

Interactive comment on “Extension of the WRF-Chem volcanic emission pre-processor to integrate complex source terms and evaluation for different emission scenarios of the Grimsvötn 2011 eruption” by Marcus Hirtl et al.

Anonymous Referee #2

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General comments:

The manuscript by Hirtl et al., discusses the extension of the volcanic emission module of the chemical transport model WR-Chem. This study presents the update of the WRF-Chem volcanic emission pre-processor towards more complex source terms and evaluates the results for the eruption of the Grimsvötn volcano in Iceland in May 2011. This paper shows that the most complex source term gives better performance. The paper is well-written and I recommend the publication to Nat. Hazards Earth Syst. Sci., after addressing the specific and technical comments listed below.

C1

Specific comments:

In the abstract, “The volcanic emission module of the chemical transport model WRF-Chem has been extended to allow integrating detailed temporally and vertically resolved input data from volcanic eruptions.” and then in page 2, line 50-51 “This study presents the extension of the WRF-Chem volcanic emission pre-processor towards more complex source terms and evaluates the results for the eruption of the Grimsvötn volcano in Iceland in May 2011. ” Are you updating a module in the WRF-Chem code or a “pre-processor”? I suggest being consistent.

Page 3, line 68-69: In the text, “Forecast models, (...) produced unrealistic forecast as shown by comparison to satellite data.” Could you explain what do you mean by “unrealistic”? I think you need to justify why you are doing this study. Which are the significant gaps in this field?

I suggest to include a paragraph with the uncertainties in the extension of the volcanic pre-processor (Section 2). For example, what is the uncertainty of “the resulting total volcanic emission, which is used for the WRF-Chem simulation, is scaled; in order to compensate for the deviations caused by the interpolation to ensure mass conservation”, and it is scaled to which number? I suggest to rewrite this section in a clear way that give more details about the extension code you have made and its uncertainty.

Section 2, line 85-86: What do you mean by “The online approach (meteorology with air chemistry) accounts for a numerically consistent air quality forecast; no interpolation in time or space is required.”? You are not doing “air quality forecast” here.

Page 9, line 264-265: Have you checked if the model is capturing the meteorology for the days of the model simulation?

Conclusions: I am missing a sentence talking about air quality and human health. High concentrations of PM10 and SO2 during a volcano eruption are seen in several regions of Europe (Fig. 12).

C2

Technical corrections:

Page 2, line 37-38: “Low, medium and high” are three regions. However, “less than or equal to 2 mg/m³, greater than 2 mg/m³, less than or equal to 4 mg/m³, and higher than 4 mg/m³” are four groups. Please check that.

Page 6, line 162; “attitudes” Change to: altitudes

Page 6, line 185-186. Please check that all satellites have reference at some point of the manuscript. I don’t see any reference for METEOSAT satellite.

Page 7, line 200. Why don’t you show 24 May on the Supplementary information if you are discussing the results? Same for the next days from Fig. 8 that is mention in Page 7, line 216.

References: Page 11, line 330 “L. L” and page 13, line 405 “T. V”.

Figures: Figure 3: Title “and” Change to “from”.

Figure 12: Axes should be bigger, it is difficult to read. If you are showing only S3, you show specify that at the caption.

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