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Parameterizations for global thundercloud corona discharge distributions

Sergio Soler et al.

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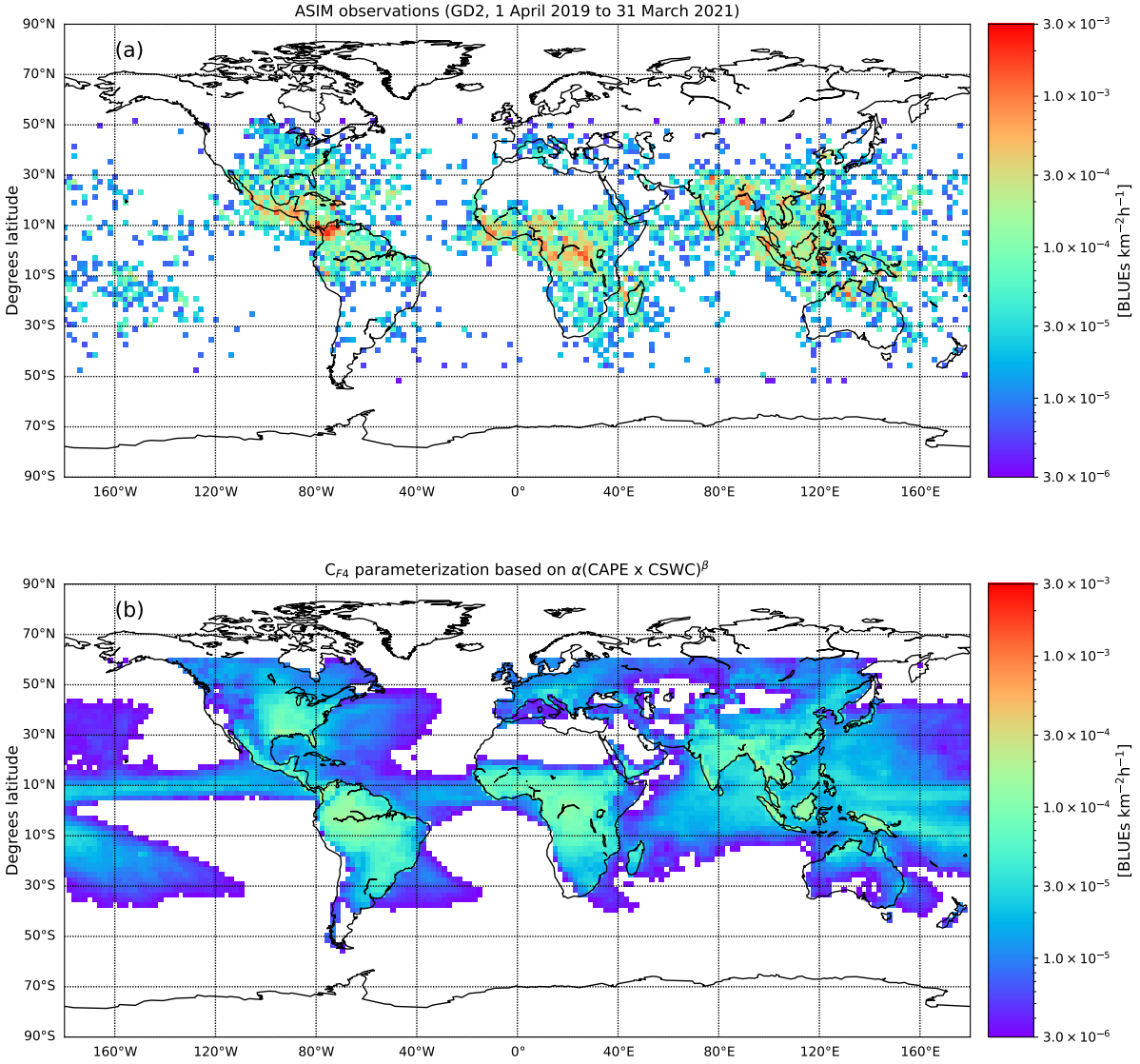

Figure S1. Two-year average (1 April 2019 through 31 March 2021) nighttime geographical distribution of global corona (BLUE) electrical activity in thunderclouds according to the GD-2 distribution derived from ASIM observations (Soler et al., 2022) (a), and annual global predictions for BLUE occurrence rate based on ERA5 hourly data introduced in the corona (BLUE) parameterizations C_{F4}. Note that the colorbars have the same scale.

