The TWP-ICE case study

ARM radiative processes & cloud modelling meeting

Thu Nov 20th

Maria Russo

Jon Petch

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The TWP-ICE case study

- GCSS PCS WG
  - Info
- Models involved
  - CRMs – Ann Fridlind
  - SCM ensembles – Christian Jakob/Laura Davies
  - LAMs – Maria Russo

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GCSS - PCS (Precipitating Cloud Systems) home page

WCRP ▸ GEWEX ▸ GMPP ▸ GCSS ▸ PCS

Recent news

- **[25/9/08]** News update: TWP-ICE multi-model comparison & PCS next meeting [html]
- **[30/7/08]** The next discussion of PCS WG cases will be at the ARM ARM CM & RP WG Meeting in Princeton. The meeting web page is [html]
- **[30/7/08]** Talks from the plenary sessions of the 4th Pan GCSS meeting are now online at [html]
- **[25/6/08]** A report on the PCS WG sessions held at the 4th Pan GCSS meeting [html]
- **[27/5/08]** The UPDATED agenda for the PCS WG sessions at the 4th Pan GCSS meeting [html]
- **[15/5/08]** Updates to the PCS web pages including the intercomparison page [html]
- **[13/5/08]** The 4th Pan GCSS meeting web page [html]
- **[2/1/08]** The latest news of the PCS [html]
- Archive of news

Our main pages

- Intercomparisons: a link to all current and past intercomparison pages
- Published work: some publications related to our work (not updated since 06)
- Meetings: past and future meetings of our WG.
- Contacts: instructions on how to (un)subscribe to our maillist and other contact details
- ARM Cloud Modelling WG: we often collaborate closely with this WG.

About GCSS PCS

The goal of the GCSS Precipitating Cloud Systems working group (PCS - formally DWG and WG4) is to improve the parametrization of precipitating cloud systems in global climate models (GCMs) and numerical weather prediction (NWP) models through an improved physical understanding of cloud system processes. The main tools of the GCSS PCS WG are:

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Status and Preliminary Results of GCSS TWP-ICE Case Study: Limited Area Model Intercomparison

Maria Russo

Status of LAM intercomparison

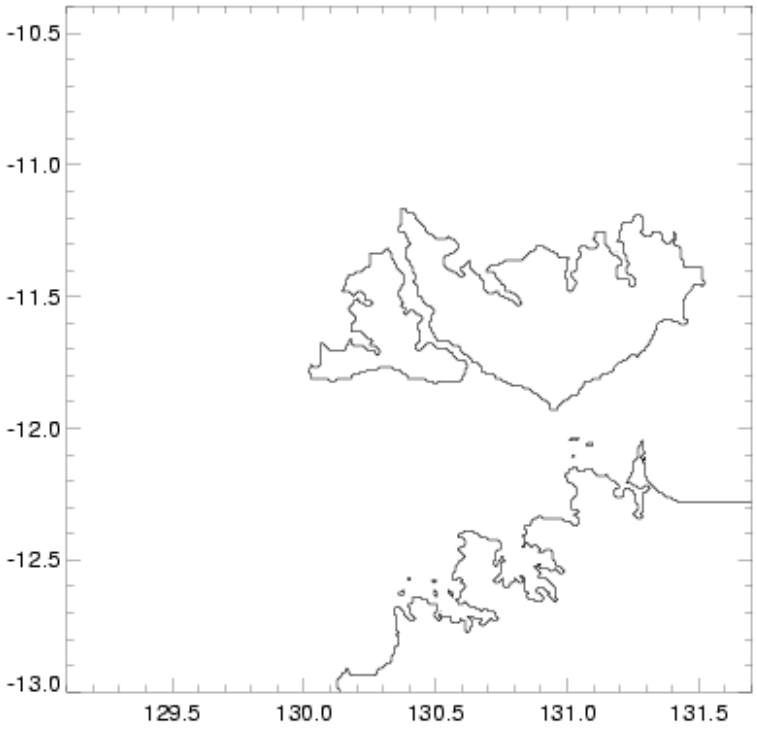
- Preliminary tests have been carried out at Cambridge
- Finalized LAM document to be released by Nov-Dec
- So far the following people have expressed an interest:
  - Maria Russo (UM ~1km)
  - Dimitri Mirov (COSMO ~7km)
  - Axel Seifert (COSMO ~2km)
  - Yali Luo (WRF)
  - Charles Chemel (WRF)
  - Sue van den Hoover (RAMS)
  - Chou Sin Chan (ETA)

