Supplement of

Potential of using CO_2 observations over India in regional carbon budget estimation by improving the modelling system

Vishnu Thilakan et al.

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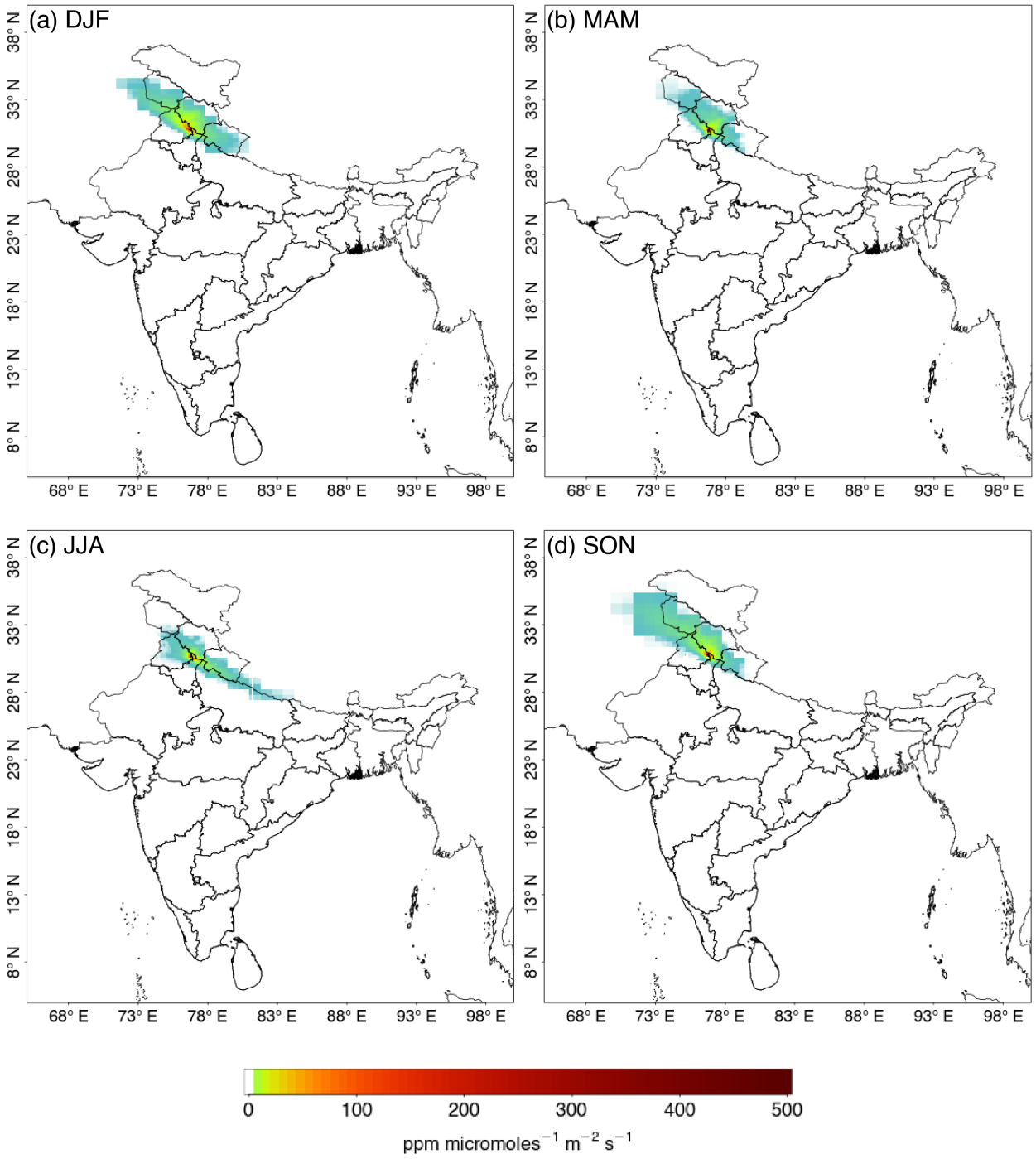

Figure S1. Seasonally integrated STILT footprints for Mohali (MHL) during 2017. (a) Winter (b) Pre-Monsoon (c) Monsoon (d) Post-Monsoon