1 Introduction

We present in this supplementary material a number of figures (Figure S1 through Figure S9) that complement those presented in the main text of the paper. These support figures are already commented in the main manuscript.

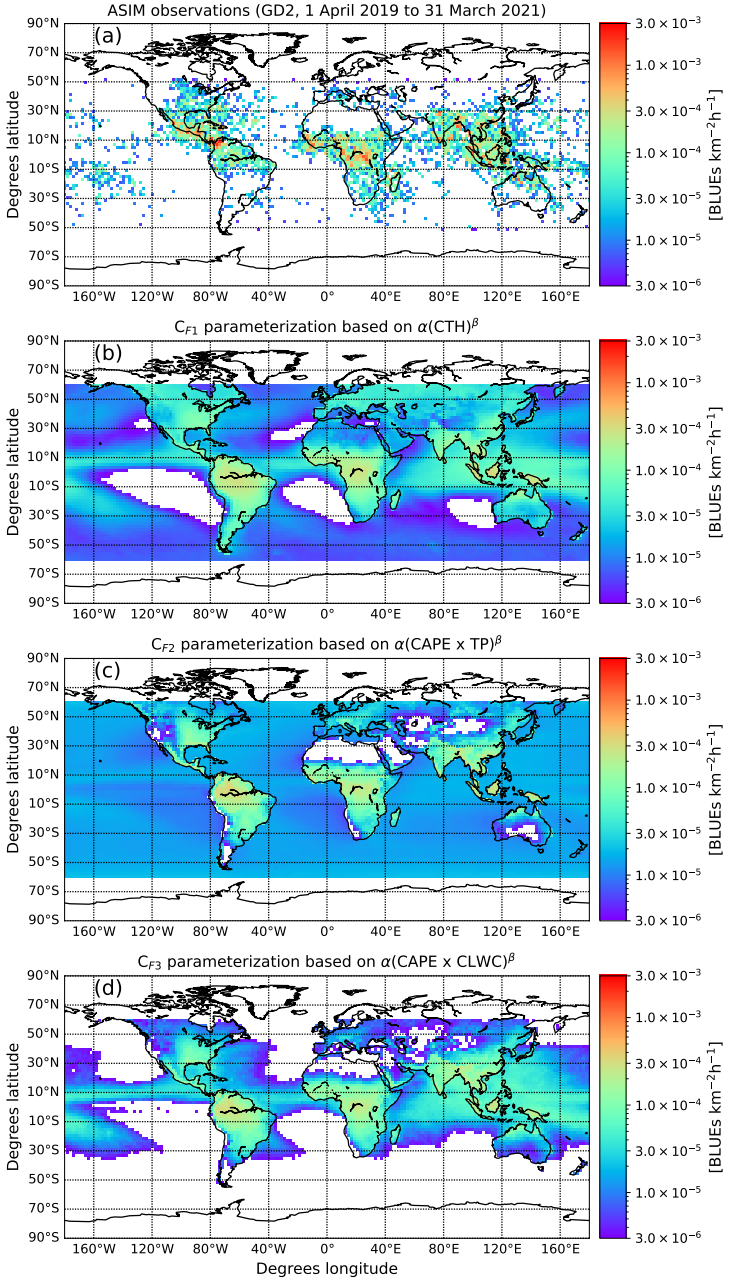

Figure S2. Two-year average (1 April 2019 through 31 March 2021) nighttime geographical distribution of global corona (BLUE) electrical activity in thunderclouds according to the GD-2 distribution derived from ASIM observations (Soler et al., 2022) (a), annual global predictions for BLUE occurrence rate based on CLARA monthly data introduced in the corona (BLUE) parameterizations C_{F1} (b), and ERA5 monthly data introduced in the corona (BLUE) parameterizations C_{F2} (c), and C_{F3} (d).

