Interactive comment on "Atmospheric mercury speciation dynamics at the high-altitude Pic du Midi Observatory, southern France" *by* X. W. Fu et al.

Anonymous Referee #1

This paper evaluates source regions of high GOM and PBM concentration episodes at a high altitude station in westen Europe. The exact vertical distribution of the various mercury species and in particular the oxidation mechanisms of GEM are a major scientific questions in the mercury community. Using backwards trajectories to indentify potential source regions of GOM and PBM, this paper provides a significant contribution to current research questions. The findings are generally in line with recent observations from air-craft campaigns indicating that the free troposphere is a major source of GOM. The paper is well written and the data seems credible. I suggest to publish the paper after minor revisions and clarifications:

1) Please clarify how you determined the end points of trajectories (3 hourly endpoints

according to the meteo time step?). Why did you choose a fixed period of 7days for GOM and 10days for PBM? Did you take into account precipitation events when calculating backward trajectories with HYSPLIT? Concerning GOM and PBM I suggest to stop the backwards trajectorie once RH>99% as previously produced/emitted GOM and PBM will probably be scavanged.

2) Please clarify whether you used any form of ensemble trajectory calculations in HYSPLIT. Already after 2-3 days source regions but especially the altitude can vary significantly. A trajectory could easily originate from the FT in one run and from inside the PBL in a sligthly perturbed model run. (see Figure R1 which depits 27 member ensemble for a single 10 day backward trajectory. Here after 3 days you can see a massive vertical spread of the end points)

3) Please clarify what are the standard conditions for your mercury measurements (e.g. 0°C 1024hPa).

4) Given your Tekran setup (10 L/min 1h sampling for GOM and PBM) the automatic peak integration shoukd start having problems at concentrations < 12pg/m^3. This wont affect the findings of this paper, but in general, I would suggest to check this and possibly apply a correction to small GOM and PBM measurements (compare: Atmos. Meas. Tech. Discuss. doi:10.5194/amt-2015-376, 2016)

5) line 21: I would prefer if you gave the concentration range instead of the maximum concentration. (33-98 pg/m^3) (91-295 pg/m^3) line 40: Higher than 'those' instead of 'that' line 52-53: Please clarify here that PBM is not significantly removed by dry deposition line 61: should read 'which' instead of 'what the' major oxidants line 72-75: You state that CARIBIC found a positive correlation between TGM and O3. However, the publication by Slemr et. al you mention only discusses a correlation between GOM and O3. line 139-140: please rephrase (do not retain half of GOM) line 157,162, and others: I generally suggest to write 'at the PDM observatiory' or 'at PDM' but not 'at PDM observatory' line 196: Please clarify what exactly you mean by end point and

what time step you used (e.g. hourly endpoints?) line 277: ratios instead of ratio line 370: relative instead of relatively Supplement Table S3 caption: It should say "high GOM events"
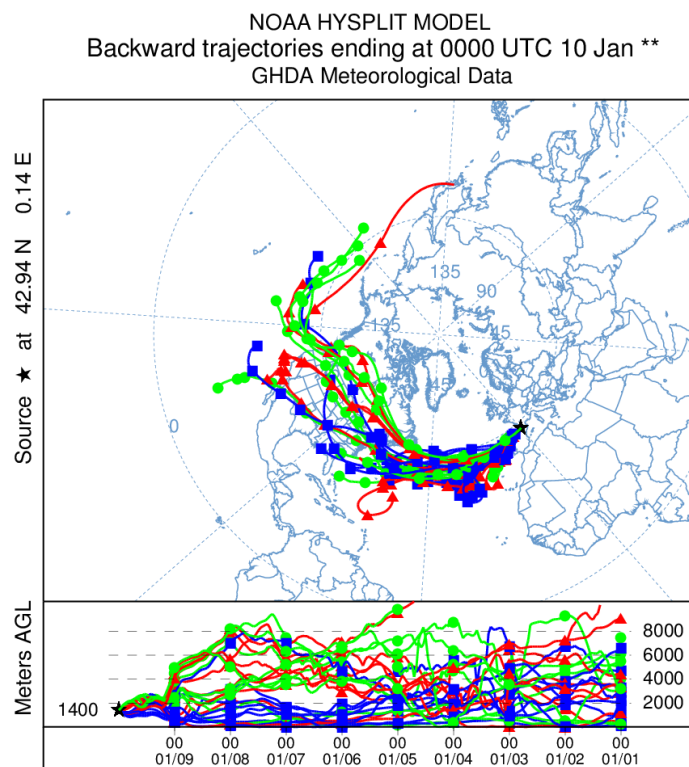
Fig. 1. HYSPLIT 27 member ensemble for a single 10 day backward trajectory