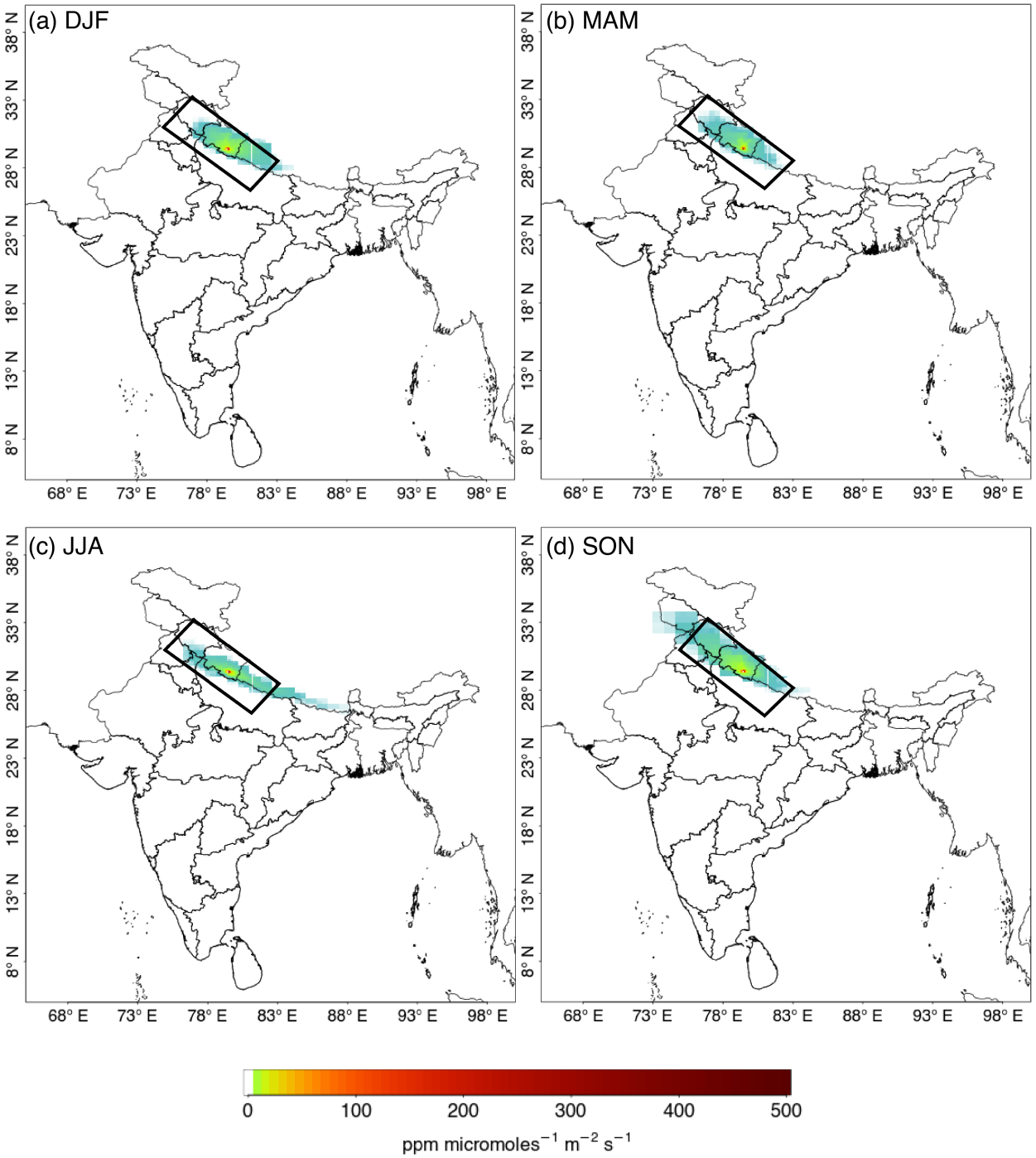

Figure S2. Seasonally integrated STILT footprints for Nainital (NTL) during 2017. The marked region represents the area used for the MODIS NDVI analysis. (a) Winter (b) Pre-Monsoon (c) Monsoon (d) Post-Monsoon

