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Effects of two different biogenic emission models on modelled ozone and aerosol concentrations in Europe

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Table S1. Statistical metrics for model performance evaluation. N is the number of data sample, and M_i and O_i represent modeled and observed values, respectively.

Metric	**Definition**
Mean Bias (MB)	$MB = \frac{1}{N}\sum_{i=1}^{N}(M_i - O_i)$
Mean Gross Error (MGE)	$MGE = \frac{1}{N}\sum_{i=1}^{N}\lvert M_i - O_i\rvert$
Root Mean Square Error (RMSE)	$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(M_i - O_i)^2}$
Mean Fractional Bias (MFB)	$MFB = \frac{1}{N}\sum_{i=1}^{N}\frac{2\cdot(M_i - O_i)}{M_i + O_i}$
Mean Fractional Error (MFE)	$MFE = \frac{1}{N}\sum_{i=1}^{N}\frac{2\cdot\lvert M_i - O_i\rvert}{M_i + O_i}$

Table S2. Ratio of tree species to total needleleaf and broadleaf forests in country level.

Country	Ratio to total conifer trees (%)						Ratio to total broadleaf trees (%)					
	Norway spruce	Fir	Scots pine	Larch	Arolla pine	sum	Beech	Maple	Ash	Oak	Chestnut	sum
Albania	6.7	0.0	93.3	0.0	0.0	100	44.9	0.0	0.0	55.1	0.0	100
Armenia	29.6	5.6	64.8	0.0	0.0	100	37.1	0.0	0.0	62.9	0.0	100
Austria	80.8	9.0	3.8	6.4	0.0	100	83.3	0.0	0.0	16.7	0.0	100
Azerbaijan	29.6	5.6	64.8	0.0	0.0	100	37.1	0.0	0.0	62.9	0.0	100
Belgium	38.9	0.0	61.1	0.0	0.0	100	61.1	0.0	0.0	38.9	0.0	100
Bulgaria	14.3	0.0	85.7	0.0	0.0	100	45.9	0.0	0.0	54.1	0.0	100
Bosnia and Herzegovina	71.4	0.0	28.6	0.0	0.0	100	50.0	0.0	0.0	50.0	0.0	100
Belarus	16.8	0.0	83.2	0.0	0.0	100	0.0	0.0	0.0	100.0	0.0	100
Switzerland	64.0	18.7	5.3	6.7	5.3	100	69.6	8.7	8.7	8.7	4.3	100
Cyprus	0.0	34.7	65.3	0.0	0.0	100	22.0	0.0	0.0	76.0	2.0	100
Czech Republic	100.0	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	-
Germany	63.9	3.3	32.8	0.0	0.0	100	68.0	0.0	0.0	32.0	0.0	100
Denmark	73.7	14.0	12.3	0.0	0.0	100	60.7	7.1	7.1	25.0	0.0	100
Spain	0.0	0.0	100.0	0.0	0.0	100	9.1	0.0	0.0	90.9	0.0	100
Estonia	38.7	0.0	61.3	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	-
Finland	28.3	0.0	71.7	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	-
France	15.6	12.5	68.8	3.1	0.0	100	17.5	0.0	5.3	70.2	7.0	100
United Kingdom	53.4	0.0	34.2	12.3	0.0	100	25.0	0.0	25.0	50.0	0.0	100
Georgia	29.6	5.6	64.8	0.0	0.0	100	37.1	0.0	0.0	62.9	0.0	100
Greece	0.0	34.7	65.3	0.0	0.0	100	22.0	0.0	0.0	76.0	2.0	100
Croatia	71.4	0.0	28.6	0.0	0.0	100	50.0	0.0	0.0	50.0	0.0	100
Hungary	0.0	0.0	100.0	0.0	0.0	100	16.7	0.0	0.0	83.3	0.0	100
Ireland	66.2	0.0	33.8	0.0	0.0	100	50.0	0.0	0.0	50.0	0.0	100
Italy	20.0	0.0	60.0	20.0	0.0	100	30.8	0.0	0.0	38.5	30.8	100
Lithuania	41.3	0.0	58.7	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	-
Luxembourg	91.2	0.0	8.8	0.0	0.0	100	75.6	0.0	0.0	24.4	0.0	100

