Airborne measurements of the atmospheric structure, evaporation and heat fluxes over the Arafura Sea and the Northern Australian savannah during the TWP-ICE field experiment

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The Tropical Warm Pool International Cloud Experiment (TWPICE) held in the area around Darwin in late 2005 and early 2006 yielded one of the most complete data sets of tropical convection ever collected. The experiment’s main aim was to examine convective cloud systems from their initial stages through to the decaying and thin high level cirrus and measure their impact on the environment. The experiment included an unprecedented array of soundings to support cloud resolving and other modeling studies as well as a large range of in-situ and remotely sensing observation platforms. The experiment was a large multi-agency campaign including substantial contributions from the US DOE ARM program, NASA, the Australian Bureau of Meteorology, CSIRO, EU programs and many universities.

A key component was the fleet of aircraft including the NASA WB57, DOE Proteus, the M55 Geophysica and DLR Falcon from Europe, and the ARA ECO-Dimona and ARA Egrett. The ground network included a ship as well as several ground sites with a wide range of cloud sensing radar, lidar and passive instruments.
### The ARA Airborne Research Platforms

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>Registration</th>
<th>Altitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond Aircraft HK36TTC ECO-Dimona</td>
<td>VH-EOS</td>
<td>5m – 7,000m</td>
</tr>
<tr>
<td>Diamond Aircraft HK36TTC ECO-Dimona</td>
<td>VH-OBS</td>
<td>5m – 7,000m</td>
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<tr>
<td>Grob G109B</td>
<td>VH-HNK</td>
<td>5m – 4,000m</td>
</tr>
<tr>
<td>Grob G520T Egrett</td>
<td>VH-ARA</td>
<td>20m – 15,000m</td>
</tr>
</tbody>
</table>

- Most instrumentation

![Image of aircraft]
Eppley radiometers
Laser altimeter
Heimann KT15 IR
IMU/GPS
Data System
Atmospheric Structure, evaporation and sensible heat fluxes over:

- the Arafura Sea
- the Tiwi Islands
- the Northern Australian Savannah
ARAFURA SEA – with RV ‘Southern Surveyor’

ECO-Dimona Flight on 4 Feb 2006

Flux survey: 8 legs of 15km each

Flux survey: outbound and inbound leg, 125km each

Here I had to give way to a freighter...

Mean flying altitude: 20m above the water

Southern Surveyor: position on arrival and departure

Beach at Gunn Point
ARAFURA SEA – with RV ‘Southern Surveyor’

Video clip
ARAFURA SEA – with RV ‘Southern Surveyor’

Southern Surveyor 125km off-shore

125km

Gunn Point Tidal flats

Cloud field.....
ARAFURA SEA – with RV ‘Southern Surveyor’

H, E vs. wind speed

H, E in W/m²

wind speed in m/s
TIWI Islands

Cross sections Over the Tiwi Islands
TIWI Islands

Video clip
TIWI Islands

Air temperature
Spec humidity
Vertical wind
Horizontal wind
Sensible heat flux
Latent heat flux
Surface temp
Laser altitude
Trees and shrubs
Terrain & flgt track
Northern Australian Savannah

LandSat7

SRTM
Northern Australian Savannah

Video clip
Northern Australian Savannah

North-South Transect (40km)
Northern Australian Savannah

Regional Fluxes 13 Feb 2006 10:30-11:30LT

Sensible Heat Flux in W/m²

Latent Heat Flux in W/m²
Northern Australian Savannah

Regional Fluxes 13 Feb 2006  10:30-11:30LT

Surface Temperature in degC

Evaporative Fraction (= E/(H+E))
SUMMARY

Flown: 60 hours + ferry across Australia - Adelaide/Darwin/Adelaide
Aircraft & instrumentation performed 100%
despite very difficult conditions

Data Gathered: Fluxes of sensible and latent heat (evaporation)
Atmospheric parameters (pressure, temperature, humidity, wind)
Vegetation parameters
Extensive aerial video coverage

Other: Dramatic P.R. coverage in Discovery Channel and ABC -
“Killer Rain” and “Darwin – Lightning City”
Unique award-winning footage gathered for BBC –
“Planet Earth”
Guidance for Egrett high altitude aircraft during Lidar missions

Data available on TWP-ICE server: ftp://iopshare.archive.arm.gov

Contact me, if you want a copy
SERA
Small Environmental Research Aircraft

...probing the environment using the least intrusive and most cost-efficient airborne technology

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Network of Airborne Environmental Research Scientists