Response to Reviewer 3:
We would like to thank Reviewer 3 for her/his comments. Below is a point-by-point response for the comments and suggestions raised in the review.
The review is copied here in full (in red), and then we dissect it and give our answers.

This is very well known that weather disturbances relieve polluted air masses from meso-to synoptic-scales. This study investigates such a process during the East Asian Summer Monsoon as observed by satellite (IASI), Aircraft (MOZAIC) and ground stations measurements of ozone. The present study is a well-conducted qualitative study ; however it doesn't report anything new. The subject has come up a number of times, one of the very first examples using the same datasets over the same region was by Barret et al. (2011).

We agree that a lot of previous studies over China and India linked weather disturbances to a decrease in pollutants concentrations, but to our knowledge our study is the first that provides a six-year regional distribution of tropospheric ozone columns over the whole region during the monsoon period from IASI, in particular over the whole Chinese region and correlate it to meteorological parameters.

The reviewer is referring to Barret et al. (2011) study "The detection of post-monsoon tropospheric ozone variability over south Asia using IASI data". Brice Barret is a co-author on this paper, and we benefited from his expertise for this study.
Barret et al. discussed two events of anomalous drop in O_3 and linked it to the crossing of large tropical storms over central India during November 2008.
Here we highlight the main differences that can be identified between the two studies:

- **Different study period and altitude levels:**
  Barret et al. study is focused on post-monsoon period, in particular November-December 2008. After the validation section, the study shifts to discuss the *elevated* O_3 concentrations in the *mid-troposphere* during Nov-Dec 2008. Our study on the other hand takes place during the monsoon season (May-September), and discusses the *decrease* in O_3 concentrations in the *lower troposphere*.

- **Different processes involved in ozone production/loss**
  Barret et al. suggests that the enhancement in tropospheric ozone in the post-monsoon season is linked to uplift of boundary layer air-masses transported from the polluted Indo-Gangetic plain and the photochemically processes favoring ozone production during transport, as well as subsidence of upper tropospheric air masses over northern India. Our results suggest a direct anti-correlation between tropospheric ozone and cloud cover/relative humidity, processes not discussed in Barret et al., and that uplift of pollutants, and/or transport from the upper troposphere into the tropospheric ozone column studied, is not the driver of the decrease in tropospheric ozone (in the new version of the manuscript we added the analysis of vertical winds with a potential vorticity/relative humidity analysis).

- **China, the main region in our study is not studied in Barret et al.**
  Barret et al., is focused on South Asia, and in particular on India, whereas our study focuses on all South and South-East Asia, including all of China. The only other study that analyzed the whole Chinese region during the summer monsoon season from satellite measurements was performed by Worden et al. (2009) and it was done using TES, and looking at mid-tropospheric O_3 (we show the [0-6] km). Safieddine et al. (2013) and Dufour et al. (2010) also analyzed the seasonal variation of tropospheric ozone over different Chinese cities and linked the decrease seen in summer to the monsoon, but no detailed and/or spatial analysis were presented.

Therefore, we agree with Reviewer 3 that the relationship between the weather processes during the monsoon and different pollutants is rather well understood, but we hope that we showed in the above comparison with literature review and in particular the one in Barret et al. that our study brings new information. The manuscript was updated to take these comments into account, and improved following suggestions provided by the two reviewers.

To further the subject and delivering added value to end users, the present study should explain satisfactorily which one of the transport process or the lack of photochemical activity in overcast and cool conditions is the main process governing the change of the low tropospheric ozone column. The study may use other IASI species such as for example carbon monoxide and for which co-authors are principal investigators and experts at ULB and UPMC.

The study has been improved according to the Reviewer's suggestion. We added both CO maps and vertical winds. In this manner, we could check if the decrease or persistence of ozone is due to photochemical activity being hindered by cloud cover, or stimulated by the presence of anthropogenic precursors (CO). Vertical winds are used to check for uplift of pollutants.
The following text was added and Figure 2 was updated with CO and vertical velocity fields. Section 3.1 is therefore updated as follows (changes are in bold):

"In order to look at the O_3 response to change in meteorology during the monsoon, we show in Fig. 2 the monsoon period [May-August] of 2011 taken as an example year of a typical monsoon. **Carbon monoxide (CO) total columns from IASI are also shown. CO is often used as an anthropogenic pollution and biomass-burning tracer (e.g. Edwards et al., 2004; McMillan et al., 2010). Note that the seasonal variation of CO is such that it is lower in summer, because of the destruction of CO by the OH radical in the presence of sunlight.** We consider different meteorological parameters in order to highlight the relationship between change in meteorology and the [0-6] km O_3 column. These are: i) the total cloud cover that gives an insight on the photochemical activity in the troposphere; ii) relative humidity, since increasing water vapor increases O_3 loss as the production rate of the reaction $H_2O + O(^1D) \rightarrow 2OH$ increases (where $O(^1D)$

is the product of the photo-dissociation of O_3 in the presence of ultraviolet light), **and iii) horizontal and vertical wind fields. Horizontal wind speed and direction are used to assess monsoon strength and possible transport. Vertical velocity is used to investigate possible ascending motion of air masses from the boundary layer towards the free troposphere.**

[…]

In June, in particular, the monsoon becomes stronger as the wind force and the cloud cover (and therefore lower photochemical activity) increase over the regions < 20°N. A decrease in tropospheric O_3 and **total CO columns is recorded over India, and over all the countries around the Bay of Bengal and South East China. In Southern India, negative (ascending winds, over the Arabian Sea) and positive (descending winds, over land) vertical velocities are present from the surface up to 700 hPa (we show here an example at 850 hPa) suggesting exchanges of air masses vertically**. **Since CO chemistry does not depend on cloud cover, the decrease in CO between May and June suggests that transport might be the main driver of decrease in pollutants.**

During July and August, the monsoon reaches its maximal strength. Due to high cloud cover and strong **horizontal** winds, the tropospheric O_3 columns show a large decrease. **For latitudes < 30°N, the drop in O_3 is more notable, particularly over the Indo-Gangetic Plain where the decline in O_3 is driven by decreasing photochemistry since CO values over this region do not follow the same trend.**

Looking at specific regions, tropospheric [0-6] km O_3 columns in Korea show a decrease in particular in July for O_3 (**and not for CO**), which coincides with the high cloud cover and relative humidity. On the other hand, and over North West of India and part of Pakistan, the low cloud cover and weak winds lead to the buildup of the high summer O_3 over this region. **Enhanced IASI CO columns over this same region suggest build-up of pollutants**, and with little to no transport, the persistence of the [0-6] km O_3 values.

