Supplement for

Application of the Multi-Scale Infrastructure for Chemistry and Aerosols version 0 (MUSICAv0) for air quality in Africa

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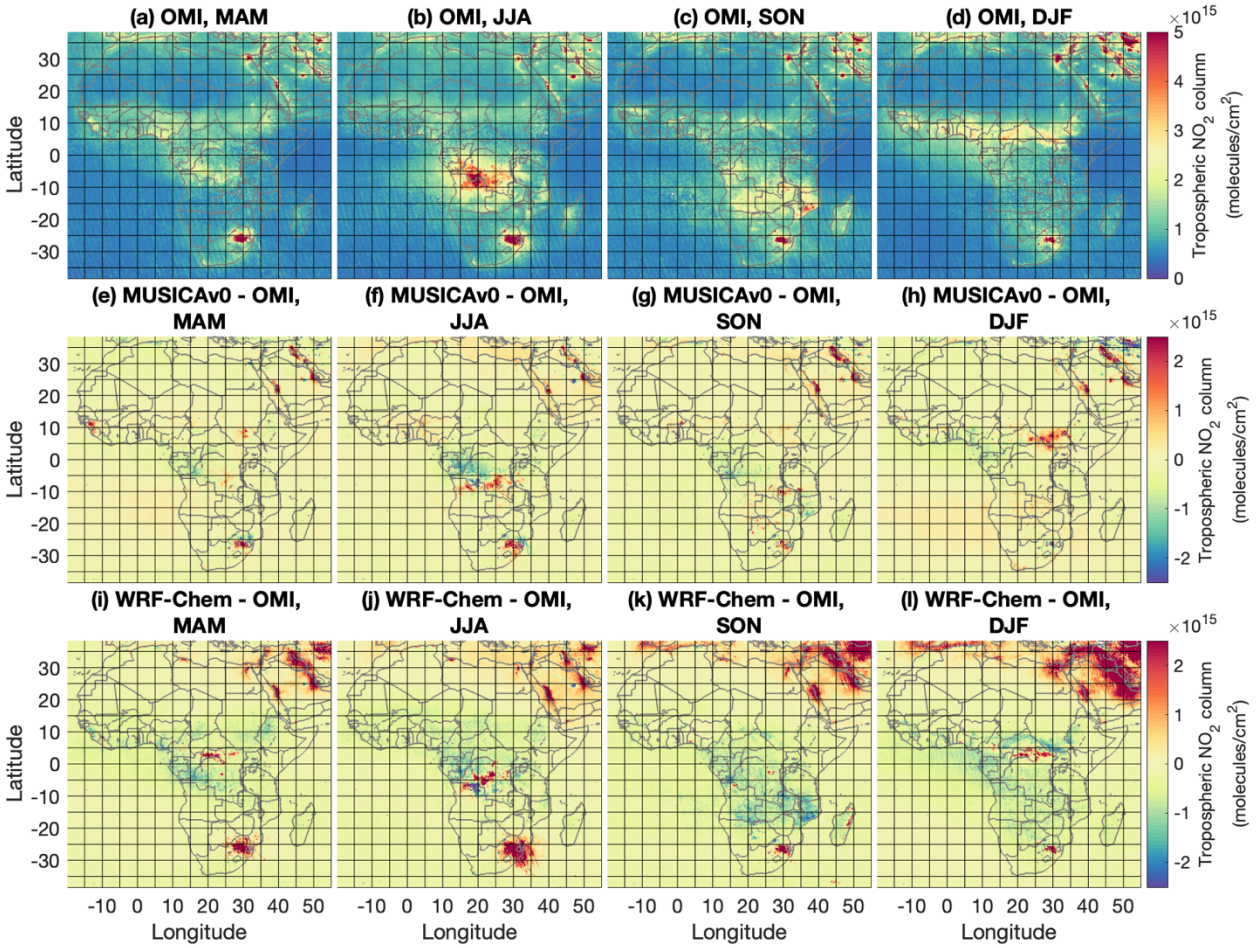

Figure S1. Comparisons of MUSICAv0 and WRF-Chem simulations and OMI tropospheric NO_2 column (molecules/cm^2) in 2017. (a-d) Averaged OMI tropospheric NO_2 column in MAM (March, April, and May), JJA (June, July, and August), SON (September, October, and November), and DJF (December, January, and February). (e-h) MUSICAv0 model biases against OMI tropospheric NO_2 column in MAM, JJA, SON, and DJF. (i-l) is the same as (e-h) but for WRF-Chem. All data are gridded to 0.25 degree × 0.25 degree for plotting.

