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Interactive comment on “Impact of different Asian source regions on the composition of the Asian monsoon anticyclone and on the extratropical lowermost stratosphere” by B. Vogel et al.

Anonymous Referee #1

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General Comments:

This study concerns an important physical process and contains interesting hypotheses that could illuminate the role of the Asian summer monsoon anti-clone for the transport of boundary layer into the stratosphere. However, the analysis is incomplete and the manuscript is not suitable for publication in its present form. For the most part, the analysis is restricted to instantaneous ‘snapshots’ of constituent (tracer) concentrations and dynamical quantities, detailed descriptions of those snapshots, and speculation about the underlying dynamics. However, there is very little analysis performed that proves – or even demonstrates – that the speculation is meaningful. What

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the authors have are interesting hypotheses that can form the basis for analysis, but not much more. The Asian anticyclone is an extensively studied phenomenon that warrants careful analysis. Furthermore, the diagnostic tools necessary for such an analysis are readily available and long familiar to this field; there is no justification for settling for speculation and anecdotal evidence for such a mature subject. To provide further guidance, the Specific Comments that follow discuss the analysis that could support individual statements in the Abstract.

Specific comments:

Abstract, lines 5-9: Regarding the statement: ‘Our simulations show that the Asian monsoon anticyclone is highly variable in location and shape and oscillates between 2 states: first a symmetric anticyclone and second, an asymmetric anticyclone either elongated or split in two smaller anticyclones.’ To demonstrate this behavior, the authors show 4 snapshots of tracer concentrations and potential vorticity with the claim that these snapshots are typical. I do not question the author’s contention that they observe these patterns often in the data. However, the human eye is often too adept at finding patterns. If the anticyclone is truly dominated by two patterns, those patterns will emerge from an EOF (or similar) analysis as the two leading modes.

Abstract, lines 9-14: Regarding the statement: ‘A maximum in the distribution of air originating from Indian/Chinese boundary layer sources is usually found in the core of the symmetric anti- cyclone, in contrast the asymmetric state is characterised by a double peak structure in the horizontal distribution of air originating from India and China.’ An EOF analysis would work here as well. Also, if the two modes are separated via an EOF analysis of PV, then the structures of tracers that accompany those PV patterns will be revealed by projecting tracer variations onto the principal components of each PV EOF.

Abstract, lines 14-17: Regarding the statement: ‘The simulated horizontal distribution of artificial emission tracers for India/China is in agreement with patterns found in

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satellite measurements of O₃ and CO by the Aura Microwave Limb Sounder (MLS).⁷ The pattern agreements can be easily verified via pattern correlations – which should be performed for the entire season, not just 4 days.

Regarding the CLaMS simulations; Sec. 3.1.3 – 3.2.2: First, the analysis of transport paths is both anecdotal and speculative. The authors have a transport model; they should use it to perform focused analysis with model experiments designed to enlighten. Second, it seems clear from the upward trends of tracer concentrations in Fig. 8 that the CLaMS simulations have not spun up – that is, tracer concentrations in Fig. 8 are not true representations of actual concentrations. For example, there are potentially more tracers in the anticyclone in August than in June simply because those in August have had more time to get into the anticyclone – regardless of any physical transport process. In this context, it is still interesting that the SE Asia tracers dominate in June. Presumably this is because transport for those tracers is faster than for other regions. Nevertheless, that spin up is occurring during the analysis period makes that figure, and all CLaMS results very difficult to interpret.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 9941, 2015.

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