 CDP

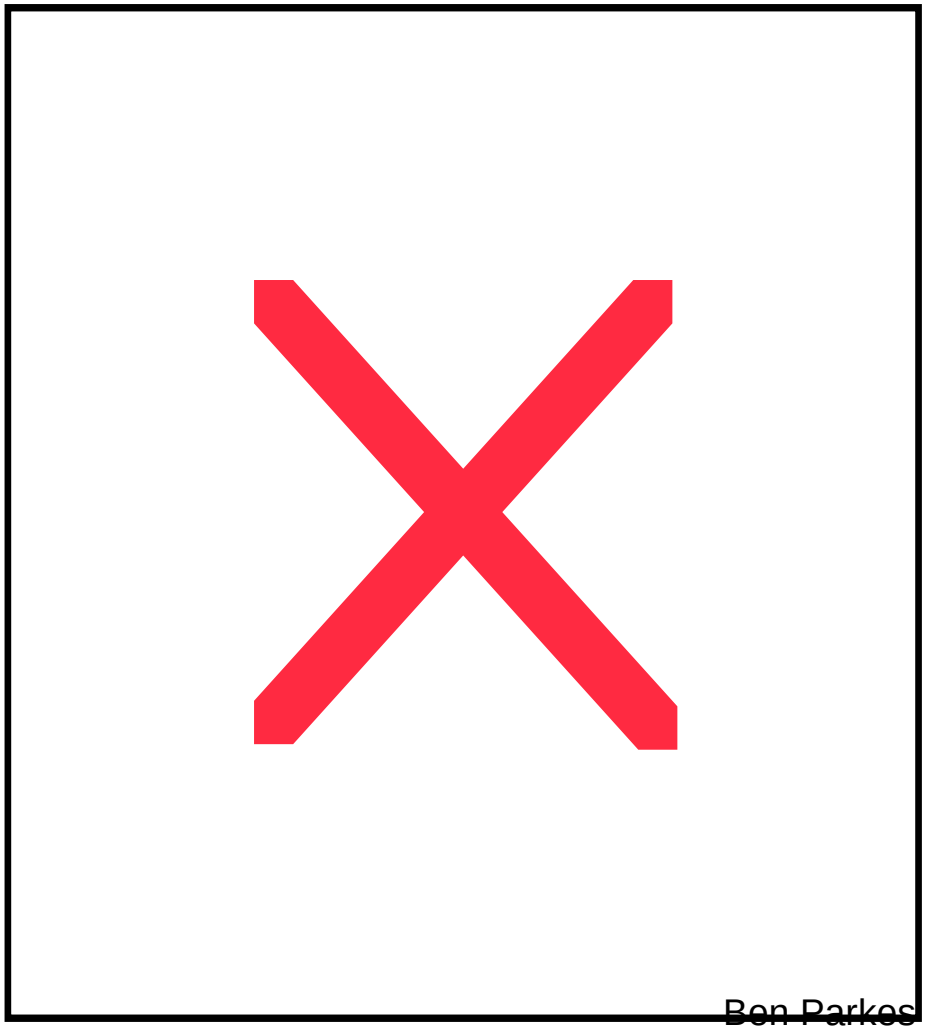
11:45 – 11:50 – Max ~25

20S 79W



12:26 – 12:40 – Max ~90

20s 77W



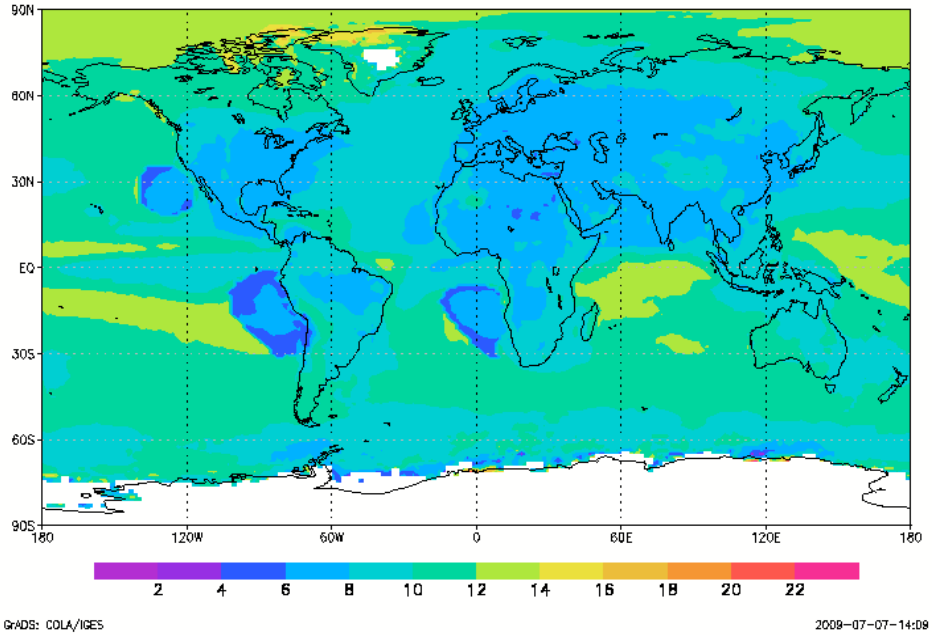
Ben Parkes

Control

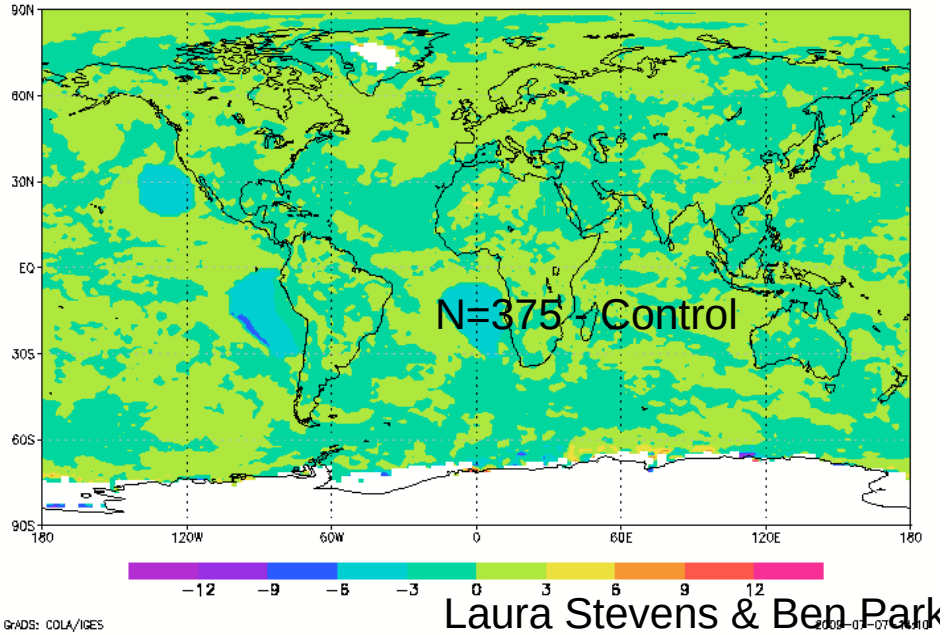
Use if HaDGAM and HDGEM models to examine the effects in climate models of different number concentrations.(N /cm2)
Global ~ -0.13microns ~ -1.2W/m2

Cloud drop effective radius
HadGAM 5 year mean

N=375



N=375 - Control



Laura Stevens & Ben Park

Questions please?

.

.

.

.

.

If none how about for you ...

Who is spellbound, lower left, and what is he singing, lower right?

Slide 3. We identified several compounds during the flights. The dominant compound across all sizes and in terms of mass is ammonium sulfate.
This arrow indicates the big gap between curves F and H and corresponds to the ammonium sulfate transition. I only marked this gap because is the big one and one can
see it with the naked eye, without doing any zoom. At this point I'm not interested to study the variation of ammonium sulfate with particle diameter, but just say that one can observe its presence across all sizes.

All curves are shown, but they overlap indicating that the compound whose temperature transition is between those temperature bands is not present in the sample.
I deleted "factor=12.478" since it's not relevant at this point.
Since the particle number size distribution shape is the same while particles are volatilizing, the aerosol might have been either fully internally mixed or fully externally mixed.

Slide 4.
Ammonium and sulfate show relatively strong correlations but the slopes are higher than 1, indicating some systematic differences that we couldn~Rt explain up to know.
Concentrations of niitrate and chloride ions are very close or below the detection limit and there is no linear correlation. This is why the slope is very close