Country	Ratio to total conifer trees (%)						Ratio to total broadleaf trees (%)					
	Norway spruce	Fir	Scots pine	Larch	Arolla pine	sum	Beech	Maple	Ash	Oak	Chestnut	sum
Latvia	34.4	0.0	65.6	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	-
Republic of Moldova	29.6	5.6	64.8	0.0	0.0	100	37.1	0.0	0.0	62.9	0.0	100
The former Yugoslav Republic of Macedonia	71.4	0.0	28.6	0.0	0.0	100	50.0	0.0	0.0	50.0	0.0	100
Netherlands	10.0	0.0	78.6	11.4	0.0	100	30.0	10.0	20.0	40.0	0.0	100
Norway	59.7	0.0	40.3	0.0	0.0	100	0.0	0.0	0.0	100.0	0.0	100
Poland	8.1	3.5	88.4	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	-
Portugal	0.0	0.0	100.0	0.0	0.0	100	0.0	0.0	0.0	97.1	2.9	100
Romania	100.0	0.0	0.0	0.0	0.0	100	61.5	0.0	0.0	38.5	0.0	100
Russia	52.9	0.0	47.1	0.0	0.0	100	0.0	0.0	0.0	100.0	0.0	100
Slovakia	66.7	11.9	16.7	4.8	0.0	100	68.2	0.0	0.0	31.8	0.0	100
Slovenia	71.4	0.0	28.6	0.0	0.0	100	50.0	0.0	0.0	50.0	0.0	100
Sweden	48.8	0.0	51.3	0.0	0.0	100	100.0	0.0	0.0	0.0	0.0	100
Turkey	0.0	34.7	65.3	0.0	0.0	100	22.0	0.0	0.0	76.0	2.0	100
Ukraine	29.6	5.6	64.8	0.0	0.0	100	37.1	0.0	0.0	62.9	0.0	100
Serbia and Montenegro	71.4	0.0	28.6	0.0	0.0	100	50.0	0.0	0.0	50.0	0.0	100

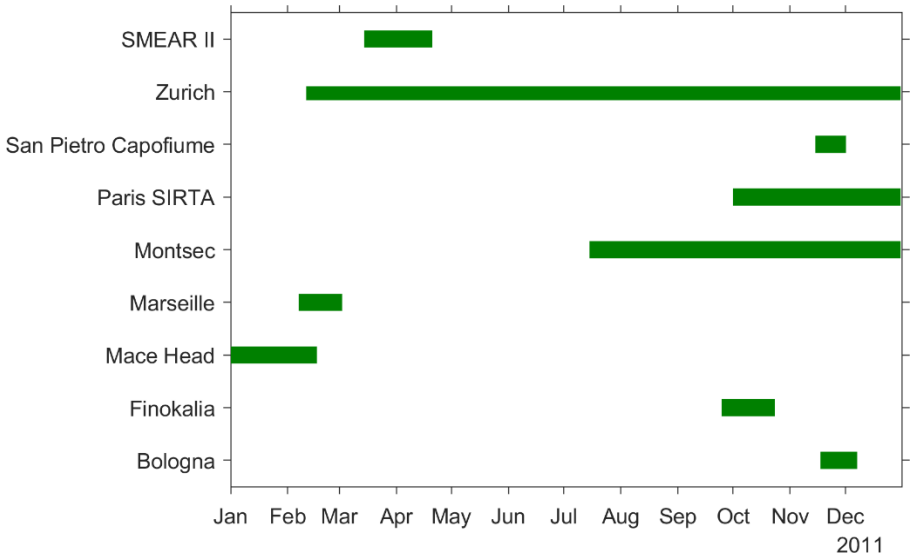

Figure S1. Time span of measurements at nine ACSM/AMS stations during the simulation period

