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Supplement of

Evaluation of regional isoprene emission factors and modeled fluxes in California

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S1. Ecoregion codes (Legend to Figure 1)

Legend

- Isop flux available
- Isop flux unavailable

ca_eco_I4

CA_Ecoregion_lev4

L4_KEY

13aa Sierra Nevada-Influenced Semiarid Hills and Basins	5d Northern Sierra Mid-Montane Forests	6r East Bay Hills/Western Diablo Range	80j Semiarid Uplands
13ab Sierra Valley	5e Northern Sierra Lower Montane Forests	6s San Francisco Peninsula	81a Western Sonoran Mountains
13ac Upper Owens Valley	5f Northeastern Sierra Mixed Conifer-Pine Forests	6t Bay Terraces/Lower Santa Clara Valley	81b Western Sonoran Mountain Woodland and Shrubland
13ad Mono-Adobe Valleys	5g Central Sierra Mid-Montane Forests	6u Livermore Hills and Valleys	81c Western Sonoran Basins
13ae Bishop Volcanic Tableland	5h Central Sierra Lower Montane Forests	6v Upper Santa Clara Valley	81d Sand Hills/Sand Dunes
13h Lahontan and Tonopah Playas	5i Eastern Sierra Great Basin Slopes	6w Monterey Bay Plains and Terraces	81e Upper Coachella Valley and Hills
13u Tonopah Basin	5j Eastern Sierra Mojavean Slopes	6x Leeward Hills/Western Diablo Range	81f Imperial/Lower Coachella Valleys
13v Tonopah Sagebrush Foothills	5k Southern Sierra Subalpine Forests	6y Gabriel Range	81g Lower Colorado/Gila River Valleys
13x Sierra Nevada-Influenced Ranges	5l Southern Sierra Upper Montane Forests	6z Diablo Range	81h Sonoran Playas
13y Sierra Nevada-Influenced High Elevation Mountains	5m Southern Sierra Mid-Montane Forests	7a Rogue/Willits/Scott Valleys	81i Central Sonoran/Colorado Desert Mountains
14a Eastern Mojave Basins	5n Southern Sierra Lower Montane Forest and Woodland	7b Serpentine Siskiyou	81j Central Sonoran/Colorado Desert Basins
14b Eastern Mojave Low Ranges and Arid Foothills	5o Tehachapi Mountains	7c Inland Siskiyou	81k Arizona Upland/Eastern Sonoran Mountains
14c Eastern Mojave Mountain Woodland and Shrubland	5p Tuscan Flows	7d Klamath River Ridges	85a Santa Barbara Coastal Plain and Terraces
14e Arid Valleys and Canyonlands	5q Eastern Hills	7e Border High-Siskiyou	85b Oxnard Plain and Valleys
14f Mojave Playas	5r Pleasant Valley/Kettleman Plain	7f Western Klamath Low Elevation Forests	85c Venturan-Angelino Coastal Hills
14g Anargosa Desert	5s Gambler Range/EK Hills	7g Western Klamath Montane Forests	85d Los Angeles Plain
14h Death Valley/Mojave Central Trough	5t Grapevine Transition	7h Eastern Klamath Low Elevation Forests	85e Diegan Coastal Terraces
14i Mesquite Flat/Badwater Basin	5u Tehachapi Foothills	7i Eastern Klamath Montane Forests	85f Diegan Coastal Hills and Valleys
14j Western Mojave Basins	5v Salinas Valley	7j Marble/Salmon Mountains-Trinity Alps	85g Diegan Western Granitic Foothills
14k Western Mojave Low Ranges and Arid Foothills	5w Northern Santa Lucia Range	7k Scott Mountains	85h Morena/Boundary Mountain Chaparral