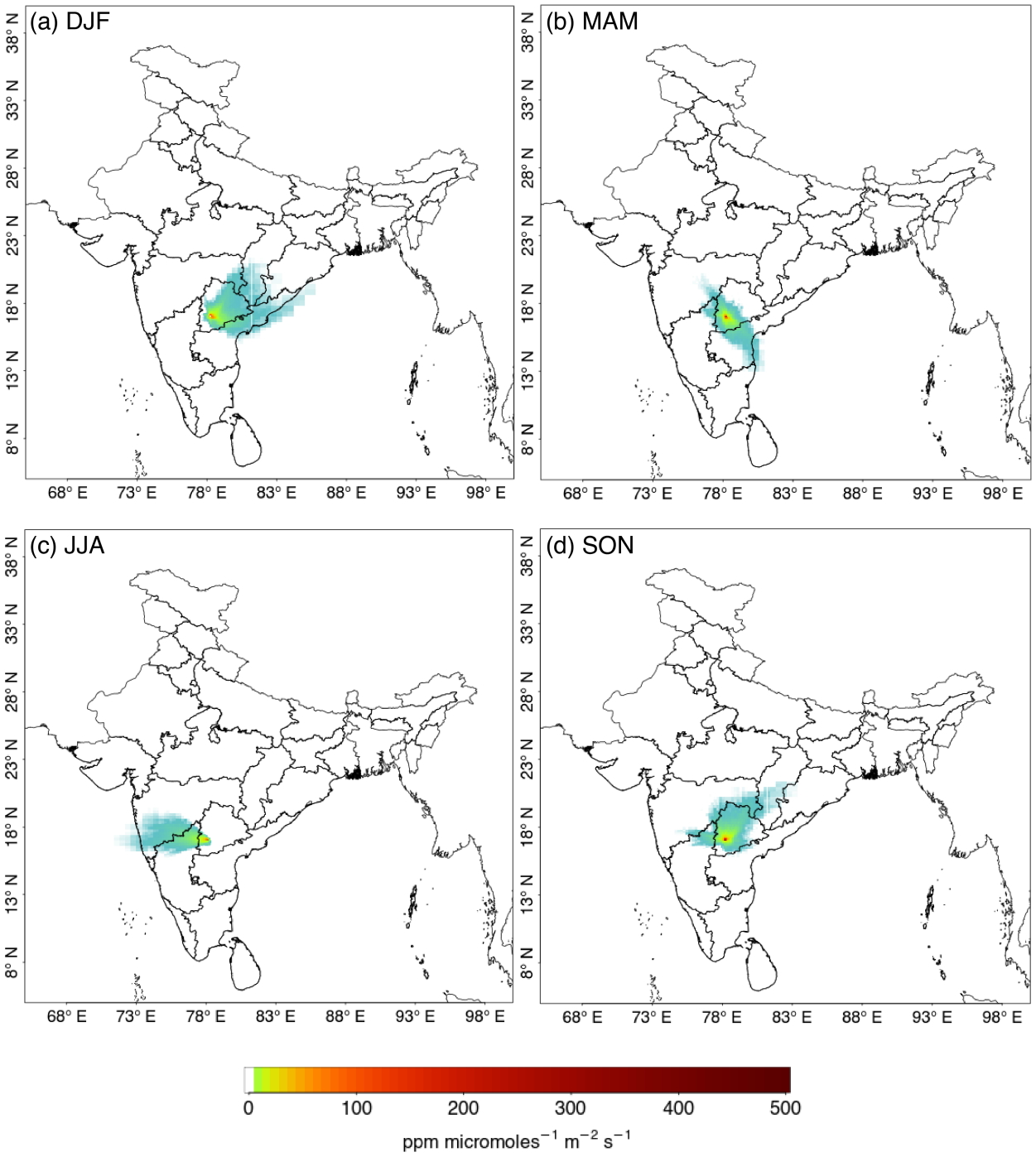

Figure S3. Seasonally integrated STILT footprints for Shadnagar (SDN) during 2017. (a) Winter (b) Pre-Monsoon (c) Monsoon (d) Post-Monsoon

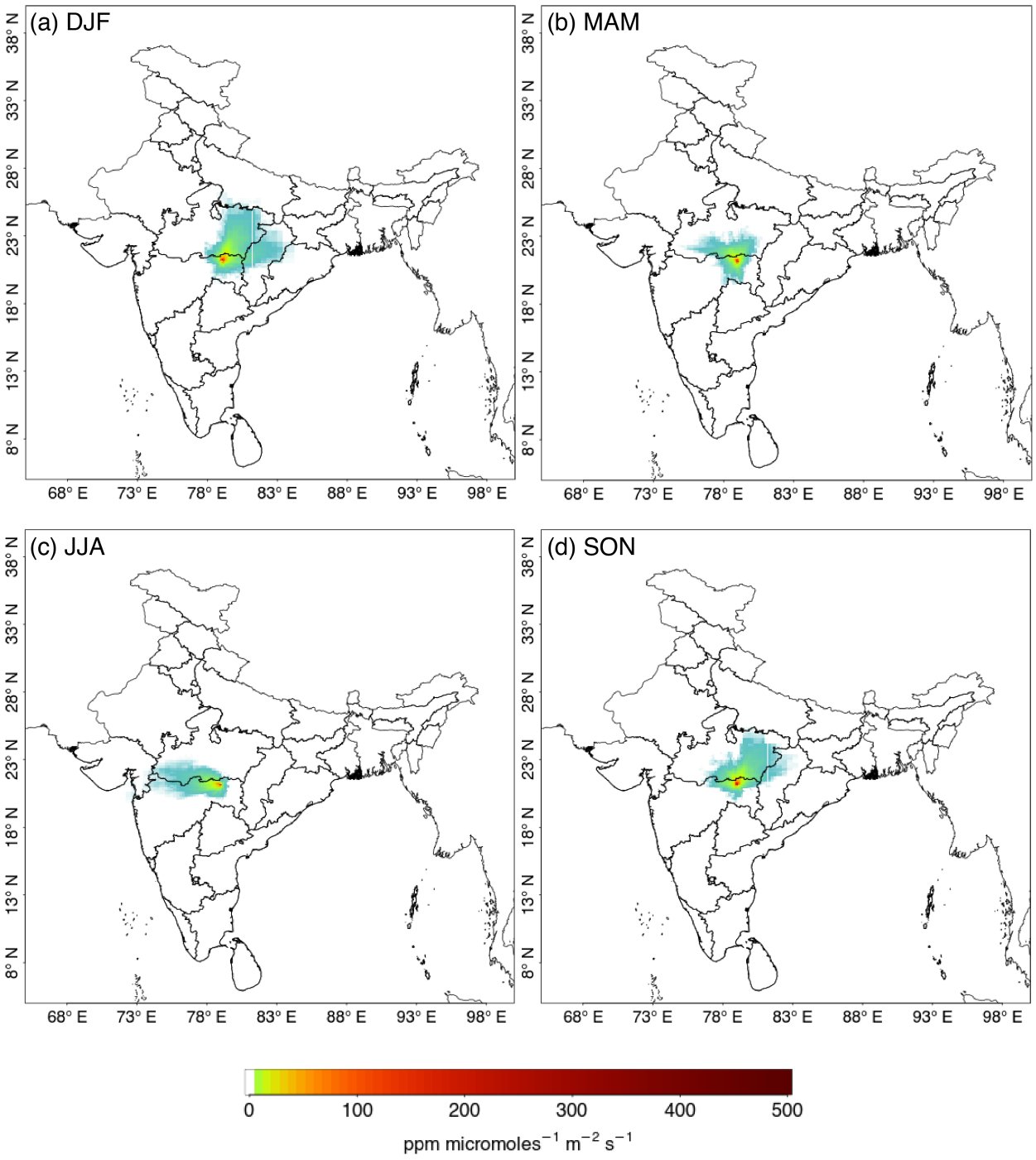

Figure S4. Seasonally integrated STILT footprints for Nagpur (NGP) during 2017. (a) Winter (b) Pre-Monsoon (c) Monsoon (d) Post-Monsoon