Looking at the winds plots over the different months, one can notice how the monsoon is stronger at the lower latitudes of the domain. Therefore the areas of Beijing, Tianjin and the North China Plain (black squares in Fig. 2) are in general less affected by the monsoon and they show much weaker O_3 decrease. **High CO total columns, used as pollution tracer, indicate the anthropogenic origin of the observed ozone enhancements.** In fact, the persistence of O_3 during the monsoon season in Beijing was previously documented using aircraft data from the MOZAIC program which suggested a summertime O_3 maximum attributed to strong photochemical production (Ding et al., 2008). The other interesting region in China that shows little or no change is the area between the Chongqing and Sichuan provinces (and designated with a black circle in Fig. 2). This region does not exhibit any monsoon characteristics with low cloud cover and weak winds. This region is also between two mountains, making the persistence of O_3 **and CO** during summer favorable. **The vertical velocity plots show that the monsoonal convection responsible of uplift of pollutants from the boundary layer to the free and upper troposphere, is more prominent for latitudes < 30°N, except for Southern India, in accordance with previous studies (e.g. Randel et al., 2010; Fadnavis et al., 2013, 2015).”**

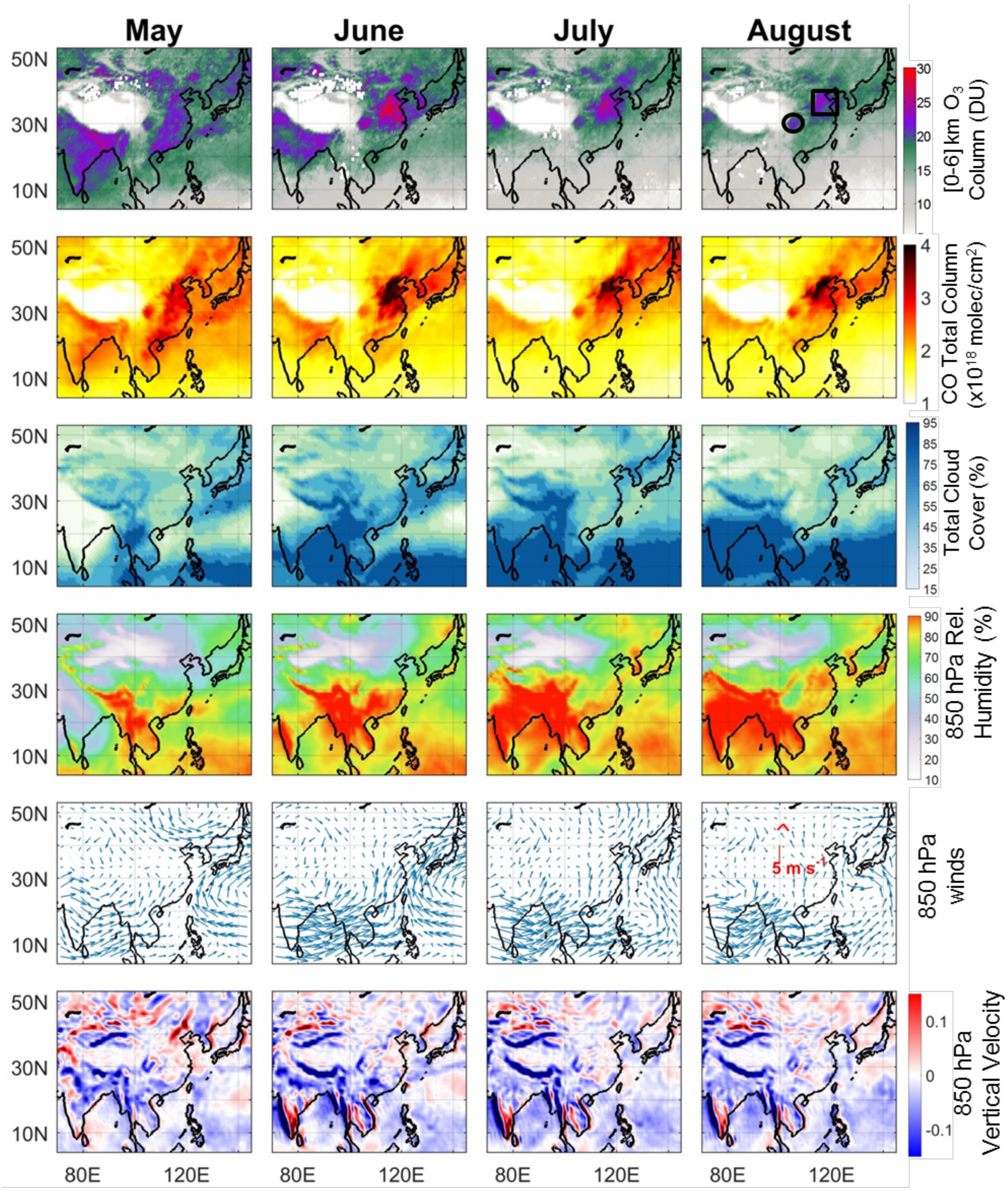

Figure 2. Monthly averaged tropospheric [0-6] km O_3 column from IASI, **CO total columns from IASI**, along with ECMWF total cloud cover, relative humidity, horizontal and **vertical winds** at 850 hPa for each of the months of May to August 2011. The black square and circle (upper right plot) are the regions the least affected by the EASM and discussed more in the text.

Finally, the declined correlation between IASI and MOZAIC ozone datasets obtained in the present study compared to the correlation obtained in Barret et al. (2011) may be worth to be discussed.

This is indeed an interesting point to investigate in the study. As Reviewer 4 also had comments for this part, we looked at the 6 years of MOZAIC/IAGOS dataset over this period and updated the discussion. Figure 3 (below) is updated and figure 4 (also below) is now replaced by the validation of IASI by the MOZAIC/IAGOS profiles over the monsoon for the period [2008-2013]. The discussion is therefore updated and we discuss the difference in correlations to the one reported in Barret et al. (2011) in detail.