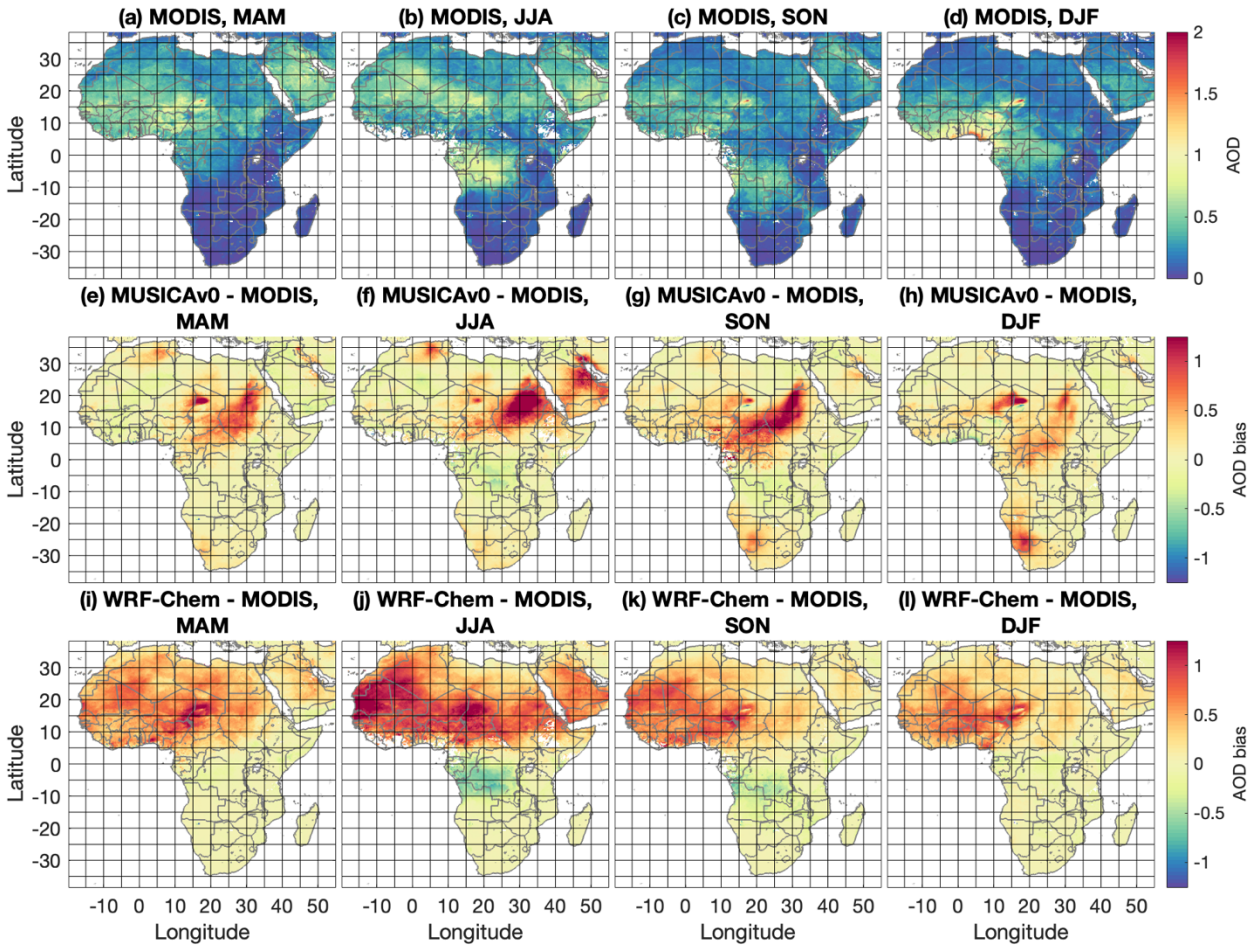

Figure S2. Comparisons of MUSICAv0 and WRF-Chem simulations and MODIS AOD in 2017. (a-d) Averaged MODIS AOD in MAM (March, April, and May), JJA (June, July, and August), SON (September, October, and November), and DJF (December, January, and February). (e-h) MUSICAv0 model biases against MODIS AOD in MAM, JJA, SON, and DJF. (i-l) is the same as (e-h) but for WRF-Chem. All data are gridded to 0.25 degree × 0.25 degree for plotting.

