Geoscientific
Model Development
Discussions

Interactive comment on "Evaluation of improved land use and canopy representation in BEIS v3.61 with biogenic VOC measurements in California" *by* J. O. Bash et al.

Anonymous Referee #1

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This study describes new developments in the modeling of biogenic emissions using two versions of the Biogenic Emission Inventory System (BEIS), version 3.14 and the more recently released version 3.6.1. Updates were made to the Biogenic Emissions Landuse Database (BELD), which is used within the BEIS modeling framework, to incorporate more recent canopy coverage and vegetation species data. Sensitivity studies compared biogenic emissions estimates from BEIS 3.14 using BELD 3 vegetation data with BEIS 3.6.1 using BELD 3 or BELD 4 vegetation data. BEIS 3.6.1 includes a canopy model of leaf temperature not available in the earlier version of the model. In addition, the study also examined the use of satellite-derived estimates of photosynthetically active radiation (PAR) versus estimates generated from the Weather

Research and Forecasting (WRF) model. Biogenic emissions estimates from the BEIS configurations and well as from the Model of Emissions of Gases and Aerosols from Nature (MEGAN) were used as input to the Community Multiscale Air Quality (CMAQ) and predictions of isoprene and monoterpenes were compared with surface measurements made in central and northern California.

BEIS and MEGAN are both widely used to support air quality planning and attainment demonstrations. This study is timely, highly relevant, and should be of great interest across a spectrum of stakeholders from the research and air quality regulatory communities. Several clarifications are needed to strengthen the results:

In Section 2.2 the similarities and differences between MEGAN and BEIS should be discussed in greater detail. Explain the sentence "MEGAN and BEIS have similar governing equations but differ in vegetation characterization, emission factors, meteorological adjustments and canopy treatment." This becomes especially important to understand later in the paper when comparisons between CMAQ model predictions and observations are made.

Does the canopy leaf temperature update make the BEIS 3.6.1 model configuration more similar to that of MEGAN2.1? The agreement between the comparisons at the Duke Forest site seem to imply that this is the case.

Regarding Figure S3: it seems that the "CMAQ/BEIS Final" simulation performance is better on some days than others. Are there insights that could be gained by examining such differences in more detail?

Are there other important updates (e.g. emission factors, etc.) to BEIS 3.6.1 relative to BEIS 3.14 in addition to the canopy model of leaf temperature and use of BELD 3 versus BELD 4 data?

Table 2 is difficult to read because of the size and amount of text. Are these emission rates presented as relevant to the current study in California or as predominant types

in the United States? Have these been updated from the previous version of BEIS? How do they differ from those used in MEGAN?

Please briefly explain how the estimates of forest biomass of Blackard et al. were made. Section 3.2 describes differences between the BELD4 and Blackard estimates, but does not sufficiently explain - beyond the use of different canopy data sets - their underlying reasons. Why was the Blackard data selected to evaluate BELD4?

Little explanation is given to provide a context for the discrepancies between the BEIS and MEGAN performance against observations. What are the author's hypotheses regarding factors that are driving these differences? How did MEGAN estimates compare with BEIS 3.14 predictions, i.e. do the updates to BEIS for version 3.6.1 result in more similar estimates between the two modeling frameworks?

Minor comments: Consider switching the order of Sections 2.1 and 2.2 such that a context is provided for the requisite input data first.

Figure 2. Could you add a difference plot for clarity?

p.8136, line 10: The reference to Figure 6 for the MEGAN results does not appear to be correct.

Some acronymns are not spelled out before the first use, please check all.