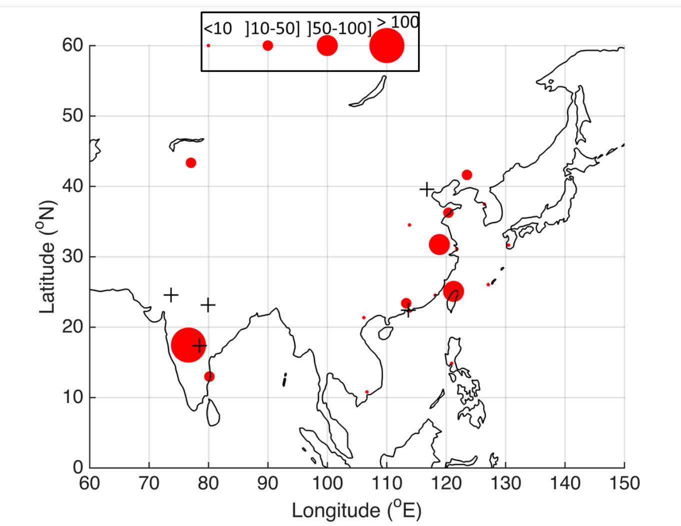

Figure 3. In red and scaled to number of observations: location of the MOZAIC/IAGOS flight data at the different airports in our study domain. The "+" sign locations corresponds to the ground stations used in Section 4 for the year 2011.

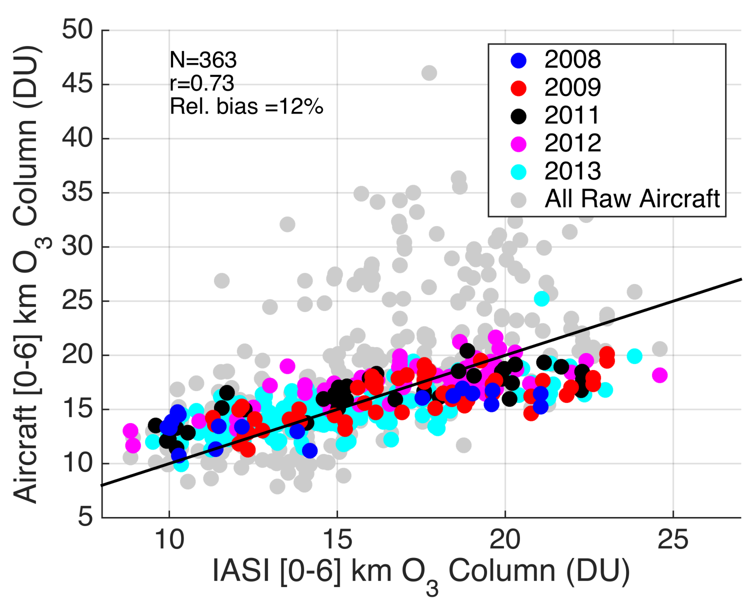

Figure 4. The [0–6] km O_3 columns retrieved from IASI correlation with 363 coincident MOZAIC/IAGOS profiles convolved with IASI averaging kernels for the period May–August of [2008-2013]. No aircraft data is available for 2010. Grey dots correspond to raw aircraft O_3 columns before smoothing.

The new discussion of Figure 4 is now as follows (changes are in bold):

"Figure 4 shows the correlation of [0–6] km O_3 column retrieved from spatio-temporal coincidence of 363 IASI and MOZAIC/IAGOS smoothed profiles during **May–August of [2008-2013] (except for 2010 where no aircraft profiles were available), and over the airports located in the study domain (see Fig. 3 for the location). Over the five years, a good agreement between the two datasets is found with correlation of 0.73 and absolute relative bias of 12%±9%. Analysis of each year data leads to correlations ranging between 0.7 and 0.8 and bias ranging between 11 and 19%.** Our results suggest a good ability of IASI to reproduce O_3 variability in the troposphere over this region. Discrepancies arise from the spatial resolution of the IASI footprint resulting in an observation averaged over tens of kilometers around the airport and therefore may include other surface O_3 contributions. Moreover, the aircraft observation takes place at different times during the day whereas IASI observation is at around 9:30 a.m. and 9:30 p.m. local time. With its limited sampling time during the day and its lower sensitivity towards the surface, IASI observation is not able to capture the diurnal variation of O_3 like an aircraft profile. **Our results show a declined correlation between IASI and aircraft products as compared to Barret et al. (2011) where they reported a correlation coefficient of 0.87 (12% ± 6%). This could be due to the different retrieval algorithm used: *SOFRID* (Barret et al., 2011) vs *FORLI* (Hurtmans et al., 2012). A discussion of the differences between the two algorithms can be found in Dufour et al. (2012). Another source of difference may arise from the different season and time period studied (Barret et al. (2011) uses a 6-month profiles over the period July–December 2008). Over the monsoon period, and in particular in May and June, the diurnal variability of tropospheric ozone is much more pronounced and highly dependent on the local meteorology. Therefore discrepancies between IASI and the aircraft profile will carry larger discrepancies given the +/- 10h coincidence criteria we used. Moreover, our study takes only the column from [0-6] km O_3 column from IASI whereas the lower tropospheric column used by Barret et al. 2011 is based on the column from the surface up to 250 hPa (~10 km) and IASI is known to have a better sensitivity in the upper middle troposphere (Boynard et al., 2009; Safieddine et al., 2013).**"