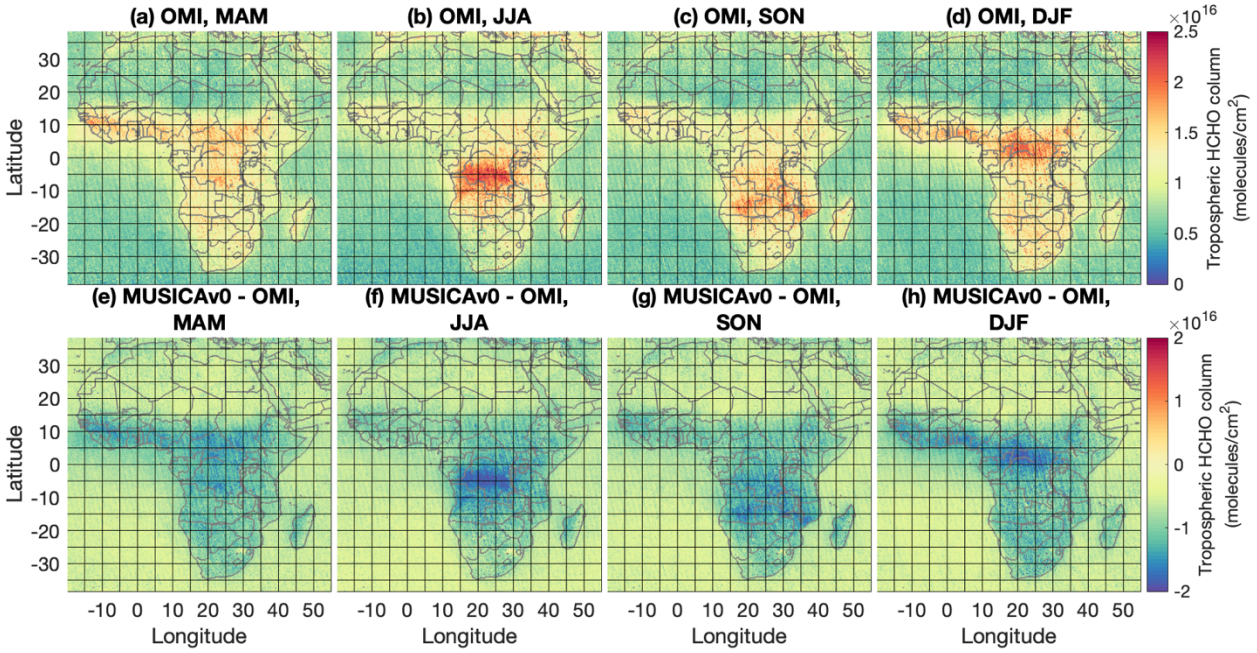

Figure S3. Comparisons of MUSICAv0 and WRF-Chem simulations and OMI tropospheric CH_2O column (molecules/cm^2) in 2017. (a-d) Averaged OMI tropospheric CH_2O column in MAM (March, April, and May), JJA (June, July, and August), SON (September, October, and November), and DJF (December, January, and February). (e-h) MUSICAv0 model biases against OMI tropospheric CH_2O column in MAM, JJA, SON, and DJF. All data are gridded to 0.25 degree × 0.25 degree for plotting.