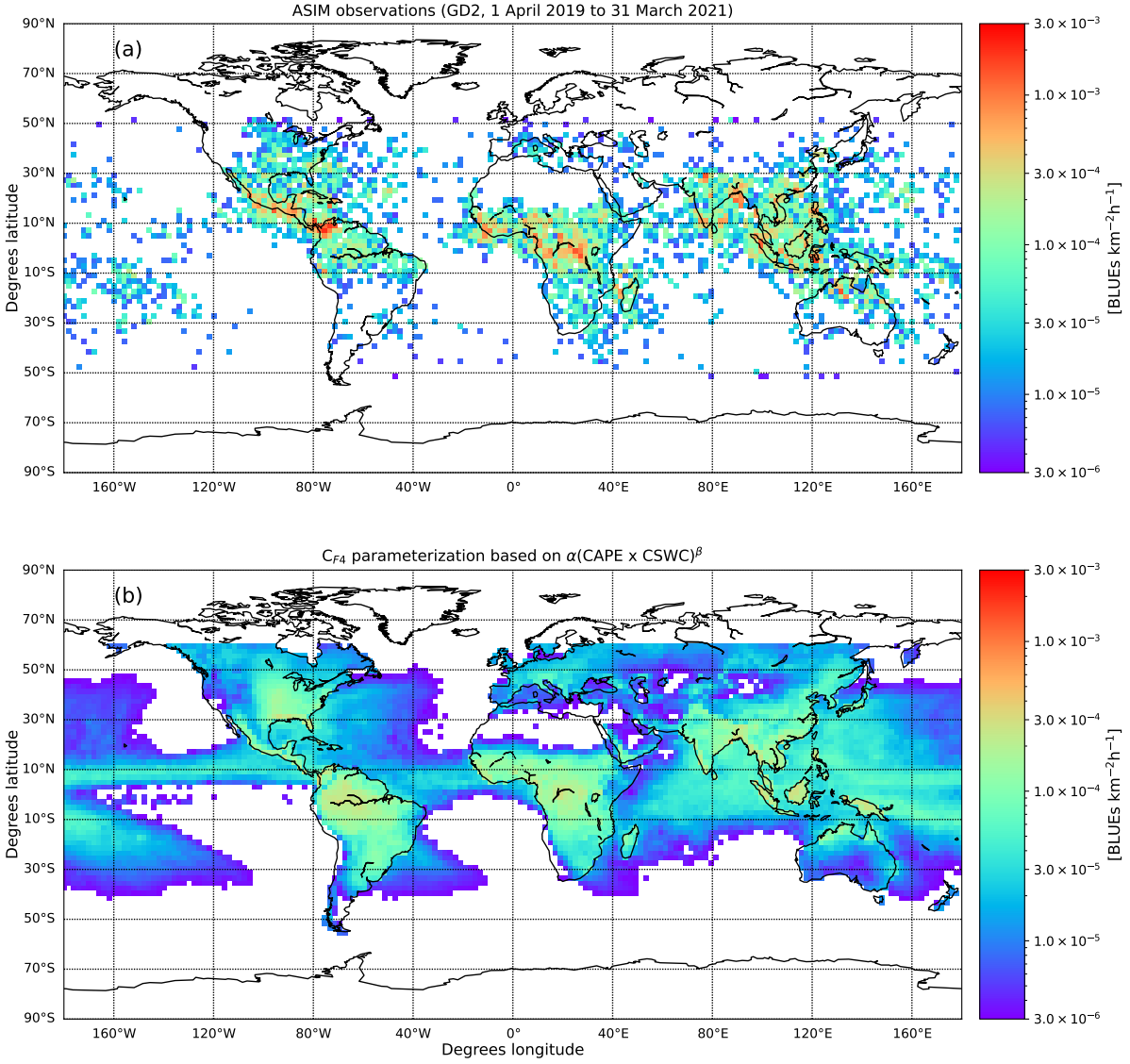

Figure S3. Two-year average (1 April 2019 through 31 March 2021) nighttime geographical distribution of global corona (BLUE) electrical activity in thunderclouds according to the GD-2 distribution derived from ASIM observations (Soler et al., 2022) (a), annual global predictions for BLUE occurrence rate based on ERA5 monthly data introduced in the corona (BLUE) parameterizations C_{F4} (b).