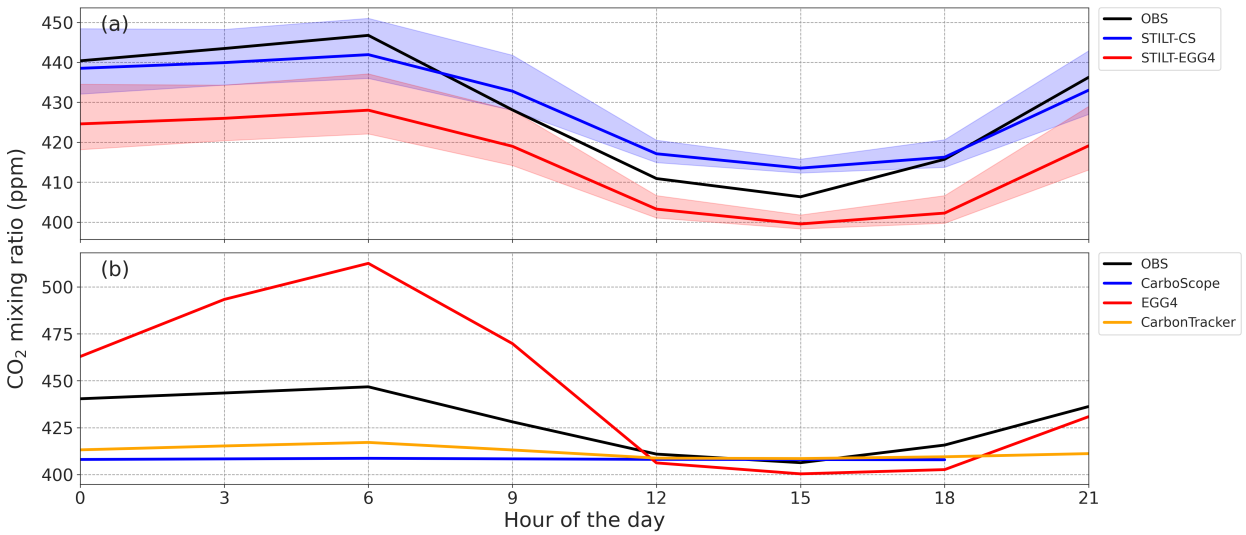

Figure S5. Time series of CO_2 diurnal cycle over MHL during 2017 is shown in comparison with (a) STILT simulations. Blue (STILT-CS) and red (STILT-EGG4) curves represent the ensemble average of the STILT simulations using different anthropogenic fluxes. Shaded regions represent the range of the model simulations. (b) Global reanalysis products. Note that STILT provides output only every three hours. Similarly, EGG4 and CarbonTracker provide outputs at a three-hour resolution and CarboScope at a six-hour resolution.