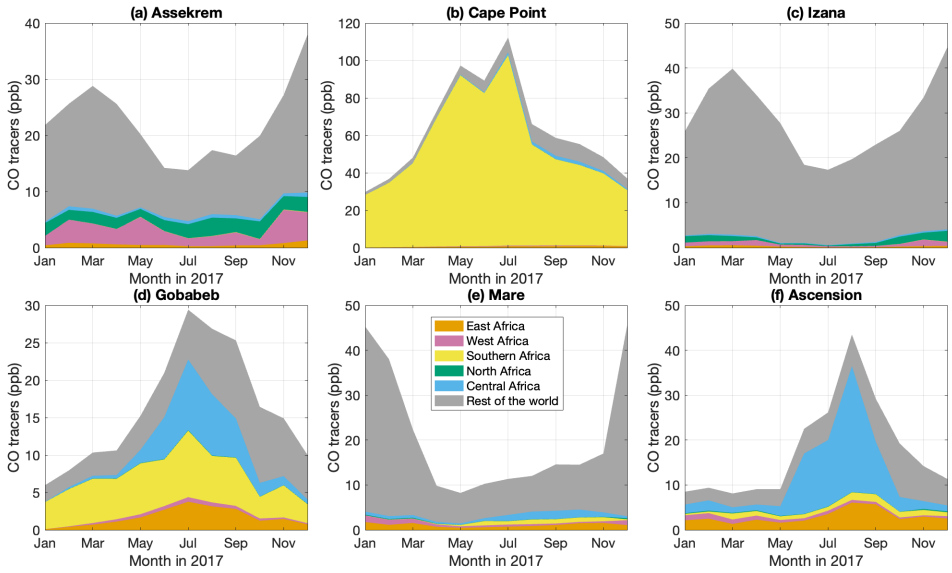

Figure S4. Monthly time series of CO tracers of emissions from North Africa (green), West Africa (pink), East Africa (orange), Central Africa (blue), Southern Africa (yellow), and the rest of the world (grey) at (a) Assekrem, (b) Cape Point, (c) Izana, (d) Gobabeb, (e) Mare and (f) Ascension. The locations of the sites and the definition of the regions can be found in Figure 1.

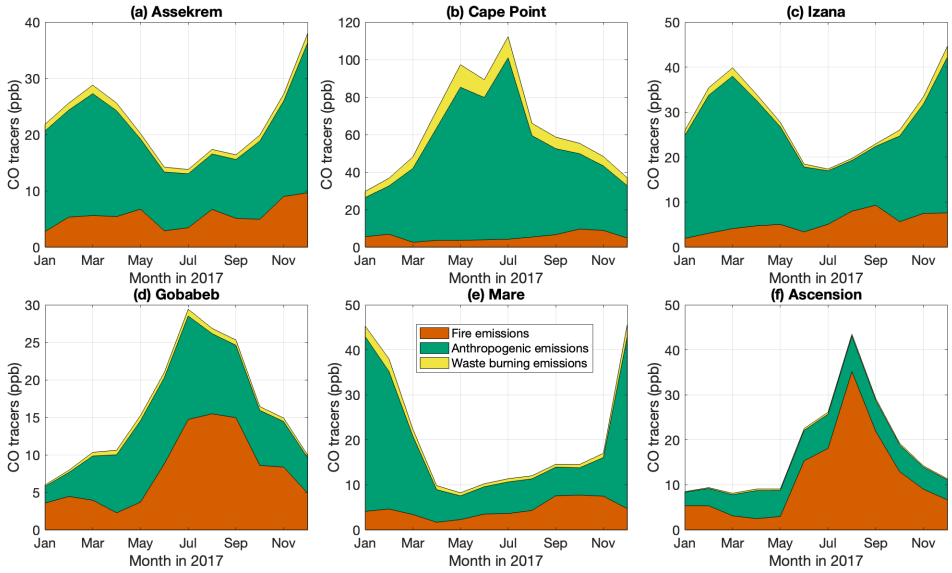

Figure S5. Monthly time series of CO tracers of fire emissions (red), anthropogenic emissions (green), and waste burning emissions (yellow) at (a) Assekrem, (b) Cape Point, (c) Izana, (d) Gobabeb, (e) Mare and (f) Ascension. The locations of the sites can be found in Figure 1.