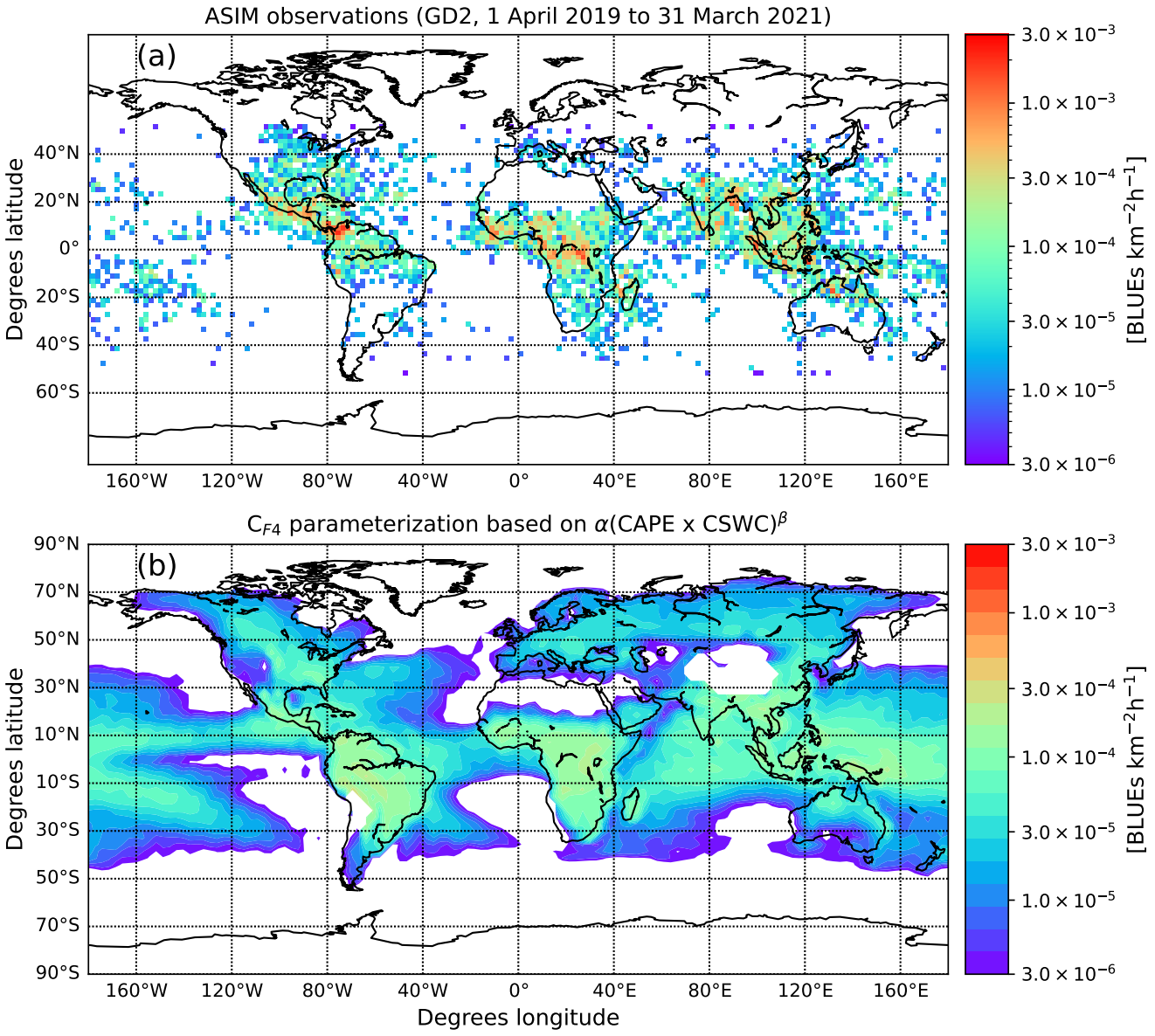

Figure S4. Two-year average (1 April 2019 through 31 March 2021) nighttime climatology of global corona (BLUE) electrical activity in thunderclouds according to GD-2 distribution derived from ASIM observations (a), annual global chemistry-climate model predictions (using 10 year simulations) for BLUE occurrence rate according to the corona parameterization C_{F4} (b). Note that the color-bars have the same scale.