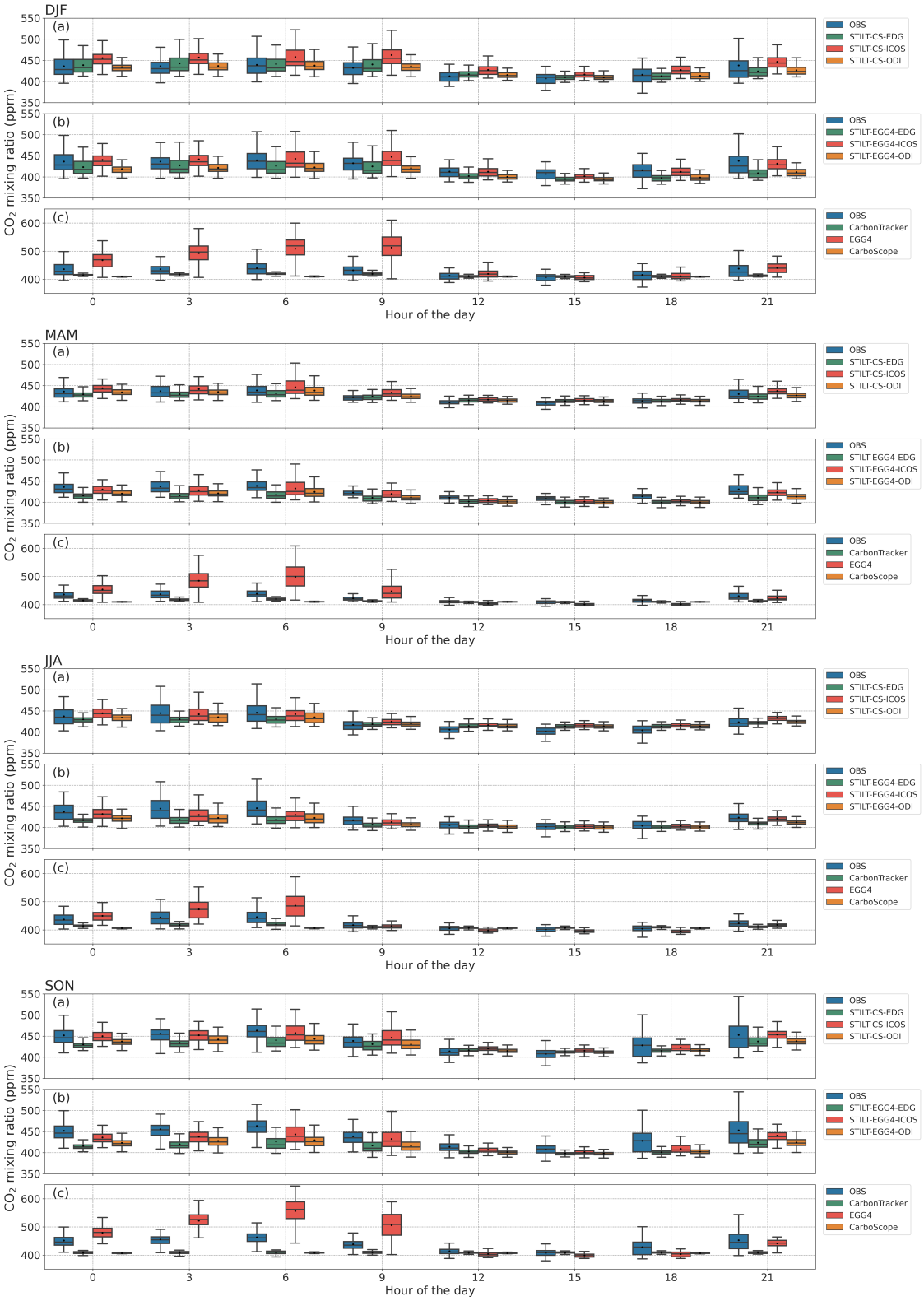

Figure S6. CO_2 diurnal cycle over MHL for different seasons during 2017 is shown in comparison with (a) STILT-CS simulations, (b) STILT-EGG4 simulations and (c) global reanalysis products. Note that STILT provides output only every three hours. Similarly, EGG4 and CarbonTracker provide outputs at a three-hour resolution and CarboScope at a six-hour resolution.

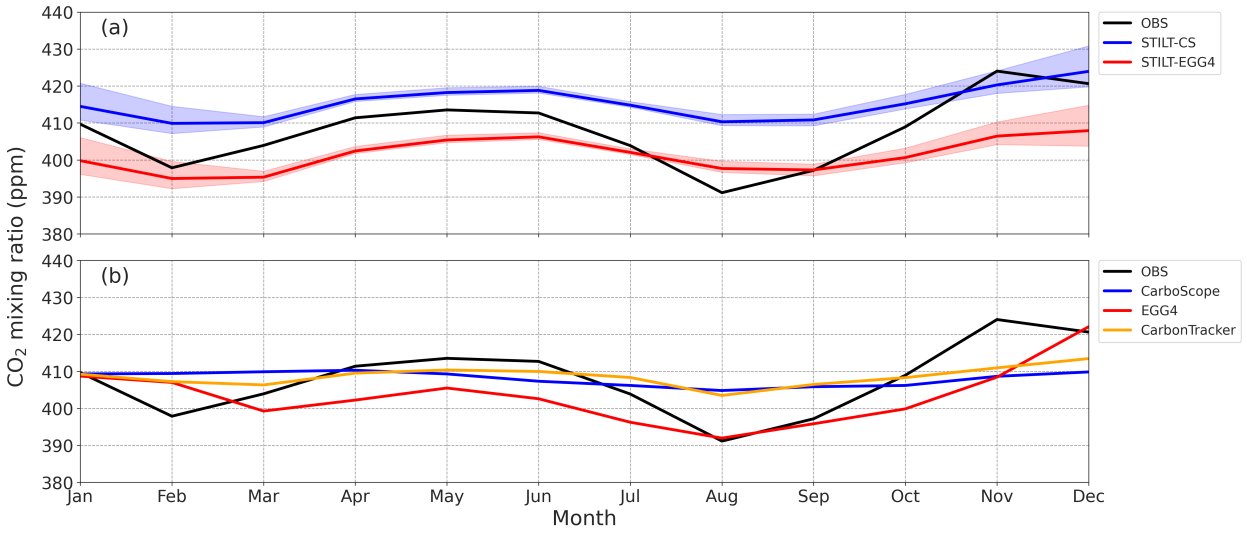

Figure S7. CO_2 seasonal cycle over MHL during 2017. Time series of monthly mean CO_2 (daytime, 11:00-16:00 local time) over MHL with (a) STILT simulations. Blue (STILT-CS) and red (STILT-EGG4) curves represent the ensemble average of the STILT simulations using different anthropogenic fluxes. Shaded regions represent the range of the model simulations. (b) Monthly mean CO_2 (daytime, 11:00-16:00 local time) over MHL in comparison with Global reanalysis products.

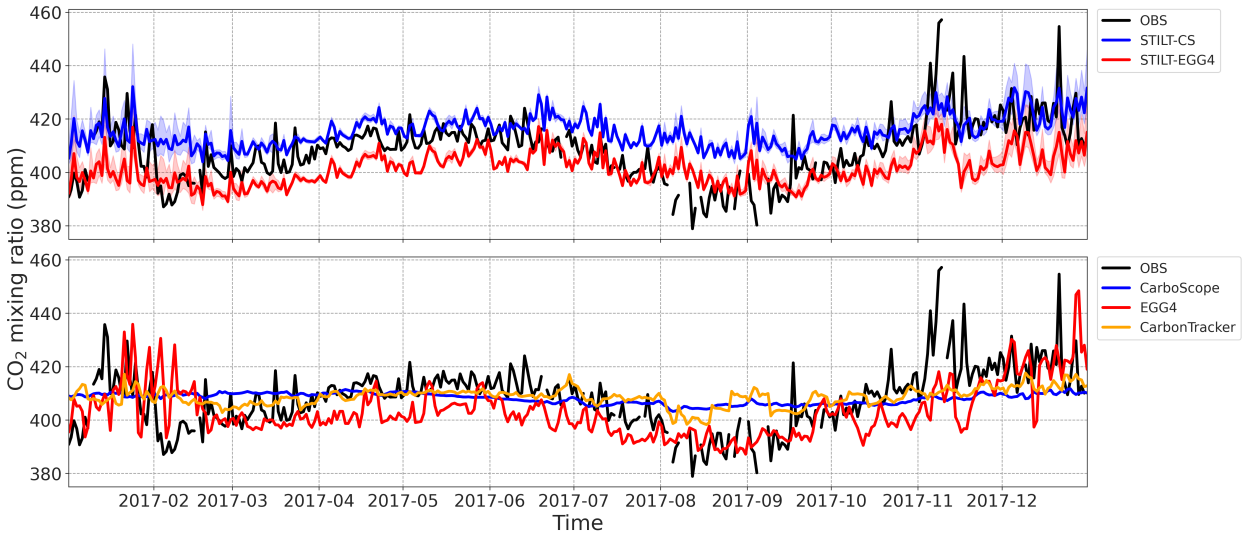

Figure S8. CO_2 daytime (11:00-16:00 local time) average time series from MHL during 2017 with (a) STILT simulations. Blue (STILT-CS) and red (STILT-EGG4) curves represent the ensemble average of the STILT simulations using different anthropogenic fluxes. Shaded regions represent the range of the model simulations. (b) Global reanalysis products.