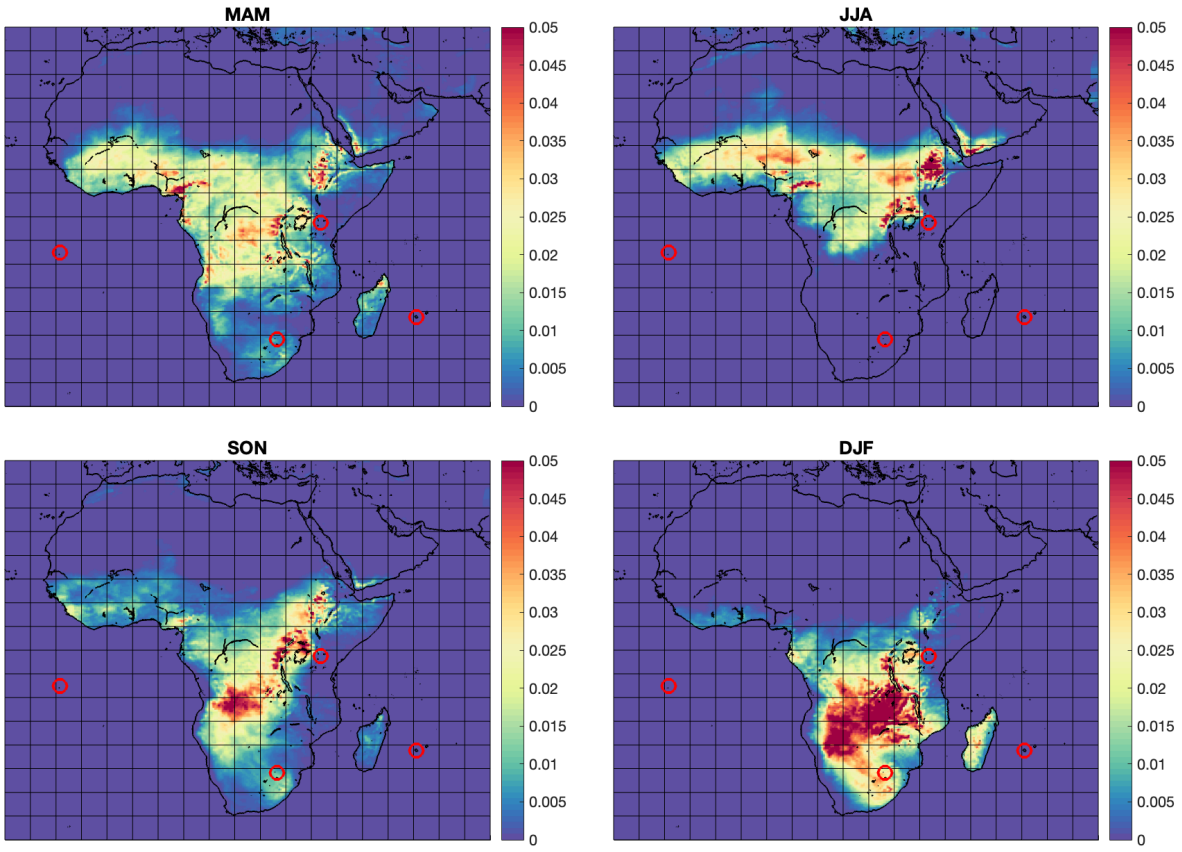

Figure S6. Modeled lightning NO emissions (g N/month/m^2) from the MUSICAv0 simulation in MAM (March, April, and May), JJA (June, July, and August), SON (September, October, and November), and DJF (December, January, and February).

