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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Assessment of atmospheric processes driving ozone variations in the subtropical North Atlantic free troposphere" *by* E. Cuevas et al.

Anonymous Referee #1

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This manuscript analyses the time series of ozone over a 22 years period (1988–2009) at the subtropical high mountain Izaña station which is representative of free troposphere aiming to assess the atmospheric processes controlling the ozone variability. Overall, it is an interesting and well structured manuscript. It merits publication to ACP and I would suggest acceptance of the paper after taking into consideration the following minor comments.

Comments:

1. Introduction: There is a recent article on European ozone trends by Logan et al. (JGR, 2012) relevant to the topic of this manuscript which could be cited.

2. Page 28392, line 4: Although there is the relevant reference to the MCAR method, a short description would be useful for the reader.

3. Page 28397, lines 6-10: It can be also mentioned the existence of common characteristics in the shape of summertime ozone diurnal cycle (day-time lower ozone values due to thermally driven upslope winds) with other high-altitude European stations such as Jungfraujoch or Zugspitze (see e.g. Schupbach et al., JGR, 2001).

4. Page 28398, lines 27-29: I think that a note comparing the ozone seasonal cycle at Izana with the respective one at other high altitude European stations (Jungfraujoch, Zugspitze, Sonnblick) could be added.

5. Page 28400, lines 8-10: The authors state that "It is noticeable the fact that trajectories from the Sahel, and those originated over North Africa and the Mediterranean Basin, travel at mid-high altitudes, mainly in July and August." It would be better to specify that these low-level trajectories originate from Northwest Africa and Western Mediterranean.

6. Page 28401, lines 23-25: The authors state that " There is not a clear relationship in winter, spring and autumn, probably due to the short variation range of 210Pb values." Do you mean that it is related with the comparison if the 210Pb lifetime versus the atmospheric transport timescale in winter, spring and autumn? Please clarify.

7. Page 28403, liens 3-5: The authors state that "So, it is noteworthy that in 10% of days in winter and autumn, backward trajectories have been impacted by upper-troposphere air masses with PVU > 1. " A plausible justification could be also downward transport from the stratosphere to the troposphere followed by mixing with tropospheric air which would decrease the PV of the air mass.

8. Page 28403, lines 15-17: Please provide some references to justify the use of 1 and 1.6 pvu as thresholds to identify the impact of STT transport (see for example Stohl et al., Atmos. Env., 2000; Akritidis et al., Meteor. Atmos. Phys., 2010). A common

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threshold for dynamical tropopause is the 2 pvu.

9. Page 28404, lines 25-27: The threshold value of 8 mBq/m3 for an air mass with stratospheric signature which was suggested by Reiter et al. (1983) and applied also in other studies (see e.g. Stohl et al., Atmos. Env., 2001) is an arbitrary value that was resulted for Central Europe but maybe different from one place to another. Apart from this approach, there have been many studies in which different thresholds of 7Be activity were used for identifying air masses of stratospheric origin based on statistical criteria (see e.g. Elbern et al., Atmos. Env. 1997 ; Gerasopoulos et al., Atmos. Env., 2001). I would suggest that some discussion for the threshold value of Be-7 should be added.

10. Page 28407, lines 27-29. The authors state that " The results identify a main contribution from pollution episodes over North America in winter, with backward trajectories heights below 4 km, whereas in spring aged air masses (previously transported from North America) are found over North Atlantic at high altitudes (above 4–5 km)." I understand and I agree with what but the authors should also mention that these height values are median values and there is a large overlap in the altitude range between A3 and B3 in Figure 13.

11. Page 28408, lines 28-29: Shouldn't be 0.58 instead of 0.54 according to Table 5?

12. Section 3.7: The authors should also take into account in their discussion on O3-CO relationship that there is an O3/CO seasonal cycle in the baseline (background) atmosphere. I am not sure if I understood well but if this O3/CO seasonal cycle in background atmosphere is not considered, maybe could lead to speculative conclusions.

13. Figure 11: Why the authors use a different color scale among the 4 plots? In Figure caption please denote what is the percentage number in red.

14. Figure 13: Why the authors use a different color scale among the 3 plots? Please

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also clarify what are the arbitrary units for the residence time.

15. Figure 15: The fact that a negative phase of NAO results in higher tropospheric ozone amounts in winter over the whole north Atlantic it is not very clear from Figure 15. I would suggest to add in Figure 15 plots of the ozone differences between NAO+ and NAO-.

16. Table 4. Please denote how many cases are included for each type.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 28385, 2012.