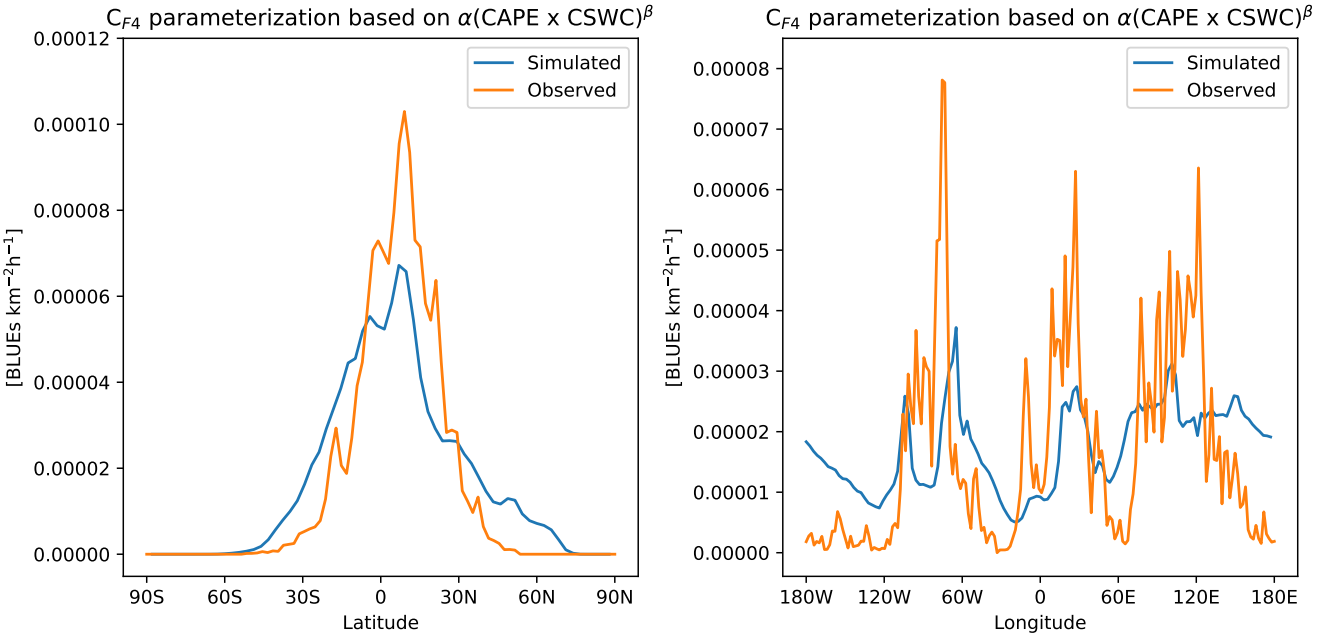

Figure S5. Zonal (latitudinal, left panels) and meridional (right panels) nighttime geographical distributions of global corona (BLUEs) electrical activity in thundercloud according to the GD-2 distribution derived from ASIM observations (orange line) (Soler et al., 2022), and zonal/meridional distributions of the annual global chemistry-climate model predictions (using 10 year simulations, blue line) for BLUE occurrence rate according to corona parameterizations C_{F4} .