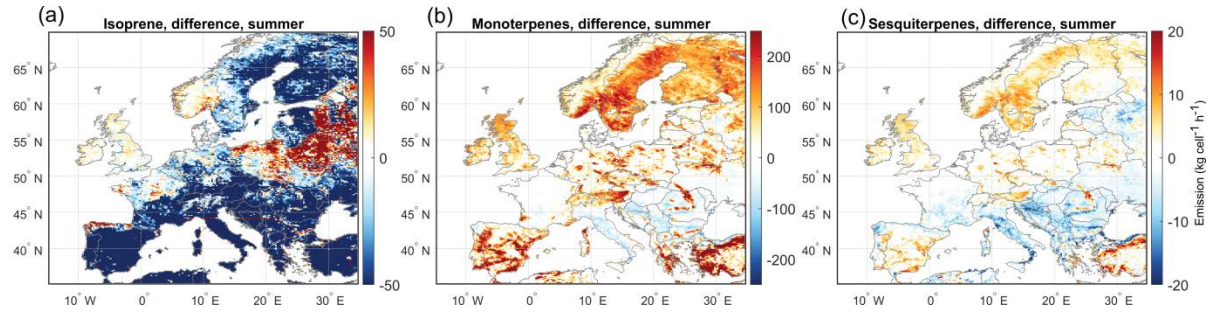

Figure S2. Difference between modelled emissions of isoprene (a), monoterpenes (b) and sesquiterpenes (c) by PSI model and MEGAN in summer.

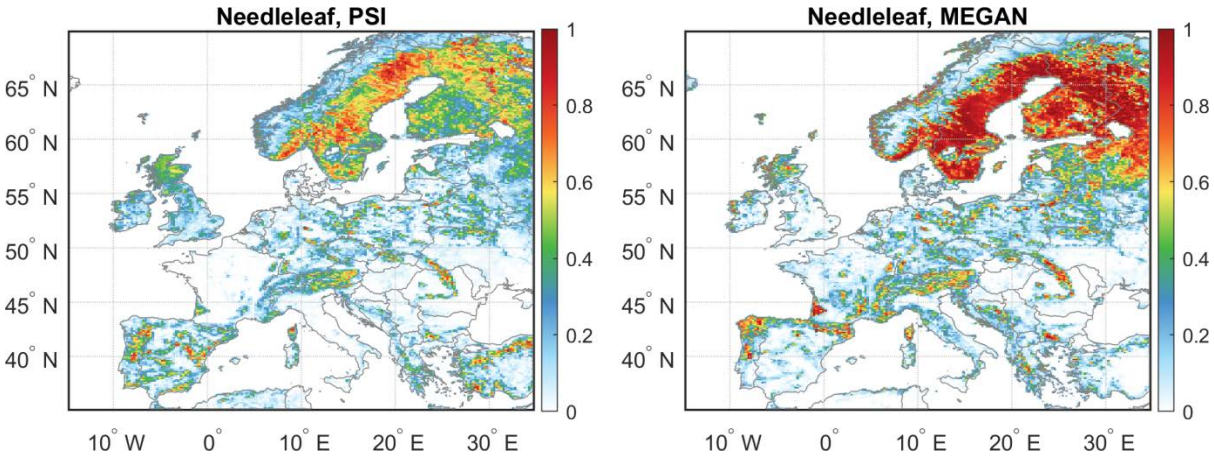

Figure S3. Comparison of fraction of needleleaf forests between PSI (left) and MEGAN (right) land-use inputs. The total fraction for PSI model is the sum of five coniferous trees including Norway spruce, fir, Scots pine, Arolla pine and Larch, while for MEGAN it is the sum of needleleaf evergreen temperate, needleleaf evergreen boreal and needleleaf deciduous boreal trees.