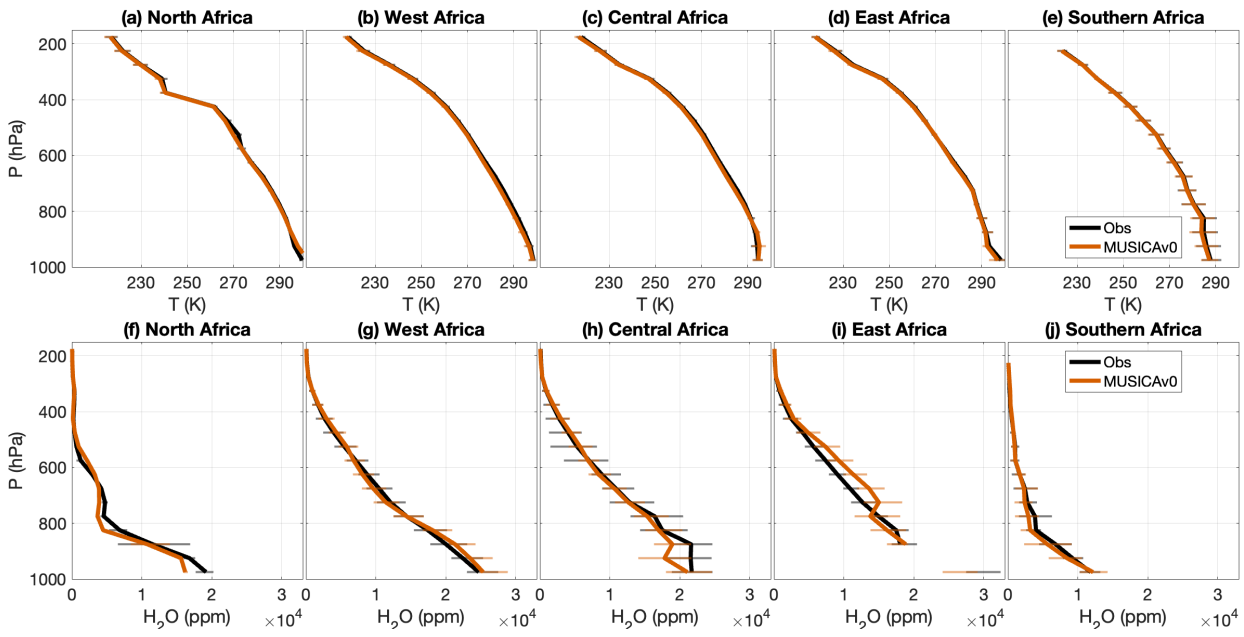

Figure S7. Vertical profiles of air temperature (T; K) and water vapor mixing ratio (H_2O; ppm) from the In-service Aircraft for a Global Observing System (IAGOS) measurements (black) and corresponding model output from MUSICAv0 (red), and WRF-Chem (blue) during 2017. Annual mean T profiles with the variation of the data in the pressure layer (25% quantile to 75% quantile) over (a) North Africa, (b) West Africa, (c) Central Africa, (d) East Africa, and (e) Southern Africa are shown. (f-j) are the same as (a-e) but for H_2O.