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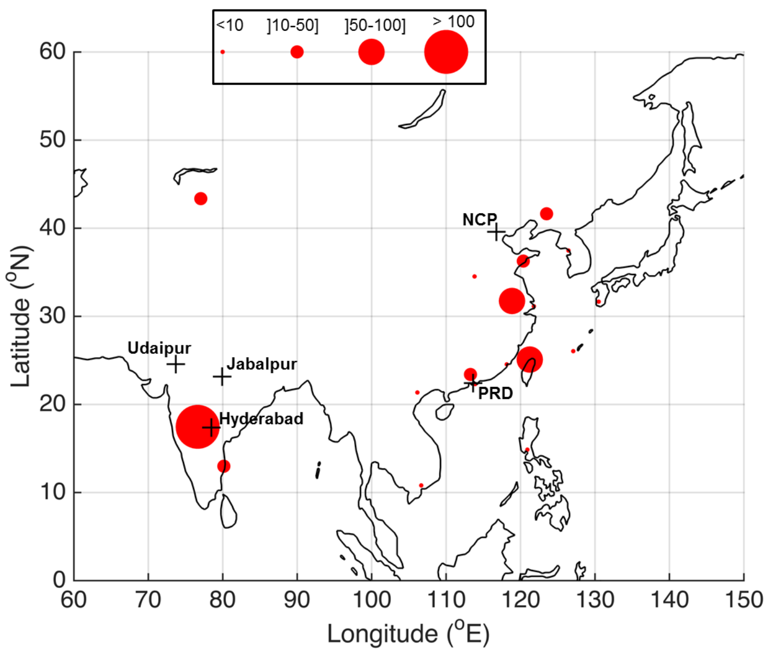
Response to Reviewer 4:
We would like to thank Reviewer 4 for her/his comments. Below is a point-by-point response for the comments and suggestions raised in the review.
The review is copied here (in red), and then we dissect it and give our answers.

The authors showcase a number of different datasets that capture atmospheric variations associated with the East Asian Monsoon. The subject is interesting and appropriate for the journal, the paper is clearly written and the presentation is good, but ultimately lacking in substantive analysis or new information. The authors show six years of IASI ozone, and then show the IASI ozone for the 2011 season alongside output from the ECMWF model. It is good to see that IASI captures the EASM phenomenon, but this has been shown before. This work shows maps of IASI data for multiple years, which has not been shown previously, but the existence of the EASM and the fact that it shows up in IASI data has already been documented in previous studies. The authors compare IASI 0-6 km columns with MOZAIC aircraft measurements for three different airports. Why do this for only one year? Presumably MOZAIC data are available for multiple years? It could be interesting to see how well IASI captures the seasonal cycle that is observed in the MOZAIC profiles at the different airports, but this is not clear from any of the figures. If IASI/MOZAIC comparisons were performed for multiple years, then it would be possible to quantify how well IASI captures the inter-annual variability of the EASM as observed at those sites.

As suggested by the reviewer, we updated the plots and the discussion to include the analysis of [2008-2013] MOZAIC/IAGOS aircraft data. We initially chose to present 2011 only as the aircraft data was most complete for the monsoon period of 2011 (as new Figure 5 shows), but analyzing more years indeed brings useful information.

Figures 3 and 4 are updated; we added new Figures 5 and 6. In this response we will start by showing the updated validation of IASI by the MOZAIC/IAGOS profiles during the monsoon of the study period, then we will study how well IASI captures the inter-annual variability of the EASM as observed at those sites.



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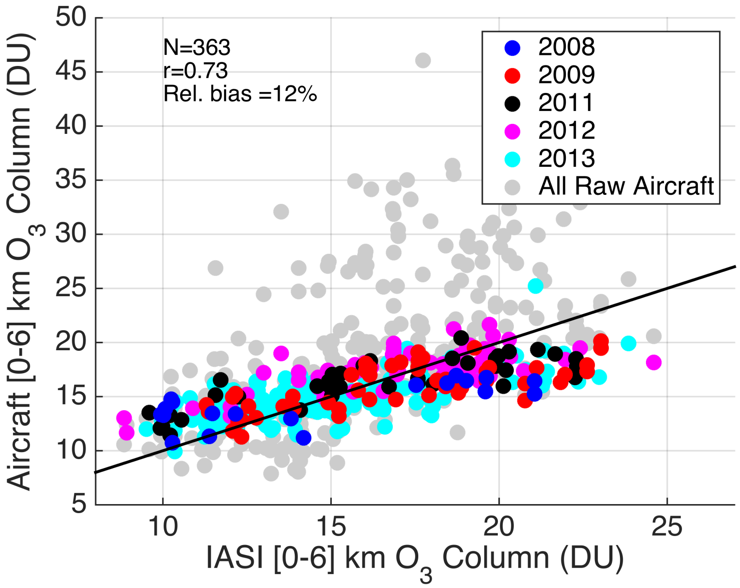


Figure 4. The [0–6] km O_3 columns retrieved from IASI correlation with 363 coincident MOZAIC/IAGOS profiles convolved with IASI averaging kernels for the period May–August of [2008-2013]. No aircraft data is available for 2010. Grey dots correspond to raw aircraft O_3 columns before smoothing.

The new discussion of Figure 4 is now as follows:

"Figure 4 shows the correlation of [0–6] km O_3 column retrieved from spatio-temporal coincidence of 363 IASI and MOZAIC/IAGOS smoothed profiles during **May–August of [2008-2013] (except for 2010 where no aircraft profiles were available), and over the airports located in the study domain (see Fig. 3 for the location). Over the five years, a good agreement between the two datasets is found with correlation of 0.73 and absolute relative bias of 12%±9%. Analysis of each year data leads to correlations ranging between 0.7 and 0.8 and bias ranging between 11 and 19%.** Our results suggest a good ability of IASI to reproduce O_3 variability in the troposphere over this region. Discrepancies arise from the spatial resolution of the IASI footprint resulting in an observation averaged over tens of kilometers around the airport and therefore may include other surface O_3 contributions. Moreover, the aircraft observation takes place at different times during the day whereas IASI observation is at around 9:30 a.m. and 9:30 p.m. local time. With its limited sampling time during the day and its lower sensitivity towards the surface, IASI observation is not able to capture the diurnal variation of O_3 like an aircraft profile. **Our results show a declined correlation between IASI and aircraft products as compared to Barret et al. (2011) where they reported a correlation coefficient of 0.87 (12% ± 6%). This could be due to the different retrieval algorithm used: *SOFRID* (Barret et al., 2011) vs *FORLI* (Hurtmans et al., 2012). A discussion of the differences between the two algorithms can be found in Dufour et al. (2012). Another source of difference may arise from the different**

season and time period studied (Barret et al. (2011) uses a 6-month profiles over the period July–December 2008). Over the monsoon period, and in particular in May and June, the diurnal variability of tropospheric ozone is much more pronounced and highly dependent on the local meteorology. Therefore discrepancies between IASI and the aircraft profile will carry larger discrepancies given the +/- 10h coincidence criteria we used. Moreover, our study takes only the column from [0-6] km O_3 column from IASI whereas the lower tropospheric column used by Barret et al. 2011 is based on the column from the surface up to 250 hPa (~10 km) and IASI is known to have a better sensitivity in the upper middle troposphere (Boynard et al., 2009; Safieddine et al., 2013).”