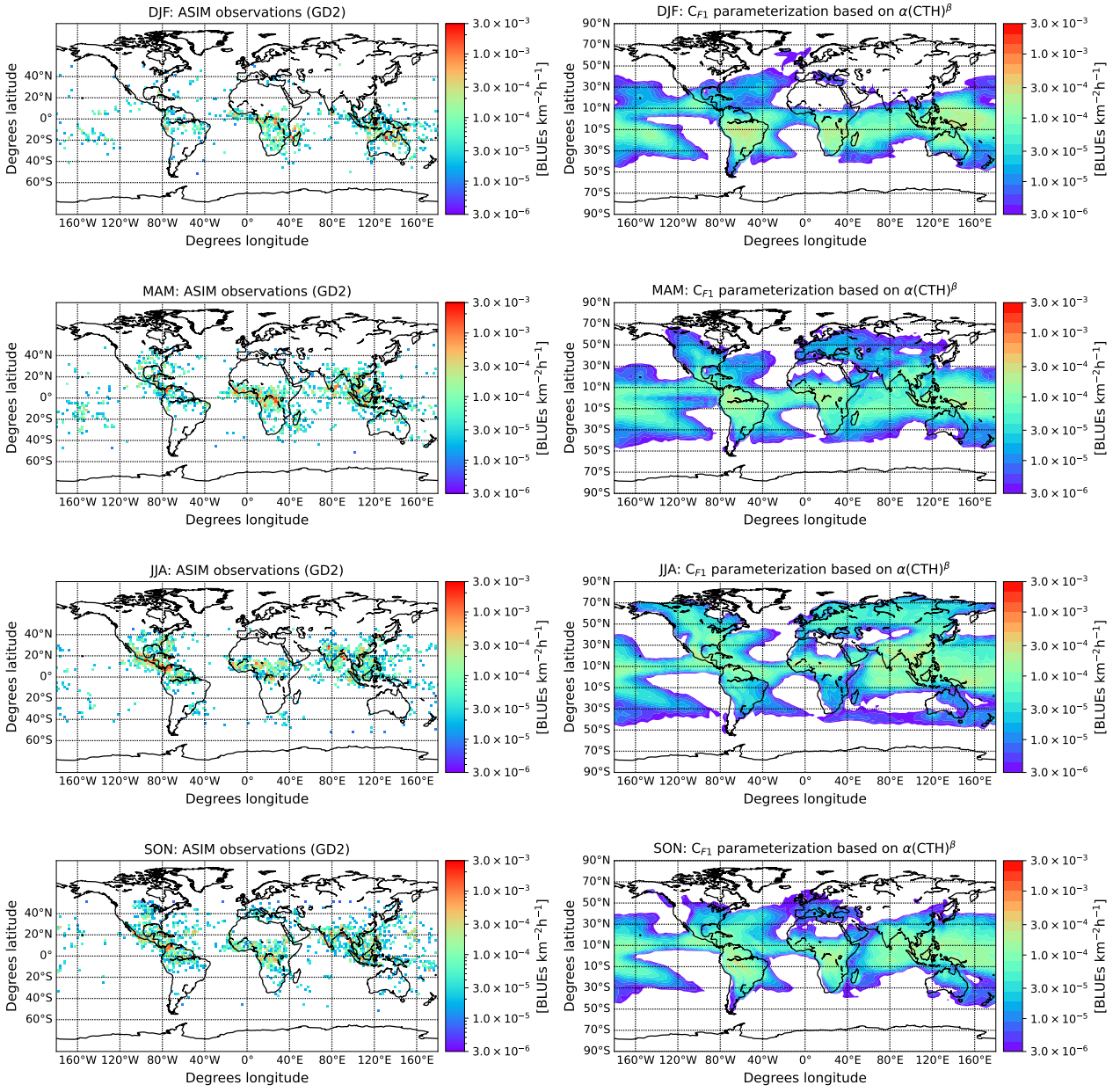

Figure S6. Two-year average (1 April 2019 through 31 March 2021) nighttime seasonal climatology of global corona (BLUE) electrical activity in thunderclouds according to GD-2 distribution derived from ASIM observations resulting in 2.60 (DJF), 3.75 (MAM), 4.01 (JJA) and 3.73 (SON) coronas (or BLUEs) s^{-1} (left column), and global annual average chemistry-climate model predictions (using 10 year simulations) for seasonal BLUE occurrence rate and geographical distribution according to the corona parameterization C_{F1} resulting in 3.33 (DJF), 3.42 (MAM), 3.81 (JJA) and 3.37 (SON) coronas (or BLUEs) s^{-1} (right column). Note that the color-bars have the same scale.