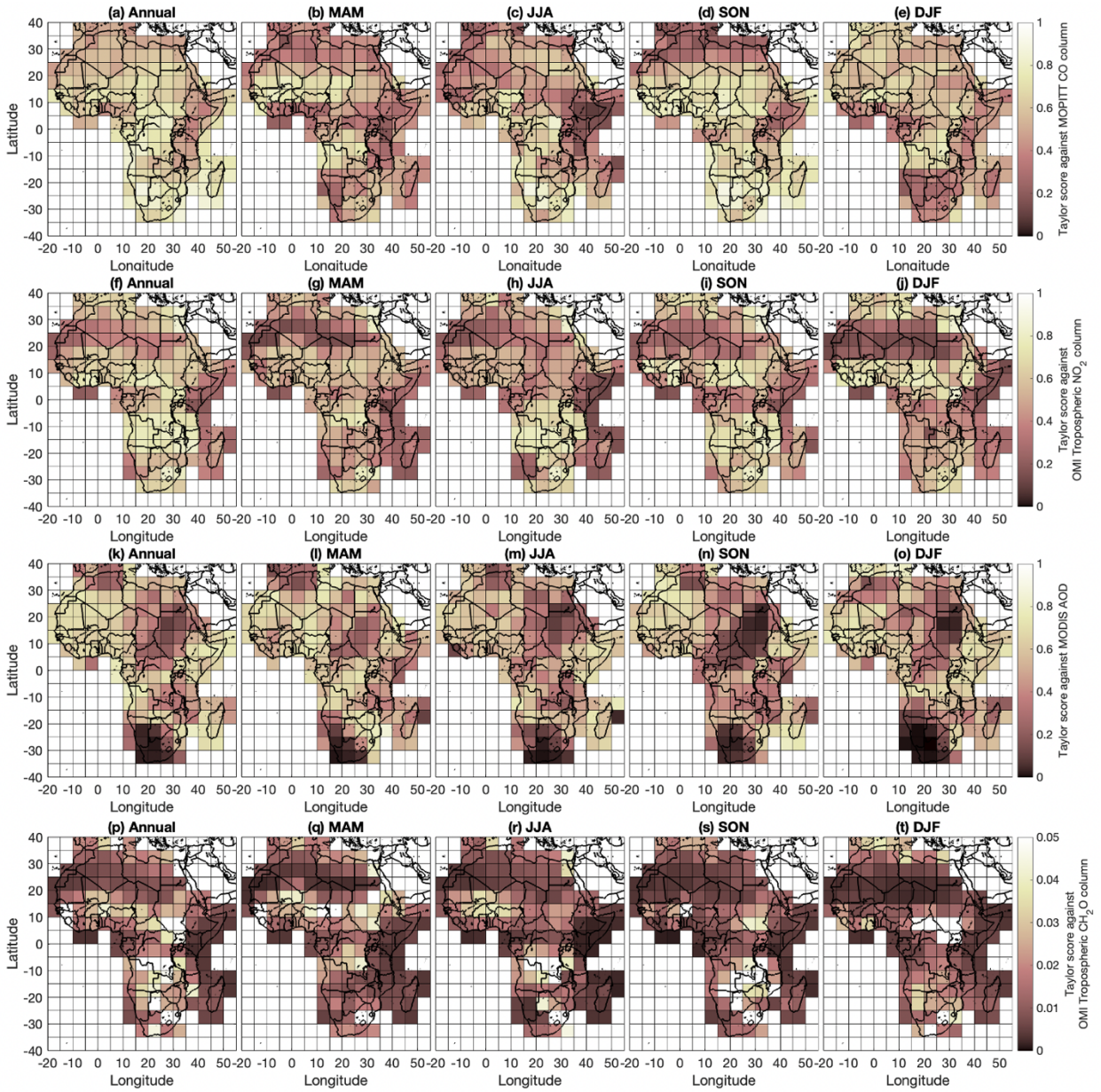

Figure S8. Spatial distribution of Taylor score of MUSICAv0 compared to satellite retrievals in each 5 degree × 5 degree (latitude × longitude) pixels. Taylor score of MUSICAv0 compared to MOPITT CO column retrievals for (a) 2017, (b) MAM (March, April, and May), (c) JJA (June, July, and August), (d) SON (September, October, and November), and (e) DJF (December, January, and February) are shown. (f-j) are the same as (a-e) but for Taylor score of MUSICAv0 compared to OMI tropospheric NO_2 column retrievals; (k-o) are the same as (a-e) but for Taylor score of MUSICAv0 compared to MODIS AOD; (p-t) are the same as (a-e) but for Taylor score of MUSICAv0 compared to OMI tropospheric HCHO column retrievals.