To address how well IASI captures the inter-annual variability of the EASM as observed by the aircraft data we created a new Figure 5.

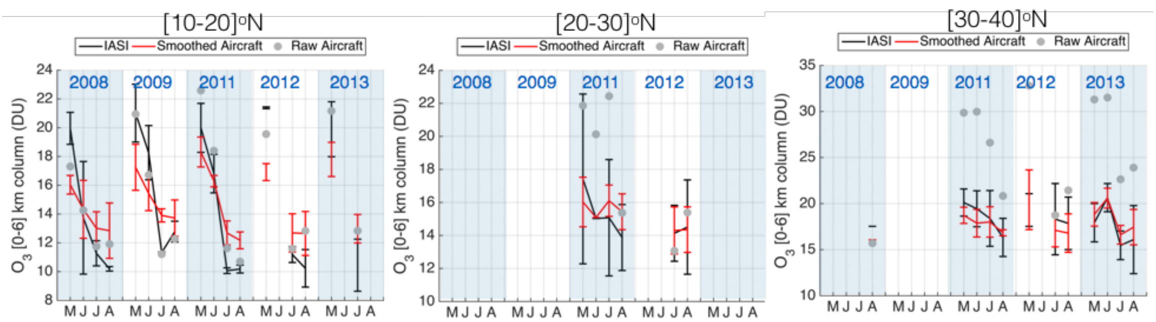


Figure 5. Time series of [0-6] km available O_3 columns from co-located IASI (black) and aircraft (smoothed in red and raw in grey) data at the airports (Fig.3) averaged between [10-20]°N, [20-30] °N and [30 40] °N from May till August of 2008 to 2013. No aircraft data was recorded in 2010.

The discussion of this figure comes directly after Figure 4, as follows:

“Figure 5 shows the time series of the columns plotted in Fig. 4 averaged over three latitude bands (the vertical bars are the standard deviation around the mean). The IASI-O_3 product captures very well the inter-annual variability of the EASM as observed by the aircraft data over the different latitude bands. The decrease in the O_3 columns is most important at [10-20]°N, and over the different years, a result that can also be seen in Fig. 1. Less data is available at [20-30]°N (no co-located observations are recorded for 2008, 2009 and 2013). For 2011 for example, a decrease -though smaller in magnitude than the one in the [10-20]°N- is recorded both by IASI and the aircraft observations between May and June. Between July and August, a decrease is recorded in 2011, and an increase is recorded in 2012, and both events are well captured by IASI. At [30-40]°N, the effect of the EASM on the tropospheric O_3 column, as Figs. 1 and 2 showed, is weak or not clear. IASI captures very well the variability during both 2011 (the consistent slight decrease between May to August 2011), and 2013 (various increasing/decreasing behavior).”

As (new) Figure 5 shows, 2011 is the year with available co-located data for both IASI and aircraft at the different latitude bands. Therefore, we choose to also keep the old Figure 5 (now Fig. 6) to check the effect of the EASM on the vertical distribution of O_3 at the different latitudes bands using 2011 as an example year. Instead of looking at specific airports, we perform a latitudinal average over [10-20]N, [20-30]N and [30-40]N, as we did in Fig. 5. The discussion of this plot was not modified much, as the previous Fig. 5 discussion holds for the current plot as well.

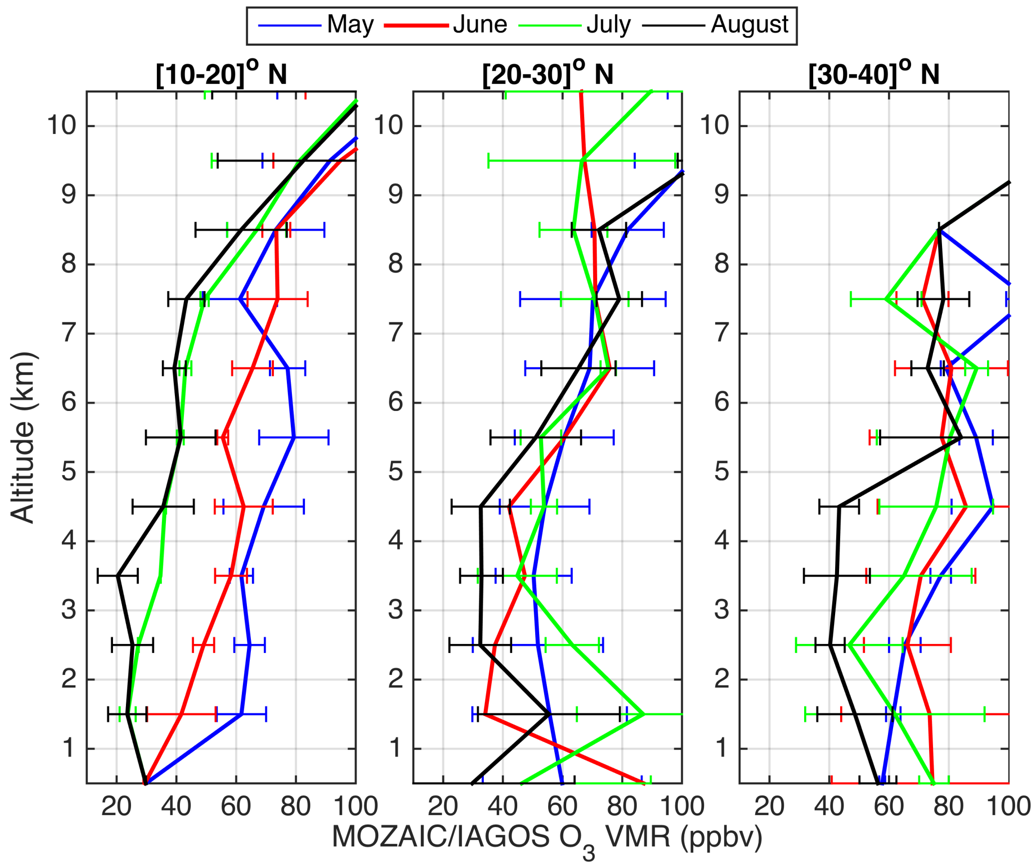


Figure 6. Monthly averaged vertical profiles of tropospheric O_3 from MOZAIC during the period May–August 2011 at [10-20]ºN, [20-30]ºN and [30-40]ºN. Error bars correspond to the standard deviation.

