

## ***Interactive comment on “Trace gas composition in the Asian summer monsoon anticyclone: A case study based on aircraft observations and model simulations” by Klaus-D. Gottschaldt et al.***

### **Anonymous Referee #1**

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This manuscript presents new perspective on transport in the Asian summer monsoon anticyclone based on newly obtained in-situ measurements, Lagrangian trajectory model calculations and also simulations from a global chemistry transport model. Tropospheric and stratospheric tracers, such as, CO, NO<sub>y</sub>, O<sub>3</sub>, and HCl are used in the analyses throughout the study. The careful and detailed analyses on both the in-situ measurements and model simulations provide valuable information on large scale transport in the Asian summer monsoon anticyclone in the upper troposphere region focused on measurements during a field campaign conducted in September 2012. I would suggest considering making this paper a little more concise so that the focus of the findings can be emphasized.

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## General Comments

- It seems crucial for this study to define the anticyclonic boundaries explicitly. There is no clear indication of when the anticyclonic circulation was strong, in terms of temporal and spatial variability throughout this study.

- POI 1 through 7 – Dividing the flight tracks into multiple segments (POIs) provide great detail on the dynamical and chemical evolution of the anticyclonic circulation. However, it seems that there is a lot of information to digest. One thing the authors might consider is focusing on the relevant flight segments that is more relevant to this study to emphasize all the findings of this study.

## Specific Comments

P2, L5-6 (Abstract) - This statement is somewhat misleading. Previous studies may have shown ozone minimum inside the anticyclone during monsoon maximum period (July-August) and this study is focused on measurements in September near the edge of the anticyclone. I would recommend removing this sentence to avoid any confusion.

P2, L26 - What is 'above processes' referring to? It would be better to describe it explicitly. Also it is important to mention this process is important for trace gas budgets in September.

P3, L14 and 27 (Introduction) - June to September (reference). - South of the anticyclone (reference).

P3, L29 - Konopka et al., 2010 (<http://www.atmos-chem-phys.net/10/121/2010/acp-10-121-2010.pdf>) can be a good reference here. For instance, their Fig. 7 shows general idea of transport of ozone in the Asian monsoon anticyclone.

P4, L22-23 - EMAC global simulations...reproduced well -> EMAC global model. ...reproduced well in the simulations.

P5, L8, 12 & 15 (section 2) - Full names of GLORIA, ANEAS and FAIRO have to be

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included here.

P5, L26-27 - the aircraft campaign – Is this referring to one specific campaign or multiple campaigns in general?

P6, L4-5 - References for those tropopause definitions should be included here.

P6, L14 - represented by this approach indirectly -> represented indirectly

P6, L22 (section 3) - sudden increase -> It may help to add exact flight time (for example: 7:50 am, UTC).

P6, L26 - yellowish -> yellow-brown to yellow

P6, L29-30 - positions of streamlines -> For better definition of the interior vs. fringe of the anticyclone, it might be helpful to add a figure showing streamlines (or boundaries) of the anticyclone. This can also be done by adding streamlines (or boundaries) in Fig. 2.

P6, L35 - (supplementary material) -> (supplementary material, S4)

P8, L11 - Geographical locations, such as, Larnaca and Oman can be marked on the map if it is necessary.

P8, L17-18 - Deep convection. . .considerably to POI5 -> I assume this statement refers backward trajectories from the surface reaching up to higher altitude as deep convection. I am wondering if there is any other evidence of showing deep convective activities during POI5.

P8, L31-33 - Highly polluted. . .though. -> This sentence is vague. It is not clear how this effect is shown in POI4.

P9, L2 - measurement locations. -> Is this based on the trajectory calculations?

P9, L8 - more natural definition -> meaning of this is not clear.

P10, L5 (section 4) - stratospheric or TL air then -> stratospheric or TL air

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P10, L23-24 - by the coarser output (time) resolution directly, and indirectly because the representation of processes is limited by the grid resolution -> because of the coarser temporal resolution of the output (direct) and the representation of processes is limited by the grid resolution (indirect).

P11, L2 - synoptic scale feature -> I am not sure I agree with this statement that ASMA is synoptic scale feature. ASMA itself is a global scale feature and its variability is represented in this study.

P11, L15 (section 5) - NO(x) -> NO<sub>x</sub>

P12, L25, 27 - then or though at the end of the sentences might not be necessary

P14, L1 (section 6) - I wonder if there is a way to reduce the amount of discussions in section 6.1. This section only serves as an introduction and contains very detailed discussion.

P14, L15 - Konopka et al. (2010) can be mentioned here.

P15, L2 - formed -> formed

P15, L7-8 - artefact of...components -> I am not sure what the meaning of this sentence is.

P15, L23 - O<sub>3</sub> correlates with HCl -> O<sub>3</sub> is positively correlated with HCl

P16, L8 - where...during POI<sub>3</sub> -> where measurements of O<sub>3</sub> were lower than outer streamlines during POI<sub>3</sub>.

P16, L10 - minted?

P16, L11 - Contrary -> On the contrary

P17, L18-25 - This paragraph can be revised just to emphasize that the focus of this study is on the analyses based on measurements during September (not Jul-Aug) and in the fringe of the anticyclone (compared to inside).

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P17, L30 (section 8) - I am not convinced that this study has showed dynamical and chemical coupling with convection.

P18, L4 - From. . .available -> Based on the in-situ measurements data,

P18, L7-13 - match -> agreement

P18, L30 - Fig. 2, 6 -> Figs. 2 and 6

Figures (Supplement) - What do colors in Figs. 4S (c, g, k) mean? Maybe the same as d, h, m?

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[Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-997, 2016.](#)

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