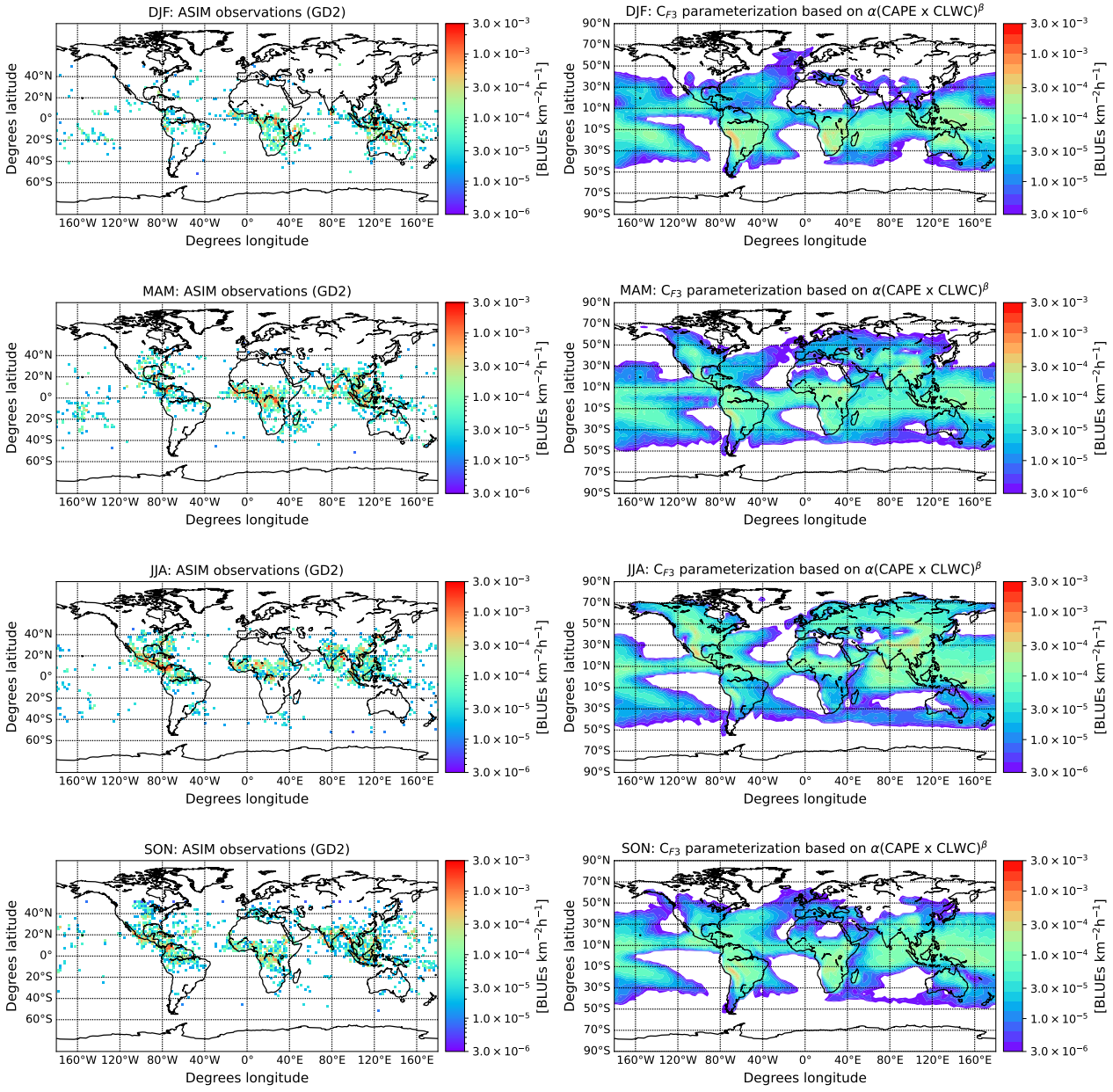

Figure S7. Two-year average (1 April 2019 through 31 March 2021) nighttime seasonal climatology of global corona (BLUE) electrical activity in thunderclouds according to GD-2 distribution derived from ASIM observations resulting in 2.60 (DJF), 3.75 (MAM), 4.01 (JJA) and 3.73 (SON) coronas (or BLUEs) s^{-1} (left column), and global annual average chemistry-climate model predictions (using 10 year simulations) for seasonal BLUE occurrence rate and geographical distribution according to the corona parameterization C_{F3} resulting in 3.22 (DJF), 3.43 (MAM), 3.96 (JJA) and 3.28 (SON) coronas (or BLUEs) s^{-1} (right column). Note that the color-bars have the same scale.

