Earth Syst. Sci. Data Discuss., author comment AC1
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Reply on RC1

Katerina Sindelarova et al.

Author comment on "High-resolution biogenic global emission inventory for the time period 2000–2019 for air quality modelling" by Katerina Sindelarova et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2021-226-AC1, 2021

We thank the anonymous reviewer for his/her kind review. We address the individual questions, comments and corrections below. The reviewers text was copied and is written in italics.

This paper presents 3 new emission inventories for biogenic VOCs globally at a spatial resolution of X(**) and a time resolution of monthly for the years 2000 – 2019. The purpose of the new emission inventories is so that others can easily drive climate and air quality models without having to make the emission calculations themselves. The 3 inventories simulate biogenic emissions using:

- *V2.1: ERA-Interim meteorology*
- *V3.1: The newer ERA-5 meteorology and updated isoprene emissions*
- *V3.0: ERA-5 and allowing land use changes over the period 2000 – 2019*

V3.1 is the recommended dataset to use, unless the model being run uses ERA-Interim as input.

I do wonder whether monthly time resolution is enough for air quality models – I guess it depends on what the focus is of the study. If it's a day-to-day study of the impacts of biogenic emissions on city summertime smogs then monthly is probably too coarse a resolution. There can be wide fluctuations in emissions on day-to-day basis in summer. Some clarification is needed here.

The reviewer is indeed right that monthly temporal resolution is not enough to capture local and short-time fluctuations of the BVOC emissions. For such studies it is necessary to run the emission model with hourly time resolution. However, such simulations are costly to perform on global level for the period of several years, as well as require a great demand for emission output data storage. The CAMS-GLOB-BIO emissions represent an approximation in this sense, however, they provide a longer-term picture of the BVOC emission evolution in time.

The paper is well written and is easy to follow. I only have some minor suggestions, and one possible error which needs checking.

***Actually, I'm not clear on the spatial resolution of the final products? The resolution of some of the input data is given, but unless I've missed it, I can't find a resolution in the*

body of the manuscript (Ok – the resolution appears in the data availability section at the end). The resolution should be included in the abstract at line 18 where 'high resolution' is mentioned.

The horizontal spatial resolution of each dataset is now mentioned in the abstract of the manuscript.

Line 75 + 77. First time we see these acronyms. MEGAN gets spelled out later in the next section, but might be worth doing here. Also LPJ-GUESS and JULES.

The text was edited and all acronyms are spelled out.

Line 155 'A' list of the MEGAN….

Corrected.

Line 170. Note that though 'the' corn….

Corrected.

Line 228. 'calculated from the EP maps'. Think that EP maps here actually should be EF maps? Check.

The EP maps are actually correct here. By EP maps we mean the high resolution input maps for a-pinene, where each grid cell is assigned with a value which represents a mean Emission Potential averaged over all vegetation types in that grid cell. In our notation, EF would be a value assigned to individual vegetation type.

Line 256. Just a side question – why is there only detailed land cover for Europe?

Compilation of detailed land cover data, preferably including information of individual tree species, and its assignment with emission factors for individual BVOC species requires great amount of work by matching the land cover categories (tree species) with EF values that can be found in the literature and/or in the EF measurement databases. The updated isoprene values for Europe used in this study are a result of work done for the EMEP model over many years. We continue working on the update of EF values also for other parts of the world. However, the limit is often availability of detailed enough land cover and availability of suitable EFs.

Line 315. I understand it is easy to aggregate all crops into one PFT, but then what emissions are 'crops' given? Eg I think corn is quite a high BVOC emitter compared to other crops, and could distort the average.

Indeed, the crops category is rather general and it contains species which are very high emitters as well as species with low or no emissions (NB: this is true also for the forest categories). Though the CLM PFT categories distinguish between corn and other crops, the input land cover data that were available and that we used in the simulations, aggregate all crops into one category. Information on spatial distribution of corn only was not provided in the data. Therefore, the output emissions also provide values for the crop category as a whole.

Line 453 'temporal'

Corrected.

Line 456 'sources'

Corrected.

Figure 2. There looks to be an upward trend in the isoprene with time. It'd be interesting to comment or compare with the isoprene trend from the run where the land-use changes were taken into account (v3.0?). Do we think the upwards trend seen here is purely due to increasing temperatures?

The isoprene trend over time is discussed at the beginning of Section 3.3 where we also compare to the isoprene trends from the run with changing land cover.

"When calculated with static vegetation map, isoprene emissions increase globally by 0.35 % yr-1 due to temporal changes in meteorology. When annually changing ESA-CCI data are implemented, the trend decreases to 0.24 % yr-1. Similar observation was made by Opacka et al. (2021), who used a modified MODIS land cover data in the MEGAN-MOHYCAN emission model to study the impact of land cover change on isoprene emissions. They found a 0.04 to 0.33 % yr-1 mitigating effect of land cover change on general positive trends of isoprene induced mainly by temperature and solar radiation."

Ref: Opacka, B., Müller, J.-F., Stavrakou, T., Bauwens, M., Sindelarova, K., Markova, J., and Guenther, A. B.: Global and regional impacts of land cover changes on isoprene emissions derived from spaceborne data and the MEGAN model, Atmos. Chem. Phys., 21, 8413–8436, https://doi.org/10.5194/acp-21-8413-2021, 2021.

Table 5. Error in longitude extent which needs checking. At first I thought the east and west were the wrong way round. America is definitely west. Australia and south-east Asia are definitely east. SE Asia (India) starts around 67E and Australia 110E so the extents don't look correct either. Potentially values in this table aren't correct if these longitudes have been used in calculations.

The values of regional spatial extent were erroneously defined in the table, but were correctly used in the data analysis. The table was edited and corrected.

Line 512. Calculated with 'the' static….

Corrected.

Line 514. 'A' similar observation…

Corrected.

Line 606. Add 'E' and 'N' to the domain extents.

Corrected.

Figures 7 + 8. The red of the MEGAN-MACC and CAMS-GLOB-BIOv3 lines are very similar. I was initially confused by the statement that CAMS-GLOB-BIO fell within the range (I'd confused it with MEGAN-MACC). Tricky when there are lots of colors in play, but perhaps the CAMS-GLOB models could be shades of red/orange and MEGAN-MACC gets a different color? I also struggled to see the yellow MEGAN 2 line - but then realised it was just a circle - perhaps remove the yellow line from the legend? Ditto for monoterpenes plot.

The plots were edited so that MEGAN-MACC dataset is better distinguished from the CAMS-GLOB-BIO datasets and the MEGANv2 is now represented only with a dot in the legend.