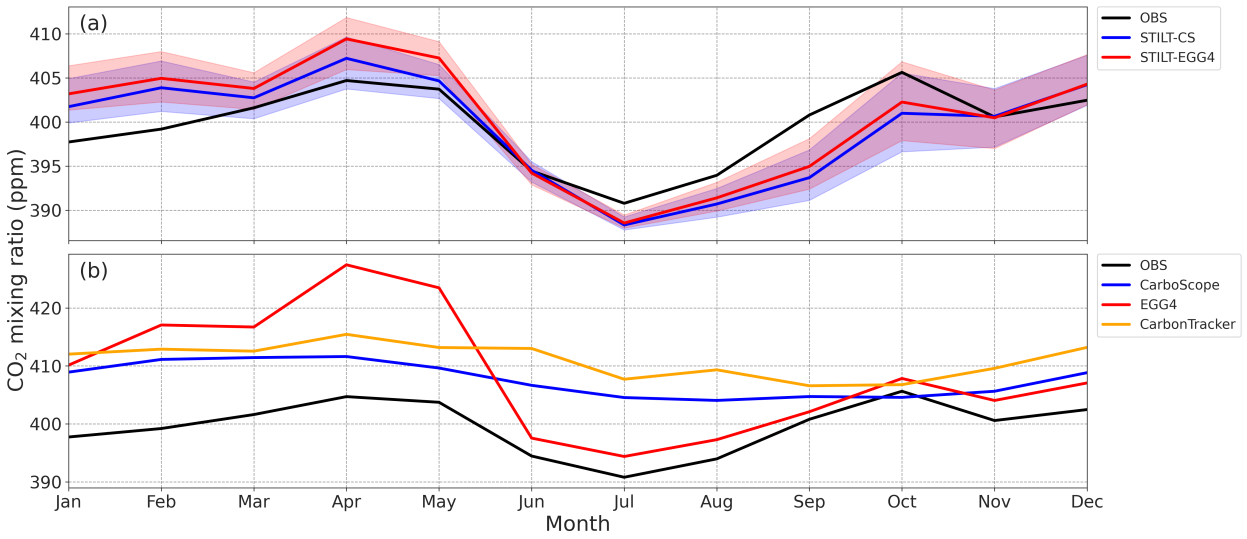

Figure S9. CO_2 seasonal cycle over SDN during 2017. Time series of monthly mean CO_2 over SDN with (a) STILT simulations. Blue (STILT-CS) and red (STILT-EGG4) curves represent the ensemble average of the STILT simulations using different anthropogenic fluxes. Shaded regions represent the range of the model simulations. (b) Global reanalysis products.

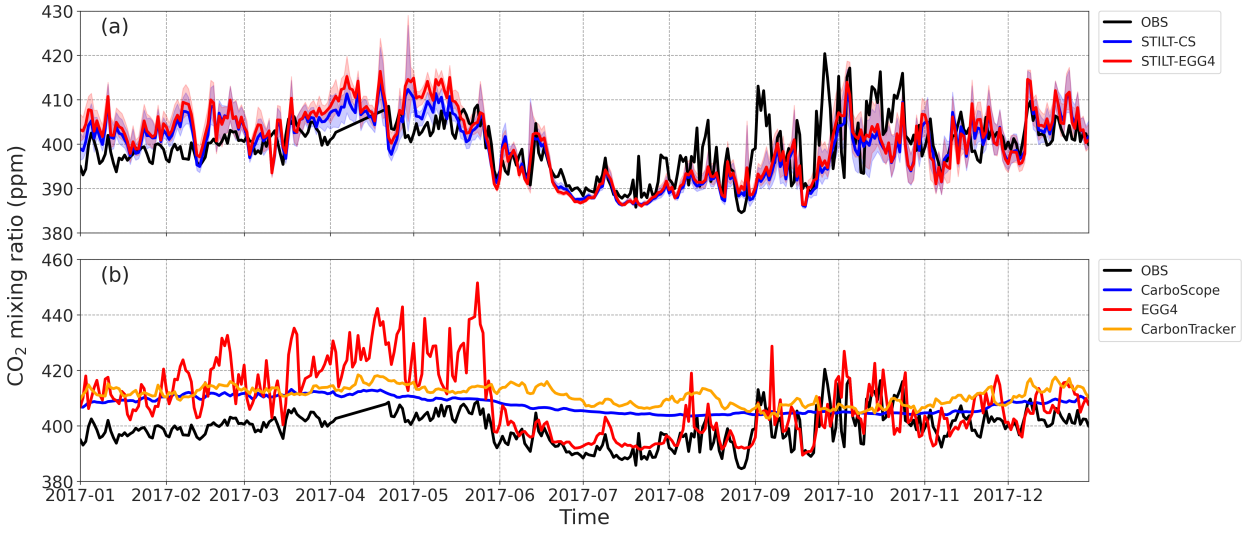

Figure S10. CO_2 daily mean time series from SDN during 2017 with (a) STILT simulations. Blue (STILT-CS) and red (STILT-EGG4) curves represent the ensemble average of the STILT simulations using different anthropogenic fluxes. Shaded regions represent the range of the model simulations. (b) Global reanalysis products.