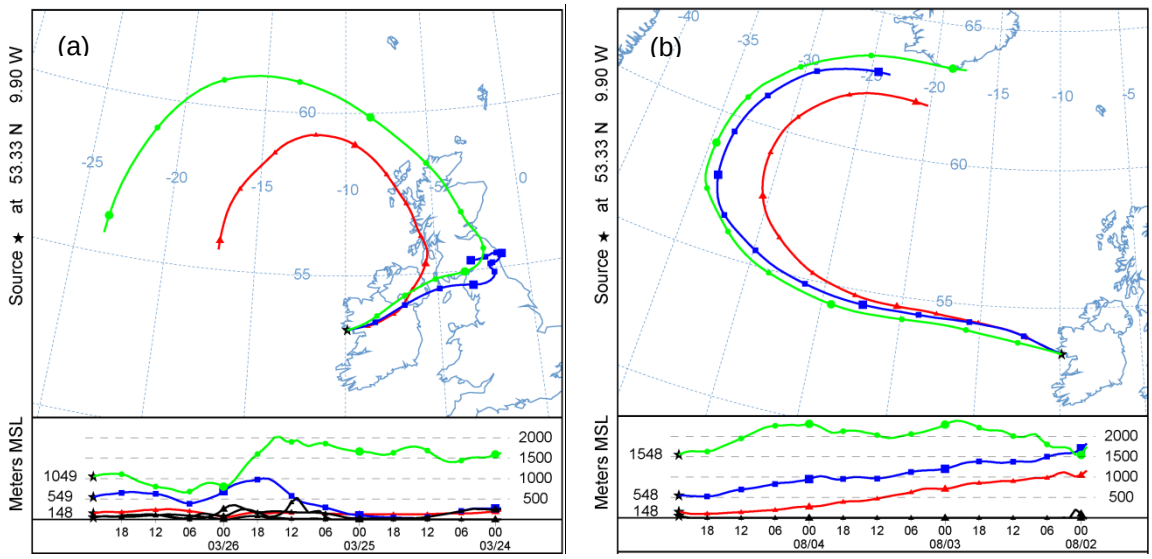

Figure S4. Backward trajectories ending at UTC 23:00 on 26th March (a) and 4th August (b), 2011 at Mace Head station by NOAA's HYSPLIT atmospheric transport and dispersion modelling system. Trajectories in three level heights were modelled: 100 m (red), 500 m (blue), 1000 m (green). The model vertical velocity approach was used for vertical motion calculation. The Global Data Assimilation System (GDAS) dataset with resolution of 0.5 degree was selected as meteorology input.