We brought the (little) following modifications to the text (in bold):

"We show in Fig. 6 the monthly averaged (with the horizontal bars as standard deviation) raw MOZAIC profiles during the EASM of 2011 taken as an example year. **At [10-20]ºN,** and from May to June, a clear decrease of around **20 ppbv in O_3 volume mixing ratios (VMR) is recorded at 1 and 2 km**. At higher altitudes up to around 7 km, an important decrease is also detected from May to June and then from June to both July and August. With a small standard deviation around the O_3 profiles, the observations **at [10-20]ºN,** suggest consistent averaged monthly behavior and shows a decrease in the O_3 profile at different altitudes from 0 to 7 km, which was also seen over the whole [0–6] km O_3 column from IASI in Figs. 1 and 2. **At [20-30]ºN,** the O_3 VMR in the lower troposphere **(1 to 5 km, no monsoon signature at the surface)** decreases from May to June of 10-20 ppbv but then increases back in July and/or August. At [5–8] km, the different months averaged O_3 VMR becomes comparable. Looking **at this latitude band** in Fig. 2, we can see how the decrease in the lower tropospheric O_3 in June can be explained by the increase in the cloud cover and in particular an increase in the wind speed at 850 hPa coming from the west Pacific. **The profiles located at [30-40]ºN, e**xcept at the surface, show a decrease in the O_3 VMR is detected from June to July and August (till 6 km). **All three averaged profiles show no monsoon signature at the surface, probably due to enhanced O_3 precursor emissions near the ascent and descent of the aircraft.**

The section on ground-based information does not seem well linked to the rest of the paper. Again, analysis of multiple years of data and how the variability relates to that observed in the MOZAIC and IASI measurements would make this study more interesting.

It wasn't very easy to get ground observation data from Chinese colleagues and unfortunately we only have those for 2011. We re-wrote this section in a way to improve the connection between the different sections of the manuscript as follows:

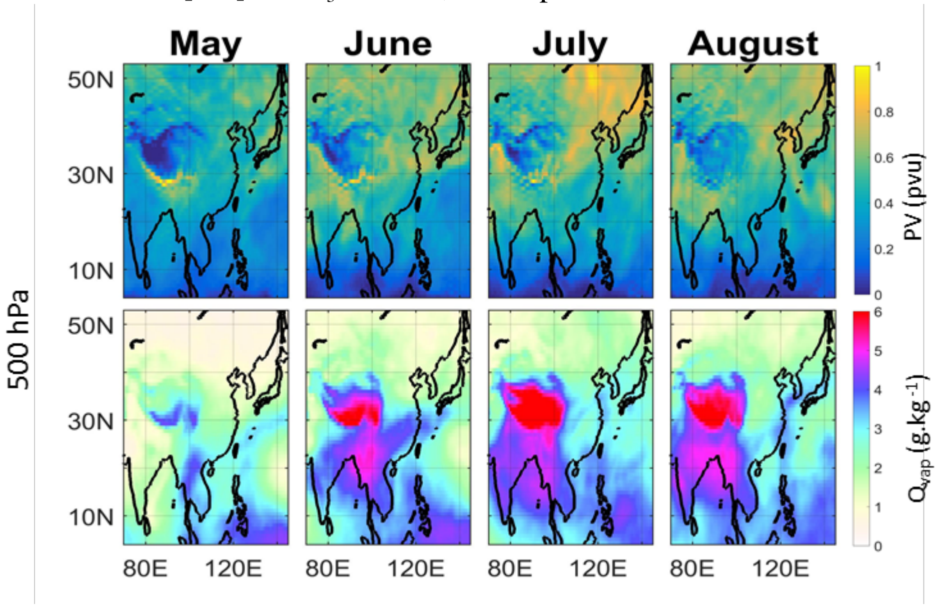
"[…] **Hyderabad shows continuous decreasing O_3 values from May to August, of total magnitude of 22 ppbv in accordance with Fig. 6 at the same latitude band. Jabalpur is located in a region where the monsoon effect is strong as seen in Fig. 1 and 2, and the O_3 at the surface behaves similarly, with a decrease of 20 ppbv. Udaipur lies in a region where the monsoon is milder, leading to a small decrease in the summer-time O_3 values that decrease of 5 ppbv between May and July and then increase back in August to 32 ppbv.** Panel b station data are the 24-h running average (and the associated standard deviation in shaded blue) of 12 stations in the PRD region and 7 stations in the NCP region. Since we are interested in the regional EASM effect on O_3, we show the average of the stations here (the station are between 25 to 300 km away). For details and more timely resolved observations for each of the station, please check the supplementary material. **The ground observations of the PRD stations, represented also by the [20-30]ºN MOZAIC profiles in Fig. 6, detect a decrease of > 35 ppbv from June to July coinciding with when the northwesterly winds from the Pacific become stronger (see Fig. 2).** The O_3 VMR increase slightly afterwards during July and August due to the decrease in monsoon strength over this region (also seen in Fig. 2). Panel b for the NCP stations shows a weak monthly decrease in O_3 concentrations from June to July and August of 5–10 ppbv. The IASI and meteorological data presented in Fig. 2, also suggest the same decreasing pattern in O_3 concentrations driven by the slight increase in cloud cover.

Alternatively, the authors might consider further analysis of the causes of the observed inter-annual variability in tropospheric ozone in this region. Is the observed variation in tropospheric ozone mainly due to meteorology? […] Or in changes in cloudiness/photochemical activity?

Figure 1 now presents 6 years of IASI-O_3 data, and we attempted to strengthen the discussion over this figure by looking at different sources to explain the year-to-year variability. We came to the conclusion (see below for more info) that the variability observed is due mainly to meteorology (including cloudiness as the Reviewer suggests), and that the other two possible sources of variability in O_3 (transport from the stratosphere, and changes in emissions) are not conclusive enough to describe and depict the year-to-year variability.

