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***Interactive comment on* “The variability of methane, nitrous oxide and sulfur hexafluoride in Northeast India” by A. L. Ganesan et al.**

Anonymous Referee #1

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Rapid economic growth in Asia is likely resulting in larger emissions of greenhouse gases and other parameters that affect climate, but few measurements exist to constrain current emission rates. Ganesan et al. report continuous measurements of CH₄, N₂O, and SF₆ for a site in northern India at Darjeeling. The observations, made through AGAGE, are high quality. The authors also give a reasonably thorough analysis of transport regimes that affect the measurements, and how they vary by season. This is a very nice study, and the data will contribute to improved understanding of CH₄, N₂O, and SF₆ emissions from S Asia.

General comments:

1. The authors rely much to heavily IPCC rather than original work for their citations.

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2. Perturbation lifetimes for CH₄ and N₂O are given in stead of budget lifetimes, which I believe are much more appropriate for this study.
3. The experimental methods section is missing a description of sampling and drying.
4. State more explicitly what quality control measures are applied to the observations. (E.g., target cylinders, comparison with independent measurements, etc.)
5. Axis labels on figures are unnecessarily small and deatiled, in some cases. For example, in Fig. 4 delete "Mole fraction", since the unit is clear from nmol/mol.
6. State where the data are available for others to use in studies of Asian GHG emissions.

Specific comments:

P2L23: You want the budget lifetime, not the perturbation lifetime. There is a recent paper by Prather et al. with CH₄ and N₂O budget lifetimes.

P2L26: CH₄ emissions related to fossil fuel are as large as any listed and are likely increasing, so they should be included.

P3L7: In AR4, N₂O came after CO₂, CH₄, and CFC-12. There are other sources like NOAA's AGGI that show N₂O has replaced CFC-12 as 3rd largest RF.

P3L9: This is the perturbation, not the budget, lifetime. Note that the 2010 WMO O₃ assessment had this wrong.

P6L18: "...improve SF₆ response." is vague. Do you mean increase peak area/ppt? Or, the peak is sharper and easier to integrate than when it comes out after N₂O?

P6L28: Measurements began before the standard gas cylinder was filled at SIO; what was used for a standard prior to that?

P7L21: add space so 10 Hz.

P9L3: How good is this assumption for CH₄ during summer when loss can be more

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than 1 ppb/day?

P9L19: Specify which is latitude and which is longitude.

P10L23: ...differences...show...

P10L25: spelling: assess; Given the mismatch between the position of the site in the model and reality, can you make an argument as to why the comparison is useful?

P11L19-28: I'm not sure of the point you are trying to make with this discussion of sensible heat flux.

P13, top: Because most emissions are in the NH, there is a strong N/S gradient in SF6, on order of 0.2 ppt. You should be able to see movement of the ITCZ across the site based on SF6 alone. Can you?

P16L11: consistent WITH changes in sunrise

P17L8: You will not "verify" national scale emissions for S Asia with measurements from this one site. Perhaps "constrain" would be a better choice.

P17L16: Delete "throughout the summer period"; "summer monsoon" is pretty explicit about the season.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 17053, 2013.

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