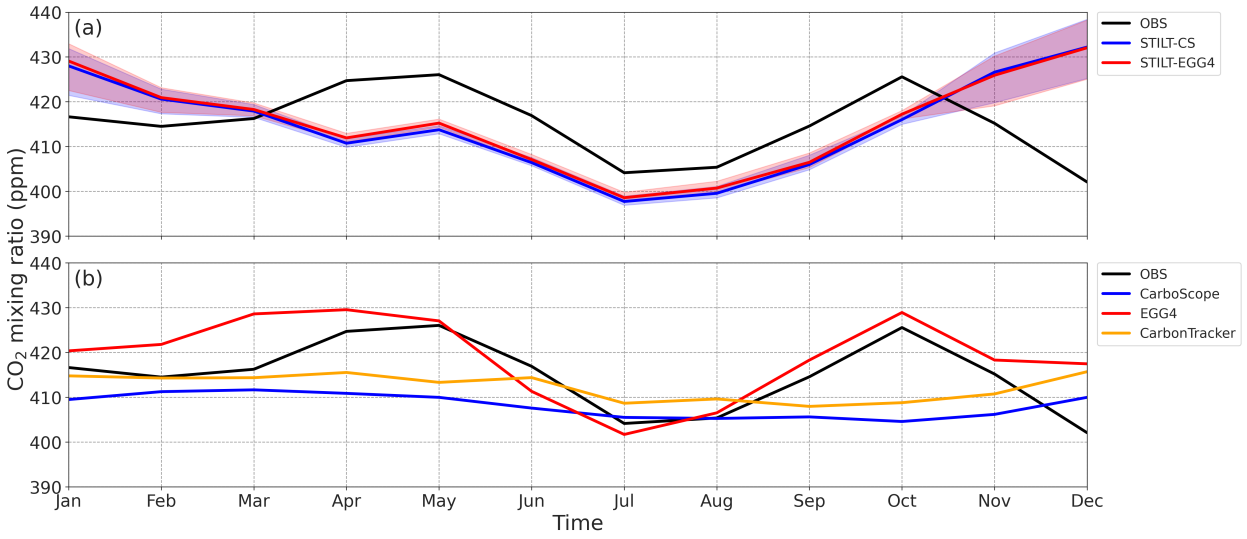

Figure S11. CO_2 seasonal cycle over NGP during 2017. Time series of monthly mean CO_2 over NGP with (a) STILT simulations. Blue (STILT-CS) and red (STILT-EGG4) curves represent the ensemble average of the STILT simulations using different anthropogenic fluxes. Shaded regions represent the range of the model simulations. (b) Global reanalysis products.

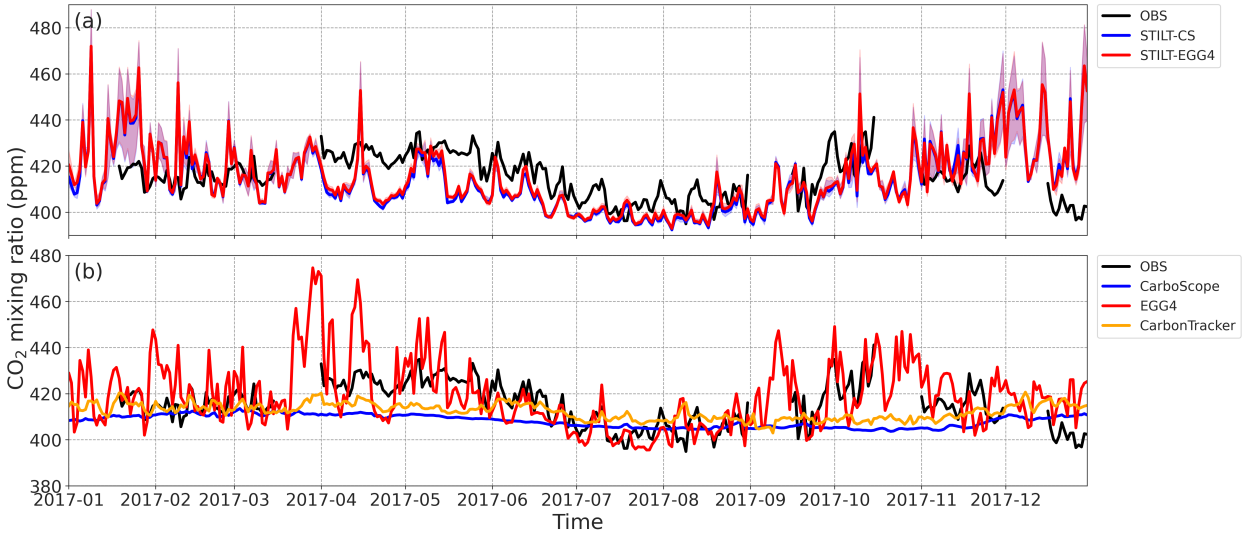

Figure S12. CO_2 daily mean time series from NGP during 2017 with (a) STILT simulations. Blue (STILT-CS) and red (STILT-EGG4) curves represent the ensemble average of the STILT simulations using different anthropogenic fluxes. Shaded regions represent the range of the model simulations. (b) Global reanalysis products.

