Geoscientific
Model Development
Discussions

Interactive comment on "Description of the uEMEP_v5 downscaling approach for the EMEP MSC-W chemistry transport model" *by* Bruce Rolstad Denby et al.

Anonymous Referee #2

Received and published: 6 September 2020

This is an interesting and extensive description of the uEMEP downscaling scheme for the EMEP MSC-W CTM. The uEMEP scheme represents a major step in downscaling of ambient NOx/NO2 and PM concentrations to local levels and is well documented in this manuscript, alongside with validation and sensitivity analysis. Though the text is not always easy to read, it is in general well written. I have only a couple of minor questions and issues that should be clarified in the text, which should help to improve readability in some parts.

Specific comments

- line 33 / "near street level modelling": What is then the ambition of the model? Is

it supposed to represent concentrations at roadside monitoring sites or background sites?

- What is the meaning of resolution <100m when there is no local topography modelling involved? Wouldn't building layout, air flows in the street canyon etc need to be accounted for at these very local scales?

- line 85: Which source sectors are included in the uEMEP downscaling calculations? Traffic, residential, any other? Should be mentioned somewhere in Sect 2.1

- line 150. "neighbour cells" sounds as if only +/- 1 in each direction but I understand from the next sentence that the local fraction region can be quite large. Please clarify in the text.

- line 153. Perhaps I missed it but it would be good to have a paragraph somewhere that explains the difference between the different domains (uEMEP vs local fraction vs moving window) as it is a bit confusing to the reader.

- Sect 2.3-2.4: These sections are difficult to follow, I would suggest restructuring 2.3 and 2.4 into one (The second sentence of 2.3 already refers to 2.4).

- Sect 2.4: This is rather complicated to follow for an effect that is probably second-order. How much is gained by the complicated moving window calculation of non-local contributions at sub-grid resolution? With a reasonably big local fraction tracking domain, the difference between sub-grid and grid level non-local contribution should become negligible?

- Line 214-216 are a bit confusing, please explain better why this method (as opposed to the area weighting) gives different total (local?) concentrations

- line 218: non-local contributions do not have any associated emission: that is considered in the uEMEP. In general I assume they do have an associated emission. Do s refer to all source sectors in the EMEP model or only those considered in uEMEP?

- line 220/ Eq 9 is confusing to me. It should be possible to slightly rephrase the paragraph before to clarify why this needs to be done and what is done here. Also, is there an inconsistency between Eq 6 and Eq 9 regarding the source grid range, Eq 6 has I-nmw/2 ... I+nmw/2 but here it runs from I-nmw ... I+nmw

- Eq 10: Why the division by nsource?

- line 291: This is the first occasion that time is explicitly mentioned, worth a sentence of explanation since so far everything was stationary.

- Section 3.2: Annual mean with rotationally symmetric Gaussian plume – As the authors state, the condition of homogeneous distribution of wind speeds in all directions is typically not met. A calculation with wind roses would not add too much in complexity but would avoid this assumption.

- Line 510: traffic emissions are often described as line sources in emission inventories. What is then the appropriate uEMEP subgrid size?

- Which source sectors are included in the uEMEP for Norwegian forecasts?

- Section 5.1: Are all station types included in the validation? How different is the performance of uEMEP, does it work equally well for street canyon stations as for urban background sites? It would be interesting to indicate the station types in Fig 10a.

- Section 5.1.2: While the agreement is clearly better than with EMEP, still the correlation is quite low and there is a low bias. What is the authors' explanation, given that emissions are provided at quite high resolution? In particular for the low bias in summer, which is also seen in PM2.5 (factor 2!) – is this a regional issue (also seen in EMEP validation against background sites) or a problem in downscaling?

Technical / language

- line 66 typo: provided

- line 130 replace then with comma

C3

- line 135 the same

- line 141 add comma after (I,J) to increase readability

- line 154 correct reference

- line 167, 176 the same

- line 250 insert comma after 'this' to increase readability

- Line 305: Define u*.

- Line 406 references missing

- line 574 reference missing

C4