14l Western Mojave Mountain Woodland and Shrubland	5x Santa Lucia Coastal Forest and Woodland	7l Klamath Subalpine	85i Northern Channel Islands
14m Western Mojave High Elevation Mountains	5y Interior Santa Lucia Range	7m Ouzel Rock	85j Southern Channel Islands
14n Mojave Lava Fields	5z Southern Santa Lucia Range	7n Outer North Coast Ranges	85k Inland Valleys
14o Mojave Sand Dunes	6a Paso Robles Hills and Valleys	7r High North Coast Ranges	85l Inland Hills
1a Coastal Lowlands	6b Salinas-Cholame Hills	7a Northern Terraces	85m Santa Ana Mountains
1i Northern Franciscan Redwood Forest	6am Cuyama Valley	7b North Valley Alluvium	8a Western Transverse Range Lower Montane Shrub and Woodland
1j King Range/Mattole Basin	6an Carrizo Plain	7c Butte Sink/Sutter and Colusa Basins	8b Western Transverse Range Montane Forest
1k Coastal Franciscan Redwood Forest	6ao Caliente Range	7d Southern Hardpan Terraces	8c Arid Montane Slopes
1l Fort Bragg/Fort Ross Terraces	6ap Solomon-Purisima-Santa Ynez Hills	7e Sacramento/Feather Riverine Alluvium	8d Southern California Subalpine/Alpine
1m Point Reyes/Farallon Islands	6aq Santa Maria/Santa Ynez Valleys	7f Sutter Buttes	8e Southern California Lower Montane Shrub and Woodland
1n Santa Cruz Mountains	6ar Upper Sacramento River Alluvium	7g Yolo Alluvial Fans	8f Southern California Montane Conifer Forest
1o San Mateo Coastal Hills	6b Northern Sierran Foothills	7h Yolo/American Basin	8g Northern Transverse Range
4d Cascade Subalpine/Alpine	6c Southern Sierran Foothills	7i Delta	8h Klamath/Goose Lake Basins
4e High Southern Cascades Montane Forest	6d Carmanche Terraces	7k Lodi Alluvium	8i Fremont Pine/Fir Forest
4f Low Southern Cascades Mixed Conifer Forest	6e Tehama Terraces	7l Stockton Basin	8j Southern Cascades Slope
4g California Cascades Eastside Conifer Forest	6f Foothill Ridges and Valleys	7m San Joaquin Basin	8k Klamath Juniper Woodland/Devils Garden
4h Southern Cascades Foothills	6g North Coast Range Eastern Slopes	7n Manteca/Merced Alluvium	8l Shasta Valley
5a Sierran Alpine	6h Western Valley Foothills/Dunnigan Hills	7o Westside Alluvial Fans and Terraces	8m Pit River Valleys
5b Northern Sierra Subalpine Forests	6i Clear Lake Hills and Valleys	7p Granitic Alluvial Fans and Terraces	8n Warner Mountains
5c Northern Sierra Upper Montane Forests	6j Mayacmas Mountains	7q Panoche and Cantua Fans and Basins	8o High Elevation Warner Mountains
	6k Napa-Sonoma-Lake Volcanic Highlands	7r Tulare Basin/Fresno Slough	8p Likely Tableland
	6l Napa-Sonoma-Russian River Valleys	7s Kern Terraces	8q Modoc/Lassen Juniper-Shrub Hills and Mountains
	6m Sonoma-Mendocino Mixed Forest	7t South Valley Alluvium	8r Adin/Horsehead Mountains Forest and Woodland
	6n Bodega Coastal Hills	7u Antelope Plain	8s Adin/Dixie Low Hills
	6o Marin Hills	7v Southern Clayey Basins	8t Modoc Lava Flows and Buttes
	6p Bay Flats	80d Pluvial Lake Basins	8u Old Cascades
	6q Suisun Terraces and Low Hills	80g High Lava Plains	