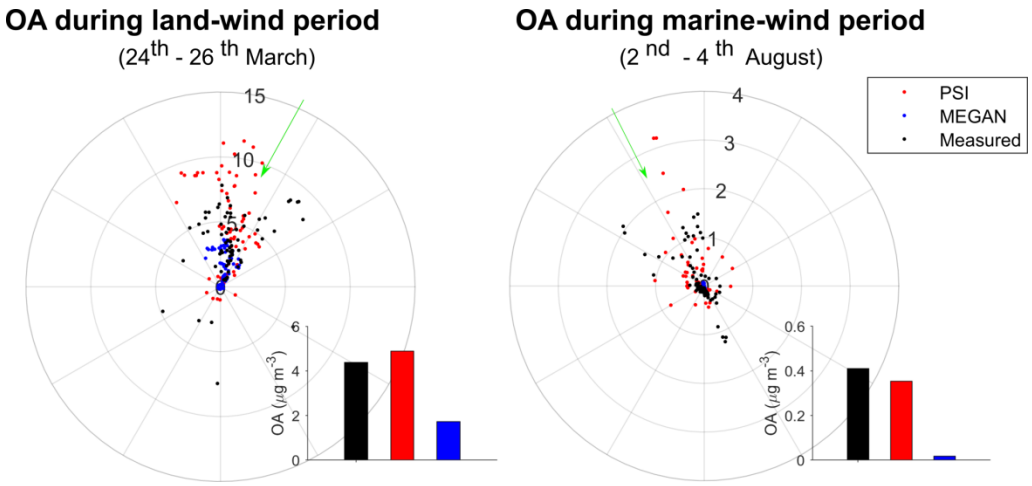

Figure S5. Measured and modelled OA concentration during land-wind and marine-wind dominant periods. Scatter and bar plots are based on hourly and hourly average data, respectively. The angles of polar axes represent modelled wind directions, and the dominant wind directions are marked by green arrows.

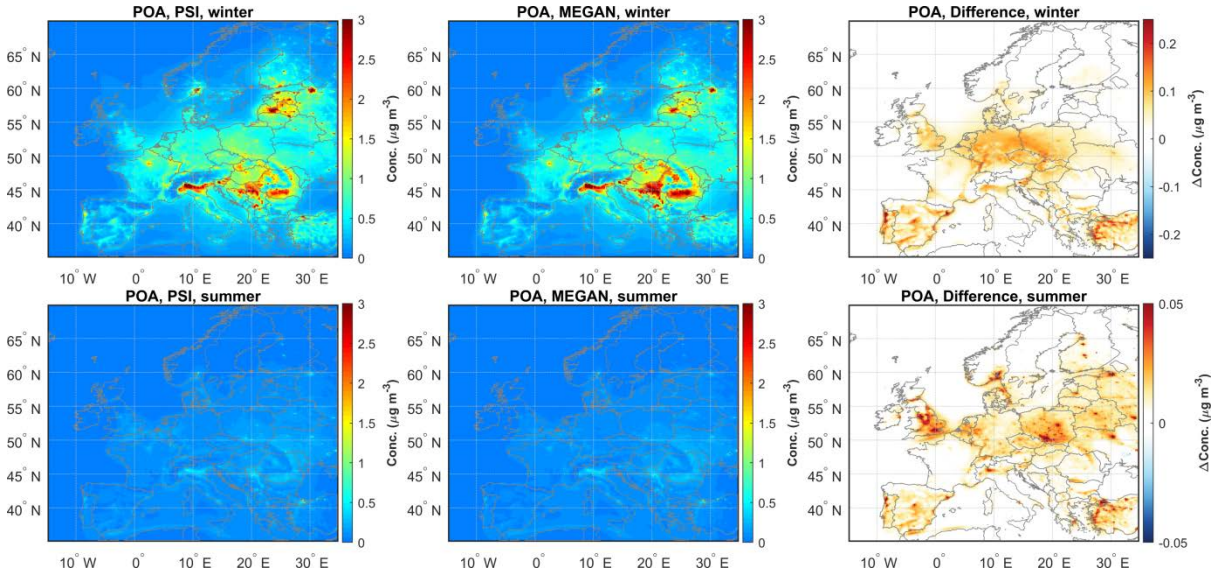

Figure S6. Modelled POA concentrations using BVOCs emission input by PSI Model (left panel) and MEGAN v2.1 (middle panel) and their difference (PSI – MEGAN, in right panel).

