

## ***Interactive comment on “The Meteorology and Chemistry of High Nitrogen Oxide Concentrations in the Stable Boundary Layer at the South Pole” by William Neff et al.***

### **Anonymous Referee #2**

Received and published: 2 December 2017

This paper describes data prescribing the boundary conditions affecting the near surface air-chemistry at the South Pole; more specifically the conditions are sought that lead to occasional episodes of surprisingly high levels of NO in the lowest 50 m or so of the atmosphere.

This is a complex discussion: NO levels may depend on large scale meteorology (advected air from the oceans), small scale mixing (boundary layer stability), sunlight, and the actual chemistry sources and sinks. The paper faces a significant challenge in presenting the reader with these processes, their importance, and the supporting data (from different campaigns) in a manner that tells the story and supports the conclu-

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sions. It is this challenge that I found wanting.

I think the paper is difficult to read: this may be in part because much of it is not my field, but I suggest that most readers will suffer similarly given the interdisciplinary nature of the discussion. The authors therefore need to help set the story better, and I suggest that two or more schematics would be most helpful. The source, mixing and ventilation of the boundary layer, with the chemical pathways (in snow, air and advected aloft) overlaid. This coupled to maps (as per figure 1, 5 and 8) with an overlay of wind roses, rather than x-y plots (figure 1 again). The authors should think of a clearer nomenclature for wind direction, as “157.5” and “337.5” implies a very highly modal air flow, rather than, for example “the SSE and NNW sectors” (I assume this is what the authors meant). Perhaps even include a sailors’ compass for those less familiar with these terms, but emphasise that such sectors have natural angular range bin of a quarter of a right angle. These would then fit nicely with wind roses of either 8 or 16 direction bins. Finally on the topic, such schematics would stress that ‘North’ at the South Pole is nominal, and the meridian is taken.

The schematic of the boundary conditions would greatly assist with giving meaning (and importance) to the whole of Section 2. Each section describes some meteorological phenomenon, but not why it matters. The reader (at least this one) was left with a wealth of information dangling, without a mechanism to sift for importance for the overall Question. All of the information presented may be vital to the argument, but, I would ask the authors to check each statement here for Invasion of the Interesting Fact (which isn’t actually critical).

Perhaps (again for the non-specialist reader) the conclusions could be presented as a “recipe for a perfect NO event”, that is, High NO is likely to happen when (a) and (b) and (c) or (a) and (d) but not (d) etc.