

Interactive comment on “Technical Note: Intermittent reduction of the stratospheric ozone over Northern Europe caused by a storm in Atlantic Ocean” by Mikhail Sofiev et al.

Anonymous Referee #3

Received and published: 1 October 2019

General comments

This technical note is a case study about an episode of reduced stratospheric ozone over Northern Europe caused by the intrusion of tropospheric air, which could be forecasted 5 days ahead by the SILAM model. The event has been validated with satellite observations from three different sensors. This study is a scientifically interesting case, which was conducted appropriately by the authors. The structure and presentation of the results of this paper need to be improved:

1. Structure of the manuscript: The structure of the manuscript needs to be changed in my opinion. The discussion section is disappointing. It contains mainly descriptions

C1

about other events and an outlook of what might or might not happen due to climate change in the future. A discussion of the model forecast results and evaluation is missing in this section. I would thus suggest a re-structuring of the manuscript: 1. Introduction, 2. Model and observations 3. Results, 4. Conclusions. Sections 3 and 4 would then go into the results section. I would shift the first part of the discussions section (about the general character of TST events) to the introduction. The second paragraph could move to the conclusion section (in a somewhat condensed way).

2. Section 4: Evaluation of the SILAM predictions: In section 3 the evolution of the event is nicely described according to the forecasts. I think the validation results should be presented in a similar, more detailed way. It is merely a few sentences that describe the total of the results. However, this is the most interesting part! It would be good to know whether the underestimation of total ozone in the model was present before and after the event as well or just during the event. Is there an explanation for this underestimation in the model? Also, more quantification of errors of some kind (e.g. table of biases) would be nice.

Specific comments:

1. Page 2, line 31: could you explicitly name the ECMWF product which was used? Sure it is not 137 levels?

2. Page 2, line 8: “However, outside the tropical regions and areas affected by the Asian monsoon the TST events are practically not considered.” Is that because they do occur only randomly or because no one has investigated this before or both?

3: Page 2, line 14: In the following section, we present the SILAM model, which forecasted the episode 5 days in advance Maybe revise the sentence. Not the SILAM model is presented but the results of the SILAM model forecasts in combination with IFS meteorological input.

24. Page 3, line 15: What do you mean by “the bulk of the domain?”

C2

4. Page 3, line 17: I think this paragraph is a bit tangled. I would suggest specifying the three satellite data sets first (OMI, OMPS and MLS) and put the rest later. 5. Page 3, line 26: 3 Predicted evolution of the low-ozone area I would shift this part in the results section. 6. Page 5, line 32: Please reformulate, it is not clear what this sentence means.

Technical corrections

1. Title: Maybe change to: Intermittent reduction of the stratospheric ozone over Northern Europe caused by a storm in the Atlantic Ocean?
2. Page 1, Line 9: Please reformulate!
3. Page 1, Line 12: Change to: The episode was caused by the intrusion of tropospheric air, which was initially uplifted by a storm in the Northern Atlantic, south-east of Greenland.
4. Page 1, Line 13: Change to: ... over the Scandinavian ridge ...
5. Page 2, line 1: Change to: over the Atlantic Ocean
6. Page 2, line 1: I would suggest: The majority of studies on the ...
7. Page 2, line 3: Maybe change to: in the above mentioned studies ... Rest of the sentence needs to be reformulated.
8. Page 2, line 3: Change to: by the Asian monsoon
9. Page 2, line 8: Better: leads to a corresponding reduction
10. Page 2, line 22: better: ...and providing global and regional forecasts up to 5 days ahead for 113 species.
11. Page 2, line 23: CBM4: explain abbreviation
12. Page 2, line 31: Better: ...of the European Centre for Medium-Range Weather Forecast

C3

13. Page 3, line 2: Change to: Shipping emissions
 14. Page 3, line 3: Maybe better: Biomass burning emissions and injection profiles...
 15. Page 3, line 5: Biogenic emissions are...
 16. Page 3, line 6: (Grewe, pers.comm.) Really no other citation available?
 17. Page 3, line 14: web site
 19. Page 3, line 17: The current study used...or this study used...
 20. Page 3, line 12: Change to: The main focus of the evaluation was set on the model's ability to reproduce the absolute level of the ozone column load, as well as on the accurate location of the depletion area in space and time.
 21. Page 3, line 15: Change to: underestimation
 22. Page 3, line 15: What do you mean by "the bulk of the domain?"
 23. Page 3, line 22: Please reformulate that sentence
 24. Page 4, line 6: Change to: a storm in the Northern Atlantic creating the initial...
 25. Page 4, line 6: Maybe better: air mass transport eastwards over
 26. Page 4, line 9: please reformulate that sentence
 27. Page 4, line 14: Better: In the model predictions...
 28. Page 5, line 11: Change to: ...was found...
 29. Page 5, line 24: Better: The impact of the Episode
 30. Page 5, line 29: May be the author meant "perspective" instead of "prospective"?
 31. Page 6, line 21: Better: the intermittent character of the ozone...
- In supplement: Please change in figure captions Dubson to Dobson

C4