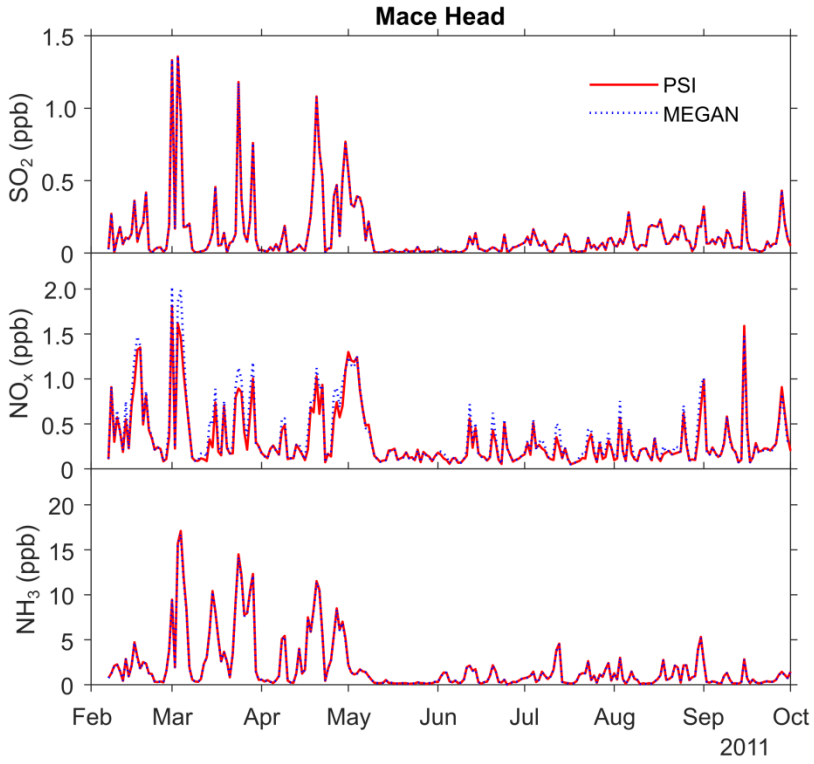

Figure S7. Temporal variation of the modelled (with both PSI and MEGAN emissions) SO_2, NO_x and NH_3 at Mace Head in 2011.