Figure S1. Legend to Figure 1 describing ecoregion codes.

S2. MEGAN architecture and main differences between versions

The main differences of MEGAN v.2.1 to MEGAN v.2.04 are:

- 1) v2.04 does not have soil moisture or CO₂ response (but these were not used for MEGAN v.2.1 simulations in this study);
- 2) MEGAN v.2.04 uses a different emission factor database and has different light response algorithms (which are nearly the same for isoprene and mostly impact other compounds);
- 3) MEGAN v.2.04 uses different parameters in the canopy environment model.

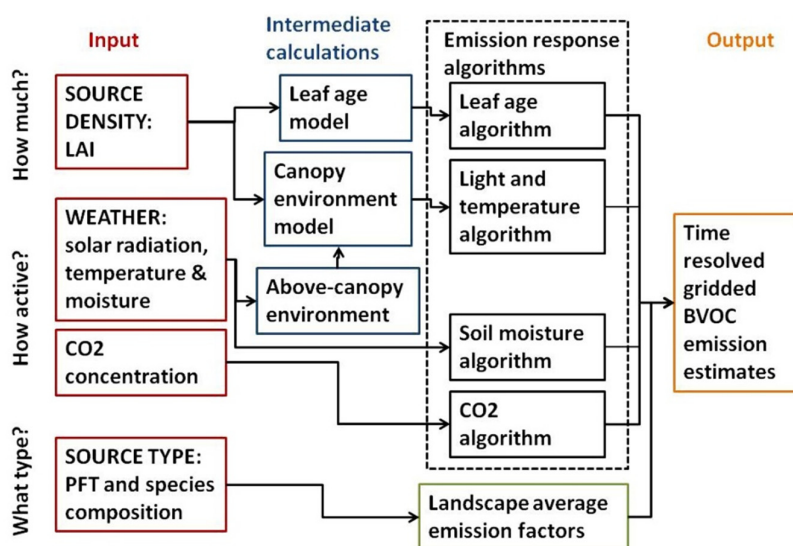


Figure S2. Schematic of MEGAN v.2.1 model components and driving variables (taken from Guenther et al., 2012).

S3. Timeseries of simulated and observed emissions

In Figure S3, the time series of simulated and measured emissions are shown (plotted along the complete flight tracks).

Local similarities and discrepancies are observed in specific areas along the flight track and are discussed in the manuscript. Although there are different sources of uncertainty, the largest discrepancy occurs if the trees are significantly under or overrepresented, which could be due to fires, new growth, or incomplete landcover.