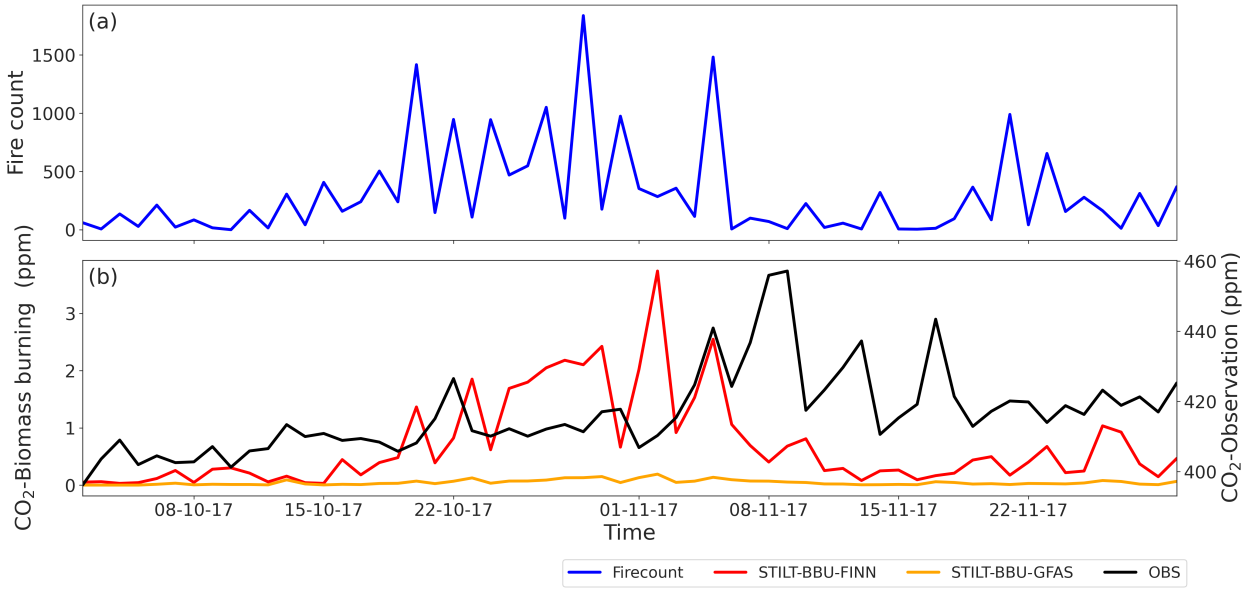

Figure S13. Biomass burning over MHL footprint region during October-November 2017. (a) Time series of MODIS fire counts over MHL influence region (see Fig. S1) during October-November 2017. (b) Time series of CO_2 daytime observations over MHL in comparison with the CO_2 biomass burning components from STILT simulations. The black line represents CO_2 daytime observations, the red line corresponds to the CO_2 biomass burning component from STILT-FINN, and the orange line corresponds to CO_2 biomass burning component from STILT-GFAS (see Sect. 6.1).

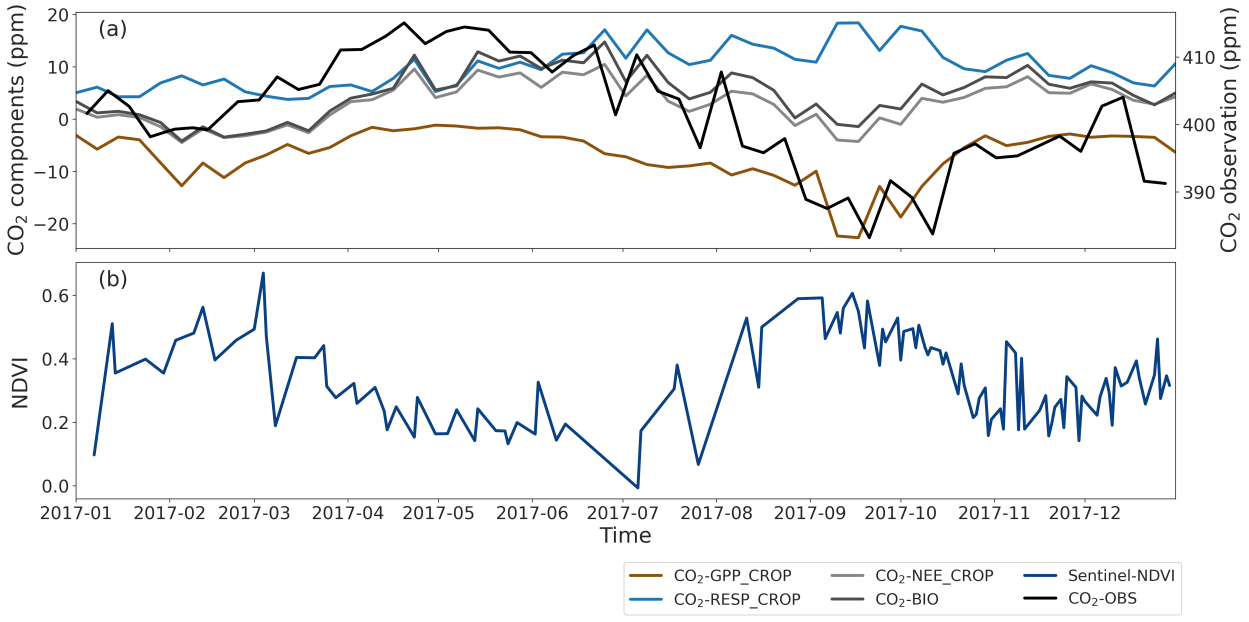

Figure S14. CO_2 variability over NTL in association with crop production. CO_2 observation is shown in comparison with (a) CO_2 biospheric components from STILT simulations. (b) NDVI estimation using Sentinel-2 data over NTL influence region (see Fig. S2) during 2017.