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## ***Interactive comment on “Four-dimensional evaluation of regional air quality models” by E. Solazzo et al.***

**Anonymous Referee #1**

Received and published: 4 March 2013

This paper presents a substantial effort to compare profiles from multiple models to measurements acquired by aircraft. However, there are many grammatical errors, formatting errors in figures, lack of definitions, and lack of robust conclusion statements that would help a paper of such size.

Although I have not made comments for the entire paper, I have a list of suggested edits that should be considered. Do not mistake my lack of comments in the middle of the paper as a pass of prose. By and large, the writing lacks a thorough proof-read, and would benefit greatly from a major revision in terms of writing prose (i.e. proper use of tense, pluralization, sentence structure, etc.). Many paragraphs could be synthesized better to reduce total size and be clearer to the reader. Also, standard conventions should be adhered to in the paper (i.e. 18-km horizontal grid vs 24x24 km<sup>2</sup> grid vs

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150km x 150 km grid); or terms like layers vs levels, or hpa vs mb; choose one style and stick with it. Also consider striking "resolution" from model grid size descriptions and replace with a more appropriate term such as "grid spacing" or other more specific term.

#### Specific Comments:

Abstract: define acronym MOZAIC. 3rd to last sentence should be re-worded. significant findings (numerical quantities) could be included.

#### Introduction Page 524:

1st Paragraph should mention that policies are written for ground level concentrations, so that the point of the final sentence is clear. 2nd sentence should be re-worded/structured. Many sentences in the paper use too many casual words and un-needed wordage that makes it difficult to determine the main point. For example, 2nd paragraph , 1st sentence reads: "Precise simulation of tropospheric fields is not only crucial from the perspective of emission control, but also to test the capability of models to capture the vertical distribution of pollutants, the exchanges between the boundary layer and the free troposphere, as well as the horizontal fluxes to and from continental domains." Consider the following revision: "Precise simulation of the troposphere is crucial from the perspective of emissions controls, and requires that we test the capability of models to represent the vertical distribution of pollutants, the exchanges between boundary layer and the free troposphere, and the horizontal fluxes between continental domains." Line 19: change "transport" to "chemistry and transport". Re-word sentence in Lines 21 - 27 to: "It is also important to assess the capability of models to simulate the meteorology that drives the transport and dispersion of pollutants, as errors in meteorology are inherited by AQ models, thereby producing errors in model-predicted pollutant concentrations and leading to potential compensating errors." If you want to discuss the effect of compensating errors as well I would do so at the end of this sentence, not the beginning.

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Paragraph which starts as "The evaluation of regional AQ...": I would make this the 1st paragraph of the paper.

Throughout the paper... do not call model simulations "runs". They should be called simulations, predictions, or model results.

Line 20: "... and estimates based on ozonesonde profiles..." estimates of what?

Paragraph that starts on 525 and continues to 526 would benefit greatly from quantities rather than just qualitative summary.

#### Page 526

Line 15: remove first instance of "individual" and "in particular". Line 19 change "connecting" to "between". Lines 20-23: sentence should be reworded. Line 24 change "trying therefore" to "attempting". Comment: is AQMEII really just a case study?.

#### Page 527

Line 1: remove "existence, usability, and" Line 5-6: remove "not because they are assumed to be unimportant but" Line 7: Eliminate or expound the statement "This is the first study of its kind." Final sentence of Introduction: change to "Thus 4-D datasets of ozone are effectively used to assess seasonal and boundary condition errors." Section 2, first sentence: remove first comma, replace "in the context of" with "by", and turn the "c" in aircraft to uppercase as defined by the MOZAIC acronym.

#### Page 528

First (continued from previous page) paragraph and second paragraph should be blended together to deliver the main points. Line 16: remove " The strategy adopted within AQMEII for the comparison with the" and replace with "We plotted the". Line 17: remove "consisted of plotting" and replace with "of". Line 18: Domains were identified? Are these the same as the trajectory domains mentioned further down in the

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paragraph? What is a trajectory domain? Wording? Lines 22-23: replace "the identification of" with "we identified". Line 25: replace "which are" with "to be". Line 25: remove "Extraction has been made taking" and add "was extracted" to the end of the sentence. Line 26-28: Change sentence to: "To simplify the data request and extraction for modelers, four areas in North America (NA) and one in Europe (EU) were identified, allowing the trajectory projections of several airports to be grouped together. Line 29: remove "All modelers were then asked to deliver" and combine with following sentence.