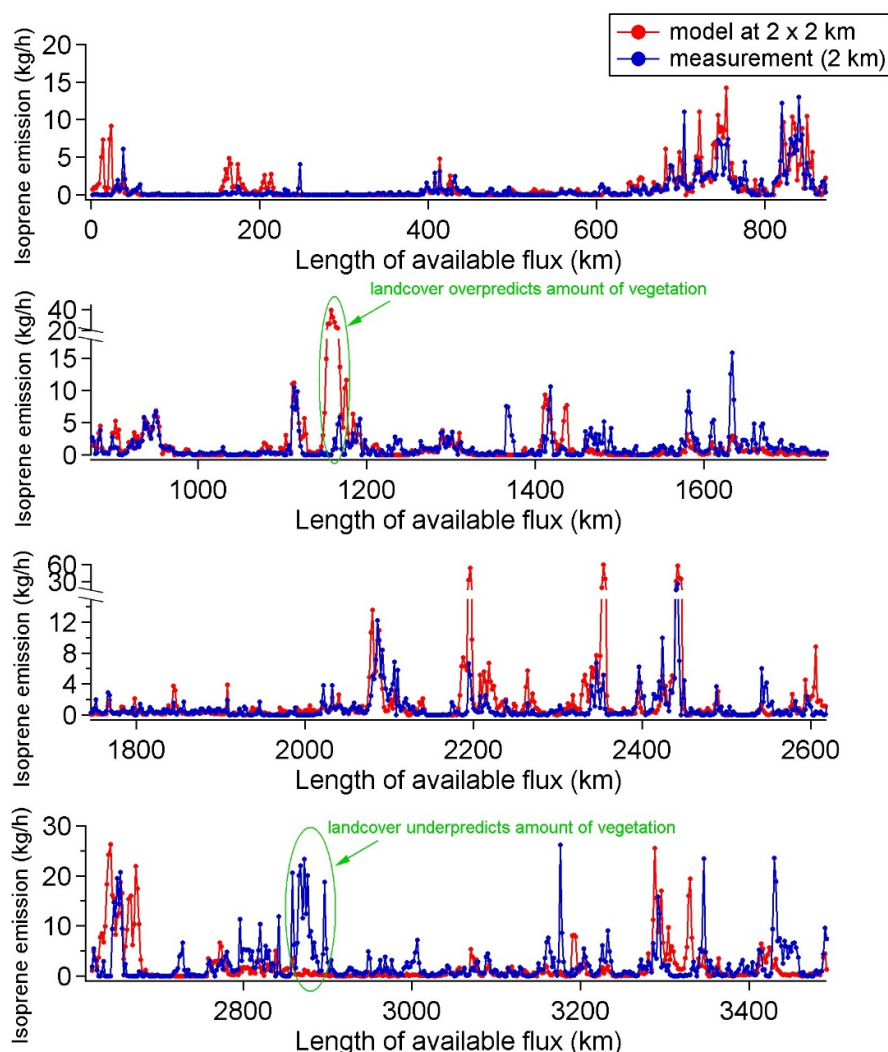


Figure S3. Time series for modeled and measured isoprene fluxes using the approximated circular footprint areas (only the data when flux was available are shown) along the full length of the flight tracks during the CABERNET campaign.

S4. The inverse G06 algorithm used in airborne emission factor derivation

In the original G06 algorithm (equation below), F_{G06} is the unknown, and BER is the known emission factor at standard temperature and PAR conditions. We inverse the equation so the BER is unknown and F is the airborne-derived surface flux. This BER is referred to as airborne basal emission factor (BEF) or just emission factor which represents the airborne flux inferred for the standard conditions of PAR=1000 $\mu\text{mol m}^{-2} \text{s}^{-1}$ and temperature = 30 °C.

$$F_{G06} = \underbrace{\text{BER} \cdot b_3 \cdot \exp[b_2 \cdot (P_{24} - P_0)] \cdot (P_{240})^{0.6} \cdot \frac{[b_1 - b_2 \ln(P_{240})] \cdot \text{PAR}}{\sqrt{1 + [b_1 - b_2 \ln(P_{240})]^2 \cdot \text{PAR}^2}}}_{\gamma_P} \cdot \underbrace{b_5 \cdot \exp[b_6 \cdot (T_{24} - 297)] \cdot \exp[b_6 \cdot (T_{240} - 297)] \cdot \frac{C_{T2} \cdot \exp\left[C_{T1} \cdot \left(\frac{1}{T_{\text{opt}}} - \frac{1}{T}\right) \cdot \frac{1}{0.00831}\right]}{C_{T2} - C_{T1} \cdot \left[1 - \exp\left(C_{T2} \cdot \left(\frac{1}{T_{\text{opt}}} - \frac{1}{T}\right) \cdot \frac{1}{0.00831}\right)\right]}}_{\gamma_T}$$

The micrometeorological variables include temperature close to the surface (T) and PAR. Previous 24 and 240-hour history of temperature and PAR are accounted for in T_{24} , P_{24} , T_{240} , P_{240} variables. The parameters of the algorithm were used as default (i.e. $C_{T1}=95$, $C_{T2}=230$, $T_b=313$, $P_0=200$, $b_1=0.004$, $b_2 = 0.0005$, $b_3=0.0468$, $b_4=0.6$, $b_5=2.034$, $b_6=0.05$).

Supplementary references:

Guenther, A. B., Jiang, X., Heald, C. L., Sakulyanontvittaya, T., Duhl, T., Emmons, L. K., and Wang, X.: The Model of Emissions of Gases and Aerosols from Nature version 2.1 (MEGAN2.1): an extended and updated framework for modeling biogenic emissions, *Geosci Model Dev*, 5, 1471-1492, 10.5194/gmd-5-1471-2012, 2012.