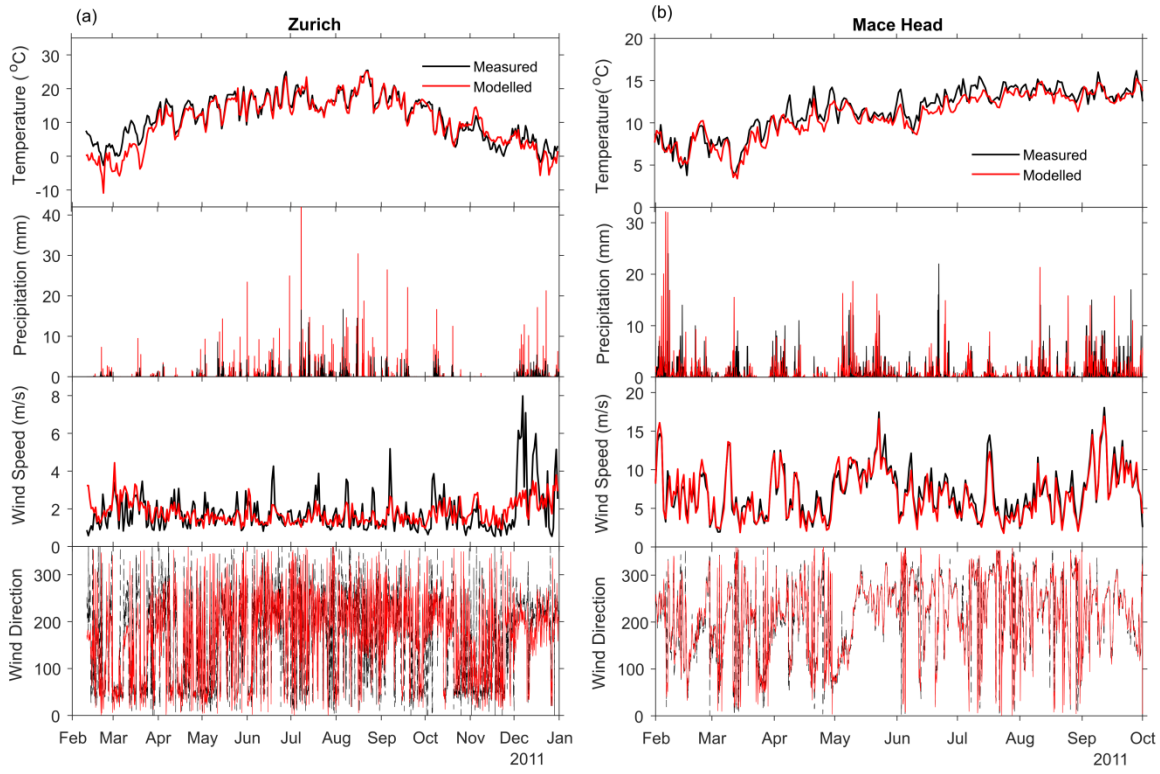

Figure S8. Comparison of observed and modelled temperature (°C), hourly precipitation (mm), wind speed (m/s) and wind direction (degree) at Zurich and Mace Head. Hourly observation data for Zurich was obtained from the automatic monitoring network of MeteoSwiss (ANETZ). Observed temperature, wind speed and wind direction at Mace Head were from Meteireann weather station, which is ~300 meters away from the AMS station; while measured precipitation at Mace Head was obtained from Belmullet, a coastal station close to Mace Head, which was downloaded from the UK Met Office Integrated Data Archive System (MIDAS) Land Surface Stations database (Meteorological Office, 2013), and with 3-hour time intervals.

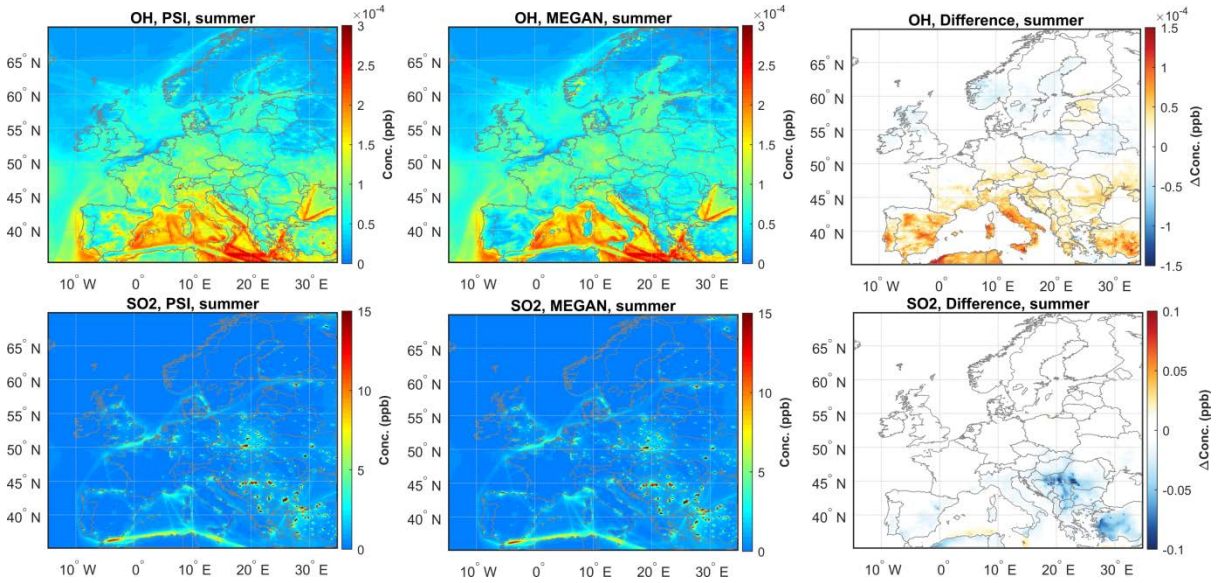

Figure S9. Modelled OH and SO_2 concentrations using PSI emissions (left), MEGAN emissions (middle) and the difference between them (right).