Page 529:

sentence explaining the ENSEMBLE web-interface should be moved to the paragraph where ENSEMBLE is defined. Line 13: replace "node" with "cell". Line 14: Wording is bad; how does a model value represent a measurement? Line 15: Remove "For all the airports included in this study" and reword the sentence (especially the last part). Line 19: Move "for each of the five areas (four in NA and one in EU)" to the end of the sentence. Line 22: insert "the" between "represented" and "two". Line 23: replace "has" with "had".

Section 2.1

WMO should be defined. Is a whole section necessary for 2 sentences? remove "these data too" on page 530.

Page 530

Section 3

Acronyms need to be defined. Are bulleted lists really necessary? I would think the models can be listed within the paragraphs. Line 4: remove "models and" and insert "and models used" after "groups". Remove 2nd sentence. Line 13: insert "respectively" at the end of the sentence. Line 17: replace "providing" with "that provided".

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Line 4: replace "These" with "The EU". Line 5: respectively? Line 9: replace "provided" with "obtained"... this sentence is unclear, especially the 2nd half. Avoid using "in this light" or "in light of" e.g. change "can be examined in this light" to "can also be examined this way". Line 24: remove "even if standard emissions were used".

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Line 3: replace "made available" with "provided". Line 6: insert "the" between "by" and "European". Line 7: move Schere reference to the GEMS parentheses beforehand. Remove "see" and "for more details". Line 8: remove "but not all" and combine with the following sentence. Line 16: move "CMAQ" to sit between "utilizing" and "version". Line 16: replace "run" with "used". Line 18: remove "of the model". Line 20: it isn't necessary to describe what is in North America.

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Line 10: insert "the" between "from" and "continuity". Line 11: remove "vertical". Line 12: shouldnt values be interpolated by log and not linear for atmospheric layers? Line 17: replace "was set up with" with "included"; remove "simultaneously". Line 18: dash and then comma?

Line 22: reference for Forester filter?

Section 3.1.3 switches to present tense... stay consistent

Page 537

Line 4: change "gird" to "grid". Line 9: move "from the horizontal advection" to after "derived". Line 16: replace first "in" with "of"; remove period and replace "It" with "and", continuing the sentence. Line 17: replace "to" with "and".

Section 4.1 Page 538

Line 12: be specific, which data? Line 15: Remove "It can be firstly observed how". Line 17: replace "ones" with "profiles". Line 18: replace "most likely descends from"

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with "is likely because of"; pluralize technique. Line 19: remove "that" . Line 20: replace "that" with "which"; replace period with comma and remove "This is". Line 21: replace "coarser resolution of this model" with "coarse resolution of the model"; remove "Differently". Line 23: remove "that being the relative humidity derived from the specific humidity and the temperature,." . Line 24: insert "the" between "where" and "water". Line 25: replace "that is" with "e.g."; remove "even".

Page 539, Line 1: Remove "relevant".

Page 554: Lines 11 - 15 have poor wording.

It is not really appropriate to just state a laundry list of (poorly worded) conclusions as bulleted points as the final statement. There should be a clear summary of the work, a list of impacts and take away messages, and expected future work.

Tables and Figures:

Table 1 Caption: remove period between "2006" and "for". Figure 1 Caption: replace "of" with "in". Figure 1 Legend: Should be moved to be beside the bottom panel so it is clear it is a legend for both panels. Figure 1 images: Use a standard method of ticks for lat/long. There are varying formats and fonts used, and the axes are not labeled. Either format correctly or remove. Figure 2 Legend: Should be moved to be beside the bottom panel so it is clear it is a legend for all panels. Figures 3 - 6: inconsistent placement of a,b,c,d,e markers. Fix this. Figure 8: Portland label is formatted differently than others. Figure 8: include the legend. Figures 9-10: Include both legends for both figures; replace "over" with "for". Figure 11 Legend: Should be moved to be external of the left panel so it is clear it is a legend for both panels; "nodes"?; Any reason these can't be one panel? Figures 12, 14,15,16: Showing half a standard deviation bar is very strange and makes it difficult for the reader. Show both sides of the bar! Figure 13 Caption: replace "lines derive" with "lines are derived". Figure 13: axes labels should not fall half way in/out of bounding box. Figures 14,15,16: Include the Legends!

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