Proposed LAM experiment setup

- Periods to run:
  - Monsoon trough ('landfoon'): 23-25 Jan 2006
  - Suppressed monsoon: 28-30 Jan 2006
- 1-hourly & 3-hourly output in Netcdf format
- Nesting, run details, and spin-up time are left to the judgement of each modeller
- 4 Idealized tracers with different source layers:
  - Mean tracer lifetime= 6 hours
  - Initialisation: tracer=1 in source layer; 0 elsewhere
  - Source: tracer kept to 1 in source layer throughout the run

Preliminary Model run

MODEL DOMAIN



- Model: UK Met Office Unified Model vn6.1
- Resolution:
  - Horizontal ~1km
  - 76 Vertical levels (model top ~40km)
- No Convection Parametrization
- Model run time: 30h

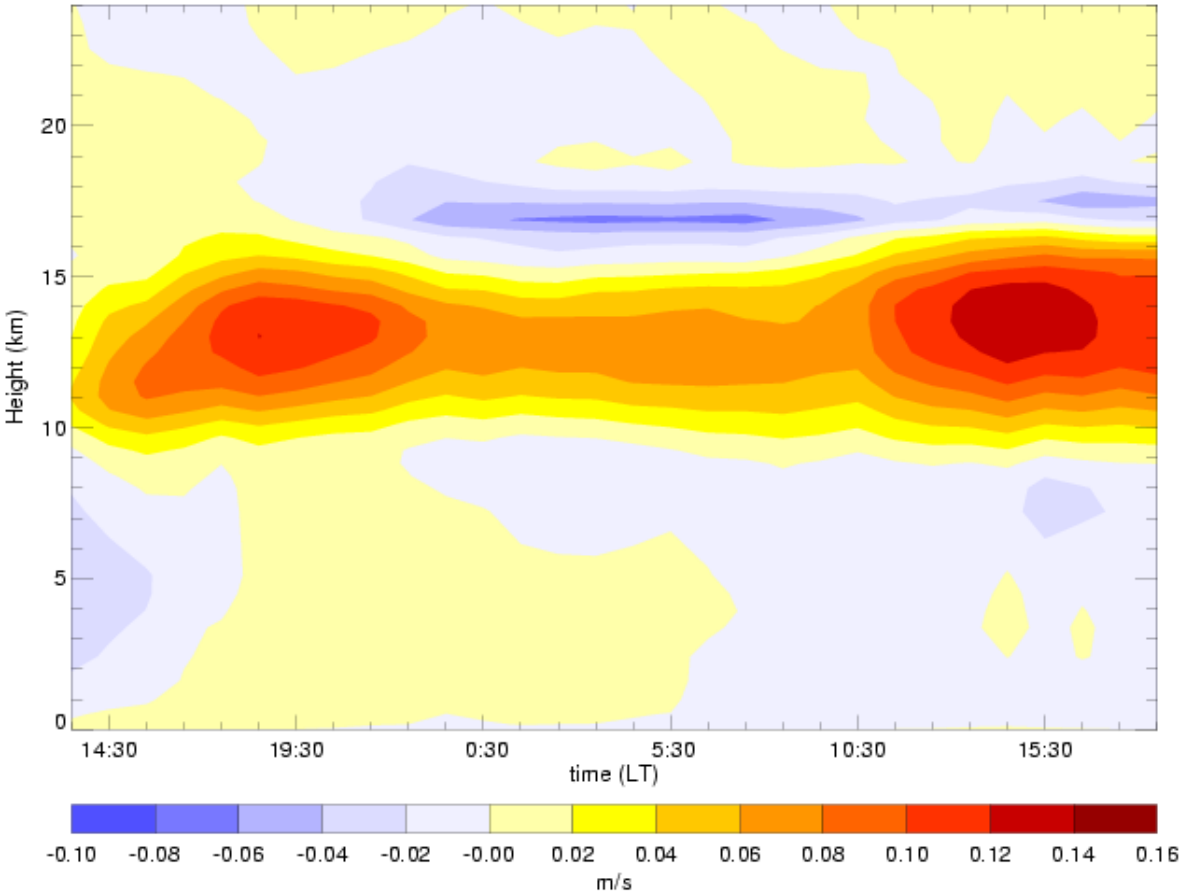
	TRACER1	TRACER2	TRACER3	TRACER4
Source layer	~0-250m	~2-4km	4-6km	14-17km

