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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The SCOUT-O3 Darwin Aircraft Campaign: rationale and meteorology" *by* D. Brunner et al.

D. Brunner et al.

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We would like to thank all referees for careful reading and valuable comments and criticism.

Replies to referee #1

The referee had only a few remarks concerning the figures. The latitude labels in all Figures will be added (if missing) or enlarged (if too small) as recommended.

Replies to referee #2

We would like to thank the referee for very careful reading and a wealth of suggestions that will allow the reader to better follow the discussion.

Specific comments:

p. 1, para 2, sentence 1: We agree that direct demonstration of the important role in TST of the Maritime Continent remains elusive. This is why later in the introduction we also refer to the publication of Ricaud et al. which is drawing a different conclusion. The sentence will be changed from '.. plays a key role' to 'There is considerable evidence that .. plays a key role'.

p. 2, column2, para 1, sentence 3: Keenan and Carbone (1992) provide some evidence that break and pre-monsoon (transition) periods are providing similar conditions for the development of Hector. This reference will be added. The frequent occurrence of Hectors during monsoon breaks was also confirmed by the observations of the TWP-ICE project.

Discussion of Figure 3: Only temperatures below the lowest extratropical tropopause temperatures are shown to highlight the tropical upper troposphere. A corresponding sentence will be added.

Discussion of Figure 4 (Hovmöller diagram): We agree that we probably paid too little attention to the westward propagating waves seen in the Figure. Their phase speed and the fact that they are more prominent at 2.5-15°S than in a Hovmöller diagram centred on the equator (not shown) suggest that they are convectively-coupled equatorial n=1 Rossby waves as described by Wheeler and Kiladis (1999). In that study it was in also pointed out that this type of waves makes a large contribution to OLR variability over northern Australia particularly during southern hemisphere summer, i.e. during the season the campaign took place. We will add this information. Matt Wheeler kindly provided an OLR wave filtering analysis clearly identifying the two waves presented as dashed lines in Fig. 4 as n=1 ER waves. The effect of the wave arriving around 10-12 Nov (in terms of OLR anomaly) on the temperature anomalies in Fig. 5 is not obvious. The study of Wheeler, Kiladis and Webster (2000) e.g. suggests that there should be a negative temperature anomaly at the tropopause level (see their Fig. 11a) associated with the n=1 ER wave rather than the observed positive one. At least at tropopause level, the signal seems to be clearly dominated by the Kelvin wave.

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Discussion of Figure 7: The only reason for selecting only the 0 UTC (09:30 local time) sondes for the tropopause conditions was to be consistent with the CAPE figure later. But we agree that it would make more sense to include the 12 UTC radiosondes as well. The figure will be revised accordingly. Including the 12 UTC radiosondes changes the average tropopause conditions (temperature, humidity, altitude) only very little and does not change any of the conclusions.

Figure 8: The figure will be revised by zooming somewhat more on the Tiwi Islands. It should be kept in mind, however, that these figures are meant to show the regional cloud field rather than the individual Hector systems. Satellite images for individual Hectors investigated during the campaign are presented in more detail later.

Discussion of 19 November flight: The westerly steering and low vertical shear referred to in this section can both be seen in Figure 5. This reference was missing and will be added. Due to the lack of local wind measurements our analysis is mostly based on information on the large scale flow (e.g. the steering at 700 hPa) and the Radar data. The Tiwis are too small to be resolved even by the 5 km resolution LAPS model operated by BoM during the campaign. The southern sea breeze was not measured directly but has been referred to in several previous studies (for instance Carbone et al., 2000; reference will be added). Since the coastlines of the Tiwis are mostly east-west oriented the formation of sea breezes is most pronounced at the northern and southern coast. The section will be changed to make this clearer.

p.11, col. 2, final para.: The referee is right that it is not really surprising that the analysis in Sect. 5 confirms the trajectory forecast. However, it needs to be kept in mind that the trajectories in Section 5 are based on analysis not forecast data. The sentence will be changed to '(see trajectory analysis in Sect. 5)'.

p. 12, col. 2, final para.: This paragraph will be dropped as suggested.

p. 14, col. 2. Sect 4.4: In the version finally published in ACPD a sentence has already been added to Section 4.4. explaining why this day was considered a 'golden day'.

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p. 14, col. 2, Sect. 4.4 'southward propagating squall line'. Again, the large scale wind fields available to us can, unfortunately, not resolve the small scale circulations over the Island. Our analysis is therefore only based on Radar images (and animations thereof that can not be presented here). There are only two surface stations (SYNOP) on the Tiwis, one near Apsley Strait and the other one at the westernmost point of Bathurst which are not sufficient to illustrate the Island circulation.

p. 17, col 1, line 4: We will extend the description of the instrument MAS as follows: '.. confirmed by measurements of the Multiwavelength Aerosol Scatterometer (MAS) which measures the light emitted by three laser diodes at different wavelengths and backscattered from aerosols and cloud particles (Adriani et al., 1996; Cairo et al., 2004).' Further details on the instrument and the way it is operated on the M55 is provided by the cited references.

p. 17, col. 1, sentence 3: This is a good point that needs further explanation. The tropopause was indeed not particularly cold on the day of the flight. The air was very dry because it had encountered a cold tropopause 2-3 days earlier. This was revealed by a trajectory analysis applied to this and all other flights of the campaign as will be detailed in a forthcoming paper. This will be made clear in the final version.

p. 17, col. 2, first sentence: The referee is right. We will briefly introduce the Hector storm on 23 November in the final manuscript and also refer to Figure 8 where it was shown already.

Technical comments on figures:

All figures will be changed following the recommendations. Unfortunately, the Berrima 256 km range radar images do not extend far enough to the south and north to cover the Falcon flight tracks. It is therefore not possible for us to avoid clipping of the flight tracks but we will mark the positions where the aircraft leaves/enters the image domain. As suggested, a few well-placed labels will be added in figures 10-13 to better guide the reader in the discussion.

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Interactive Comment

Figure 15: There are no colours in this version of the figure. Reference to colours will be removed in the figure caption.

Typos: All typos will be corrected. For longitudes and latitudes we were sometimes using single quotes when we were referring to decimal numbers rather than minutes. To be more consistent we will use the degree/minute/second notation throughout the revised manuscript.

Replies to referee #3, Jean-Pierre Pommereau

The references to Kelly et al. (1993) and Nielsen et al. (2007) will be added as suggested. Thank you for pointing this out.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 17131, 2008.