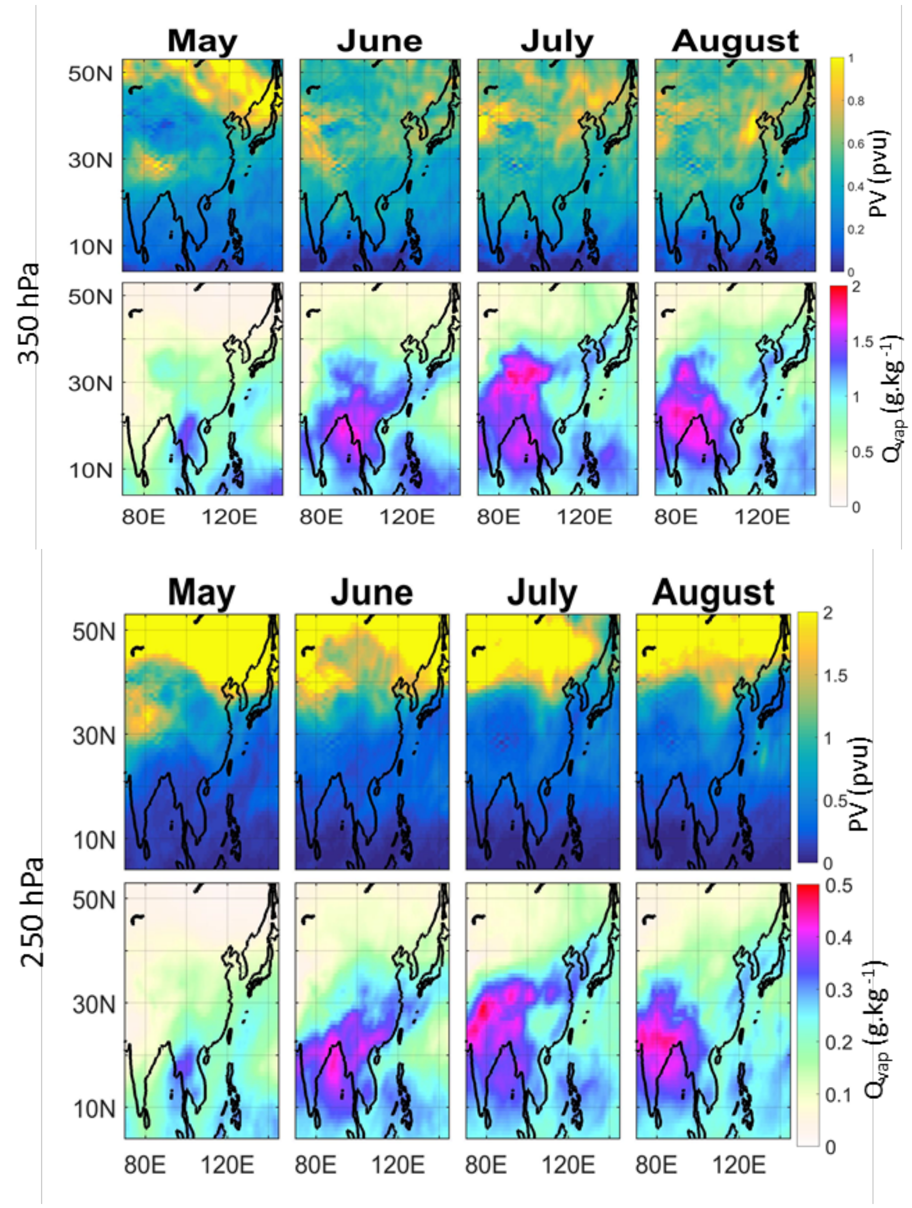
To what extent do changes in stratosphere-tropopshere exchange come into play versus long-range transport within the troposphere?

In our analysis, we chose to use the [0-6] km O_3 column from IASI to get at least one degree of freedom of information on the vertical while minimizing stratospheric contribution. We agree that STE events could be a source of ozone; in particular in the north of the domain we are studying. To answer this we analyzed potential vorticity and water vapor mixing ratios as tracers of STE events during the monsoon seasons of [2008-2013], and we choose here 2011 as an example year. Data is extracted from the ERA-interim reanalysis at 3 pressure levels: 500 hPa (~5.5 km), 350 hPa(~8 km) and 250 hPa(~10 km). Shown first here is the result at 500 hPa, which is the most relevant to check if in our [0-6] km O_3 column, stratospheric intrusions is a source of ozone.



The results suggest that the potential vorticity, at latitudes <30 N is around 0.5 pvu and increase with latitude, but stays below 1 pvu (and far from the condition of possible stratospheric intrusions of 2 pvu). The specific humidity is high on average, and lowest around the North China Plain, where we have also the highest PV, but the PV/Qvap are not high/low enough to suggest stratospheric intrusions at this altitude.

On the other hand, the possible intrusions become more important when we go up in altitude as the following 2 figures suggest, in particular at 250 hPa (10 km):



The plots show that stratospheric intrusions become important at latitudes >30°N at 10 km. The same analysis has been carried out for the 6 years of the study period [2008-2013] and similar seasonal behavior is recorded, with no particular events (in particular at 500 hPa) that suggest that the ozone regional distribution and year-to-year variation could be explained by stratospheric intrusions into the [0-6] km O_3 column shown in figure 1.

Given the above analysis, we updated the discussion of Figure 1, with the following:

"[…] To understand the year to year variability in tropospheric ozone, we looked at possible stratospheric intrusions into the [0-6] km O_3 column. Potential vorticity (PV) and the water vapor mixing ratio (Qvap) measurements were used as markers of transport from the upper troposphere–lower stratosphere (UTLS) to the troposphere, and extracted at different altitudes. We used data from the ERA-

interim reanalysis (more info about this dataset is provided in section 2.3), and it was seen that downward transport from the UTLS can have an effect at altitude > 10 km and latitudes > 30°N (results not shown here). The analysis therefore suggests that the [0-6] km O_3 monthly average columns studied here are not affected by transport from the stratosphere."

To what extent are the year-to-year variations associated with changes in regional emissions?