Preliminary Results: Model Consistency

- Diurnal cycle of convection
- Land – Sea contrast
- Tracer transport: convective plume vs. larger scale

Diurnal cycle of convection

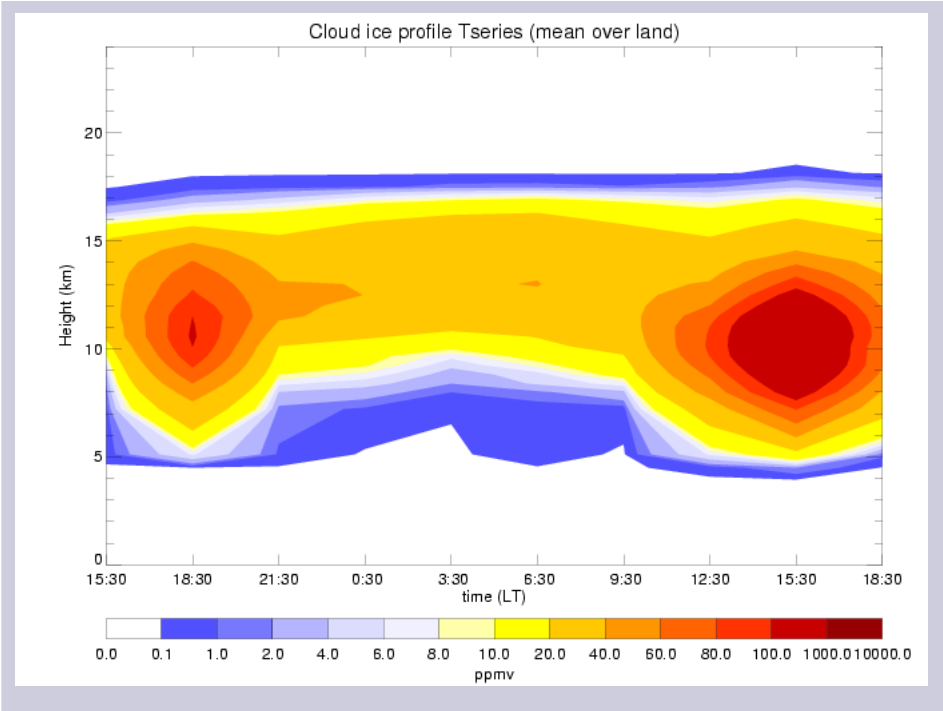
Area-averaged W profile vs. time

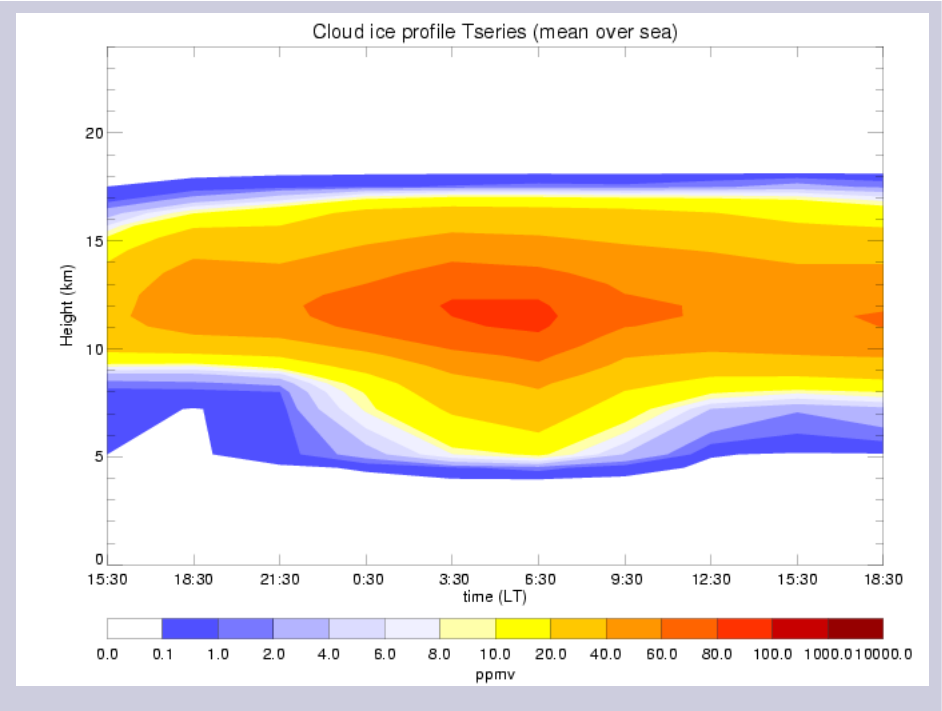


- Clear diurnal signal in vertical velocity
- Peak of convection in the afternoon
- Vertical velocities are largest between 12-15km

Land – Sea contrast

Cloud ice profile vs. time (averaged over LAND)	Cloud ice profile vs. time (averaged over SEA)





