Reply to referee's comments

First, the authors acknowledge the referees for their comments and suggestions.

Please note that changes are in red in the revised manuscript (acp-2010-262_manuscript_revised.pdf), and modified figures are enclosed in a separate file (acp-2010-262_figures_revised.pdf).

Responses to Referee # 1

Comment 1	Basically, the authors describe two possible transport process responsible for the observed ozone increase – one in the LS (475 K) and in the US (700 K). But the analysis of these two, and the way of presentation (Figures 3, 4 and 5) are rather different, which makes it difficult to follow and understand. Thus, the LS transport is analyzed by: 1) N2O and O3 maps assimilated at 475 K level by the MOCAGE-PALM system for one day, 16 April 2008 (figure 3); 2) PV and O3 maps at 475 K for the same day, as obtained from ECMWF (figure 4). As opposed to LS, the US region is analyzed by: 1) a serie of O3 maps assimilated at 700 K level by MOCAGE-PALM for the 4 days of April (figure 5, upper plots); 2) a serie of PV maps at 700 K derived from the MIMOSA model for the same dates. Why do the authors analyze a serie of days at 700 K level, but only one day at 475 K? Why do they map the N2O tracer at 475 K level, but not at 700 K? Why do they use ECMWF data to map PV at 475 K, but MIMOSA model to map PV at 700 K? (why not to use some similar tool to analyze both levels, 475 and 700 K?). What is the purpose to plot ECMWF O3 map at 475 K level? (but not to plot it at 700 K?). *In whole, I propose either to make the analysis of LS and US levels more uniform, or to explain the reasons for these differences*.
Reply	Following the referee's suggestion, figures 3-5 have been modified and rearranged so that the analysis of LS (475K) and US (700K) levels are uniform. In the modified version we make use of N_2O, O_3 and APV maps for 4 days (5, 11, 16 and 17 April 2008) at both 475-K and 700-K isentropic levels. Moreover, as suggested by Referee 2, since the MIMOSA model is driven by ECMWF fields, the use of ECMWF data in Figure 4 is not necessary. In the revised version we removed Figure 4 and renumbed the figures accordingly. See the modified figure file.
Comment 2	17728 line 3-5: "It is evidenced: : :" – it is unclear from that sentence what kind of observations and assimilated fields were considered.
Reply	The sentence has been reworded as follows: *It is evidenced from ground-based observations (co-localised radiosonde and SAOZ experiments), together with satellite global observations (Aura/MLS) assimilated into MOCAGE, a météo-France model.*

Comment 3	17729 lines 15-17: "The tropical stratosphere: : :" – why do the authors talk about tropics in this paragraph? It is unclear.
Reply	We agree with the comment. That sentence is out of place in this paragraph. It is removed in the revised version.
Comment 4	17731 lines 21-25: "Daily total ozone values: : :" – SAOZ provides data twice a day, at sunrise and sunset. What values were used as daily ozone, and how were the monthly means computed? Please, specify here or later in the text.
Reply	The manuscript has been modified in order to take into account this comment. In the revised version, the corresponding paragraph has been rewritten as follows (see subsection **2.1**, end of the 1st paragraph): *The SAOZ daily values are derived as daily averages from the observed total ozone at sunrise and sunset, while the monthly mean values are computed, month per month and regardless of the year, from the SAOZ daily values. They are used for comparison with the daily values observed during the studied period.*
Comment 5	17732 lines 14-17: "In order to emphasize: : :" – which month is selected from Fortuin & Kelder climatology? April? Please, specify.
Reply	The sentence has been changed as follows: *In order to emphasize the ozone anomaly, we use the Fortuin & Kelder ozone climatology (Fortuin and Kelder, 1998) to derive April climatological ozone profile …*
Comment 6	17736 lines 10-12: ": : : whose amplitudes exceed the monthly climatological values" – which monthly values are meant here? Climatological amplitudes? This is unclear.
Reply	The sentence has been split into two and reworded as follows: *These variations are in form of alternative maxima and minima of total ozone during March and April 2008. In addition, the daily variations of total ozone observed by SAOZ, Aura/OMI and Aura/MLS show amplitudes that exceed the monthly climatological values.*
Comment 7	17737 lines 12-15: "The ozone profile recorded on 16 April at KER: : : illustrates a significant ozone increase in the lower stratosphere: : :" – What is the reason for that conclusion? Comparison with a climatology profile? Please, clarify.

Reply	The sentence has been reworded as follows: *The ozone profile recorded on 16 April at KER … illustrates a significant ozone increase in the lower stratosphere, in the 16–24 km height range (between the ~400K and the ~650K isentropic levels), in comparison with April climatological profile from Fortuin & Kelder ozone climatology.*
Comment 8	17738 lines 16-20: "In fact, it is well illustrated: : :" – I don't understand how we can see all the movements of air-masses described in these sentences, looking on the map of only one day (Figure 3)!
Reply	We agree with the comment. It is linked to Comment 1. In the revised Figure 3 has been modified to show N_2O, O_3 and APV maps for 4 days (5, 11, 16 and 17 April 2008) at 475-K. See the modified figure file.
Comment 9	17739 lines 17-21: "However, by taking into account: : :" – How do the authors conclude that "the evidenced isentropic transport in the lower stratosphere could not explain alone the observed increase in total ozone: : :"? Please, clarify. In addition, the authors may try to estimate the share of contributions from the LS and US transport to the observed ozone increase.
Reply	The authors thank the referee for this relevant comment. For clarification we estimate the contributions from the LS and US transport with respect to April climatological values from Fortuin & Kelder and SAOZ datasets. The paragraph in question has been modified accordingly, as follows: *As discussed in the previous subsection (and shown in Fig.1 and Fig.2), difference between April climatological total ozone value (~295 DU) and April-2008 observations (~345-350 DU) is in the 50-55DU range. In addition, it is found from the 16-April ozone profile that transport in the LS explains ~72% of the observed increase in total ozone. Indeed, the isentropic transport in the LS could not explain alone the observed increase in total ozone observed by ground-based and global measurements (SAOZ, Aura/OMI and Aura/MLS) (**Fig.2**).*
Technical corrections	17728 lines 16-17: misprint, "Microwave Limb Sounder" > modified 17734 line 12: misprint, "PALM (Projet d'Assimilation par Logiciel Multi methode)" > modified

	17735 line 14: misprint, “measurements of total column ozone” > modified 17739 line 10: misprint, “air mass” > modified 17739 line 22: misprint, “air mass” > modified 17748 Figure 2: the plots (a) and (b) should have uniform style – time axis (month labels on (a), but missing on (b)), and legend (“daily SAOZ” on (a), but “SAOZ 2008” on (b); “monthly mean” on (a), but “SAOZ 1996-2008” on (b)) > as suggested by Referee 2, Figure 2a,b has been combined in one, because of much overlap. See the modified figure file. 17749 Figure 3: concentric circles depicting 60_ and 30_ latitudes are not visible on the maps > Figure caption has been modified accordingly. 17751 Figure 5: concentric circles depicting 60_ and 30_ latitudes are not visible on the maps > Figure caption has been modified accordingly.