Year to year variations associated with changes in regional emissions and their effect on local production of ozone is an interesting point to be mentioned. Looking at the literature and different emissions databases we were not able (to our knowledge) to find recent and validated emission database for years 2011- present, the latest being to 2010.
E.g. the EDGAR-HTAP project (http://edgar.jrc.ec.europa.eu/htap_v2/index.php) compiles a global emission dataset with emission estimates of different pollutants. In order to answer this question, we analyzed the emission estimates of NMVOCs and NOx as ozone precursors for the years available within the project, 2008 and 2010 individually. We calculated the total emissions by summing the individual sectors emissions (energy, industry, residential and transport). We regridded the data from 0.1x0.1 to a 1x1 grid.
For the sake of simplicity we show the difference (2010 emissions – 2008 emissions) for each of the months, reported in tons.

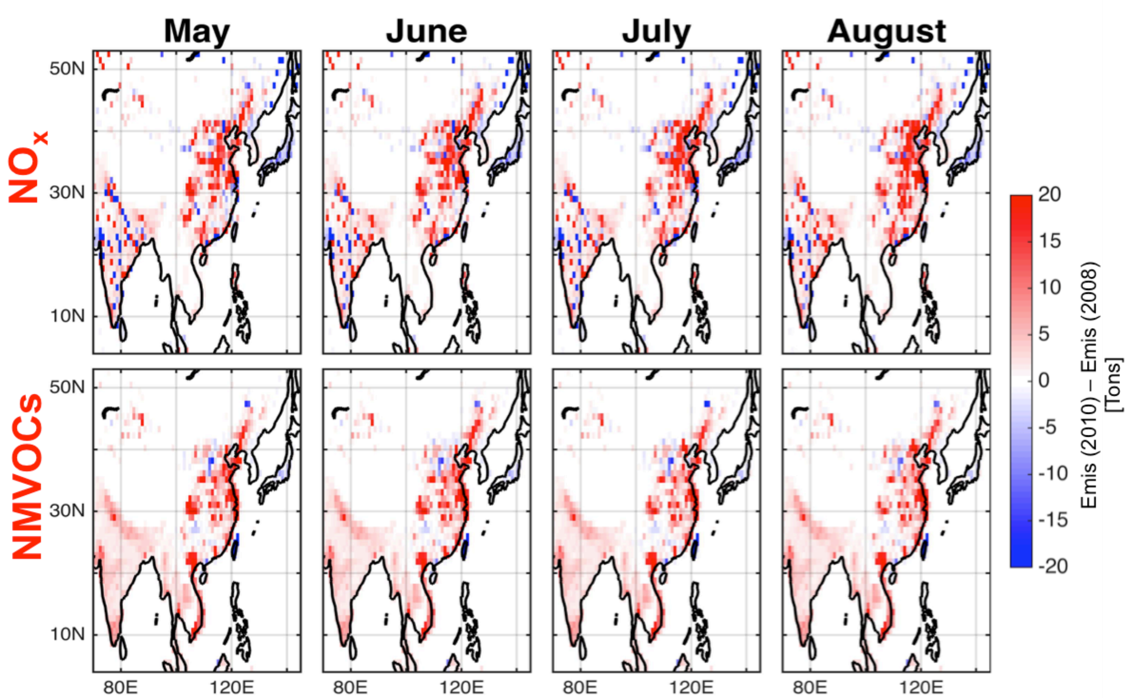


Fig S1. Change (in tons specie) between 2010 and 2008 of NO_x (upper panel) and NMVOCs (lower panel) emissions as derived from EDGAR-HTAP.

The plots show that between 2008 and 2010, there has been an increase on average over China, of 2 to 20 tons of NOx, the largest increase being over East China (between 2 and 20% increase). The North China Plain and the area around Beijing shows > 30% increase, that could be attributed to the unusual low emissions in 2008 because of the Beijing Olympic games. India shows regions with mixed trend but a uniform increase of around 5% is recorded over the whole Indian region. Japan is the only region that shows a clear decreasing signature.

Non-methane hydrocarbons (NMVOCs) also show a similar behavior, with an increase over almost the whole domain, except for Japan.
We choose to keep these plots in Supplementary materials, and talk about it in the text as follows:

"We also looked at the year to year variations associated with changes in regional emissions to study their effect on local production of ozone. We use emission estimates of NO_x and non-methane hydrocarbons (NMVOCs), which are O_3 precursors, from EDGAR-HTAP project (http://edgar.jrc.ec.europa.eu/htap_v2/index.php) available for only 2008 and 2010. An increase in both NOx and NMVOCS is observed between 2008 and 2010 over the studied domain and months, except for Japan (see supplementary materials Fig. S1). Note that strict controls on vehicles and industries emissions were implemented for the summer Olympic and Paralympic Games in Beijing between July and September 2008 (United Nations Environment Programme, 2009). Traffic was reduced by 22% during the Olympics (Wang and Xie., 2009) and restrictions were applied on polluting industries in Beijing and surrounding provinces (Li et al., 2009). While these standards did not include surface O_3 limitations, O_3 values were expected to be indirectly affected. When comparing 2008 to the rest of the years, O_3 distributions do not show a significant decrease in Beijing and/or the surrounding regions (in fact August 2010 and 2012 have lower O_3 values over Beijing than those recorded in 2008), a result also detected in previous studies looking at O_3 surface measurements (Chou et al. 2011; Wang et al. 2010). Studies suggested O_3 transport by winds from nearby polluted areas such as the North China Plain (Wang et al., 2009, 2010), or O_3 formation in the boundary layer since the photostationary state of the nitrogen cycle was perturbed (Wang and Xie, 2009). Over the rest of the domain, the increase in emissions of O_3 precursors, at least between 2008 and 2010, suggests that tropospheric ozone values also increased between these two year during the different months, but the IASI-O_3 columns do not show the same pattern. The analysis presented here suggests therefore that the meteorology associated with the EASM is the main driver of the O_3 regional distribution and year-to-year variability. […]"

The IASI ozone dataset is undoubtedly a great resource for investigating monsoon impact on the distribution of pollutants in the troposphere. The analysis presented here is an interesting start, but it would be good to see the authors take this study further in order to provide information that would add to the body of knowledge on this subject.

We hope that with the new version of the manuscript, addressing both Reviewers 3 and 4 comments in details, and updating the discussion and going more in depth into the analysis, we made the study more interesting for publication.

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