- Clear land-sea contrast in vertical profiles of ice clouds (also observed in other fields)
- Ice clouds over land peak at time of highest convection
- Ice concentration are largest between 8-14km

Tracer transport: convective plume vs. non local transport

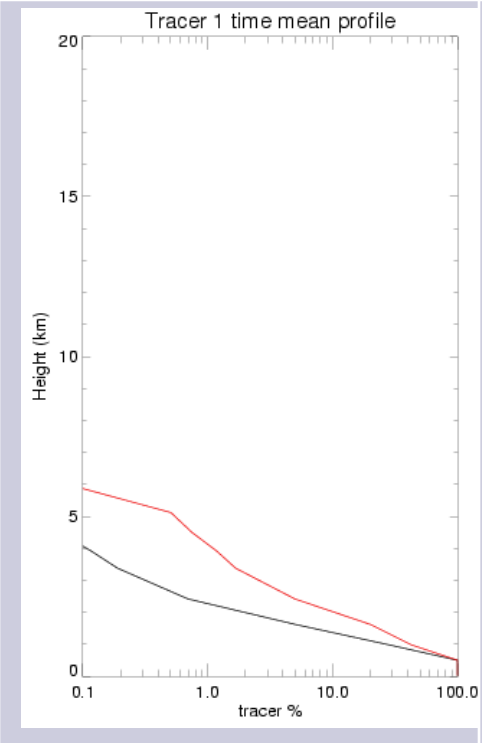
- A 30 hour mean vertical profile for each tracer has been calculated for the whole domain and for convective storm points only
- A convective storm point is defined where precipitation is larger than 15mm/hr
- Comparison of these tracer profiles highlights where localized transport in a convective plume plays a role

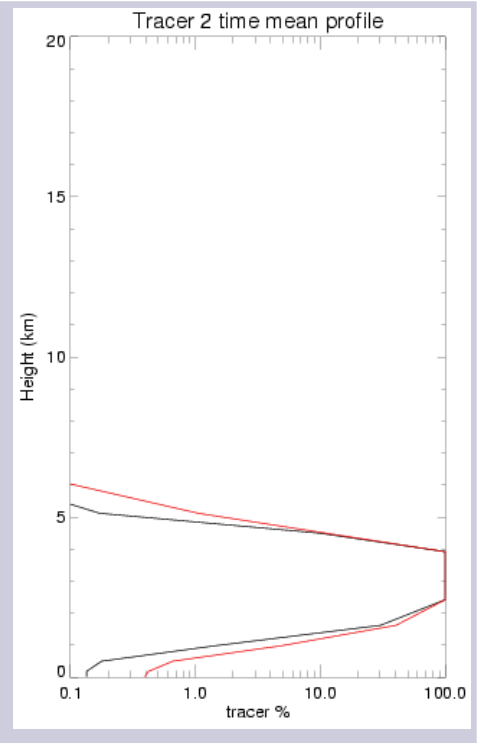
Tracer transport

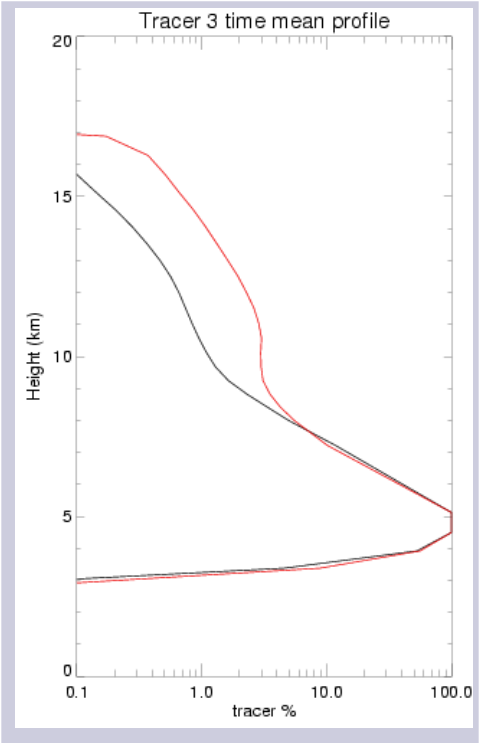
---- Area-averaged over all domain points (30 hr mean)

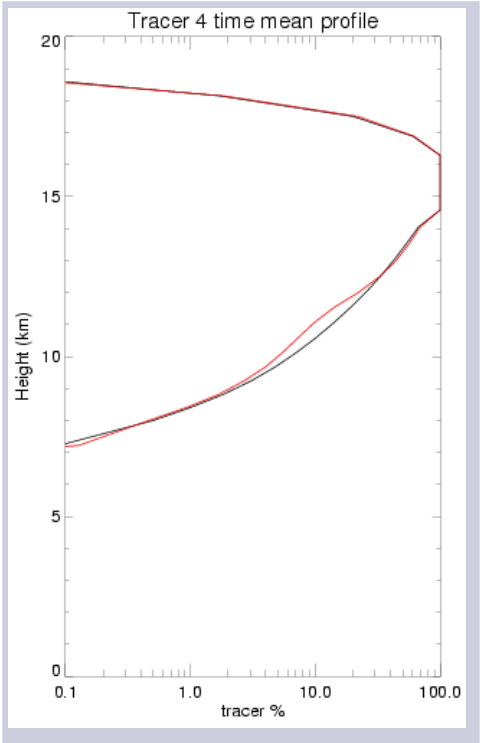
---- Area-averaged over convective storm points (30 hr mean)

TR1: surface	TR2: upper boundary layer	TR3: mid-troposphere	TR4: upper TTL









Tracer transport

TR1 & TR2 (surface & boundary layer):	TR3 (mid troposphere):	TR4 (upper TTL):
- Upward vertical transport limited to few kilometers reaching just the lower troposphere - Non negligible role of transport in convective plume	- Large upward vertical transport extending up to the TTL - Marked role of transport in convective plume	- Upward vertical transport and downward mixing into the lower troposphere - Negligible role of transport in convective plume

Conclusions

- Diurnal cycle of convection in the model reproduces the observed peaks in late afternoon
- Land – Sea contrast can be observed in several model fields such as cloud ice, cloud liquid water, tracer 1, 2 and 3
- The relative importance of direct transport in a convective plume vs non-localized transport has been highlighted for the 4 tracers.

If you are interested to know more or are willing to participate in the LAM intercomparison contact:

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