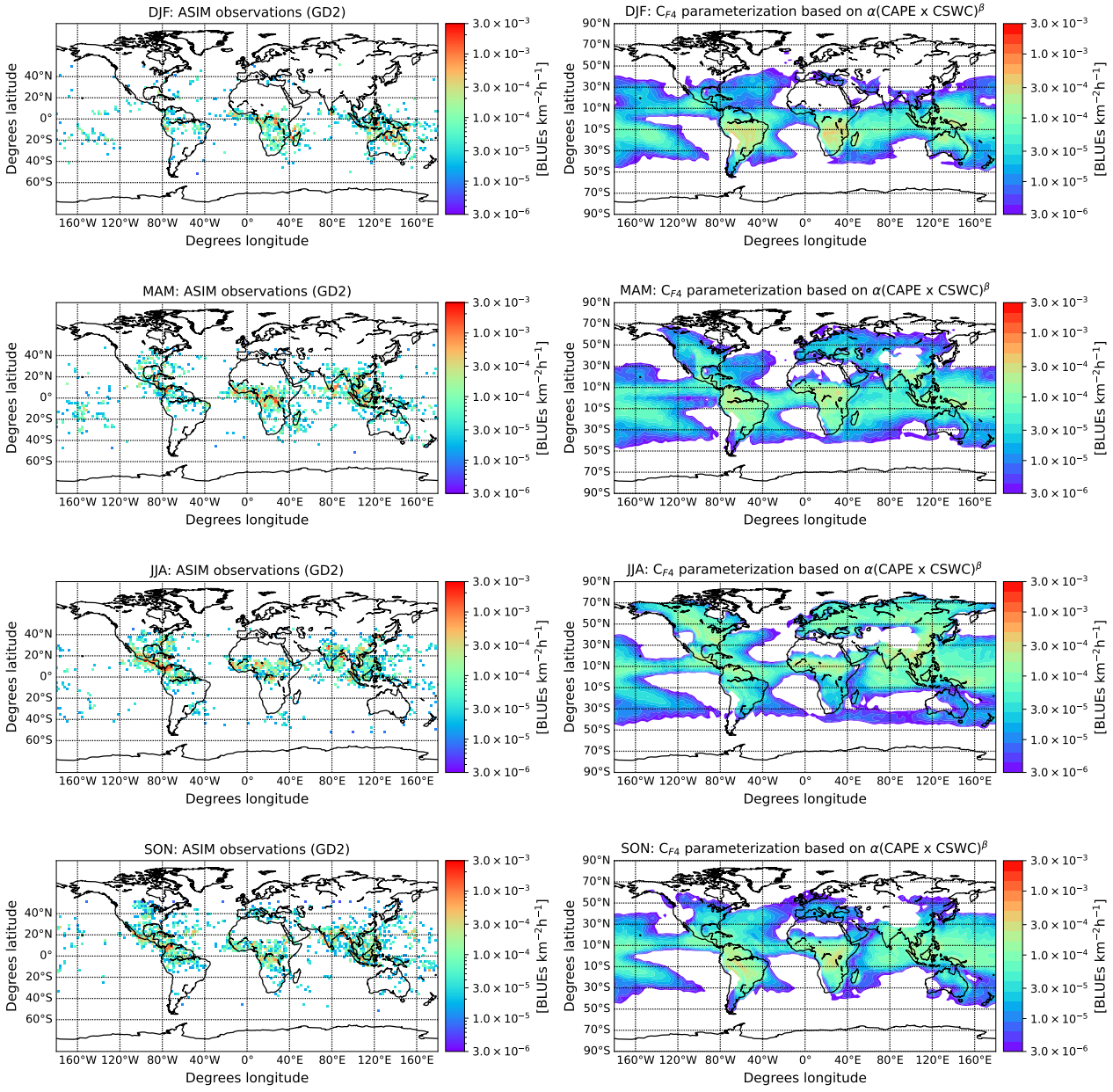

Figure S8. Two-year average (1 April 2019 through 31 March 2021) nighttime seasonal climatology of global corona (BLUE) electrical activity in thunderclouds according to GD-2 distribution derived from ASIM observations resulting in 2.60 (DJF), 3.75 (MAM), 4.01 (JJA) and 3.73 (SON) coronas (or BLUEs) s^{-1} (left column), and global annual average chemistry-climate model predictions (using 10 year simulations) for seasonal BLUE occurrence rate and geographical distribution according to the corona parameterization C_{F4} resulting in 3.26 (DJF), 3.39 (MAM), 3.93 (JJA) and 3.33 (SON) coronas (or BLUEs) s^{-1} (right column). Note that the color-bars have the same scale.

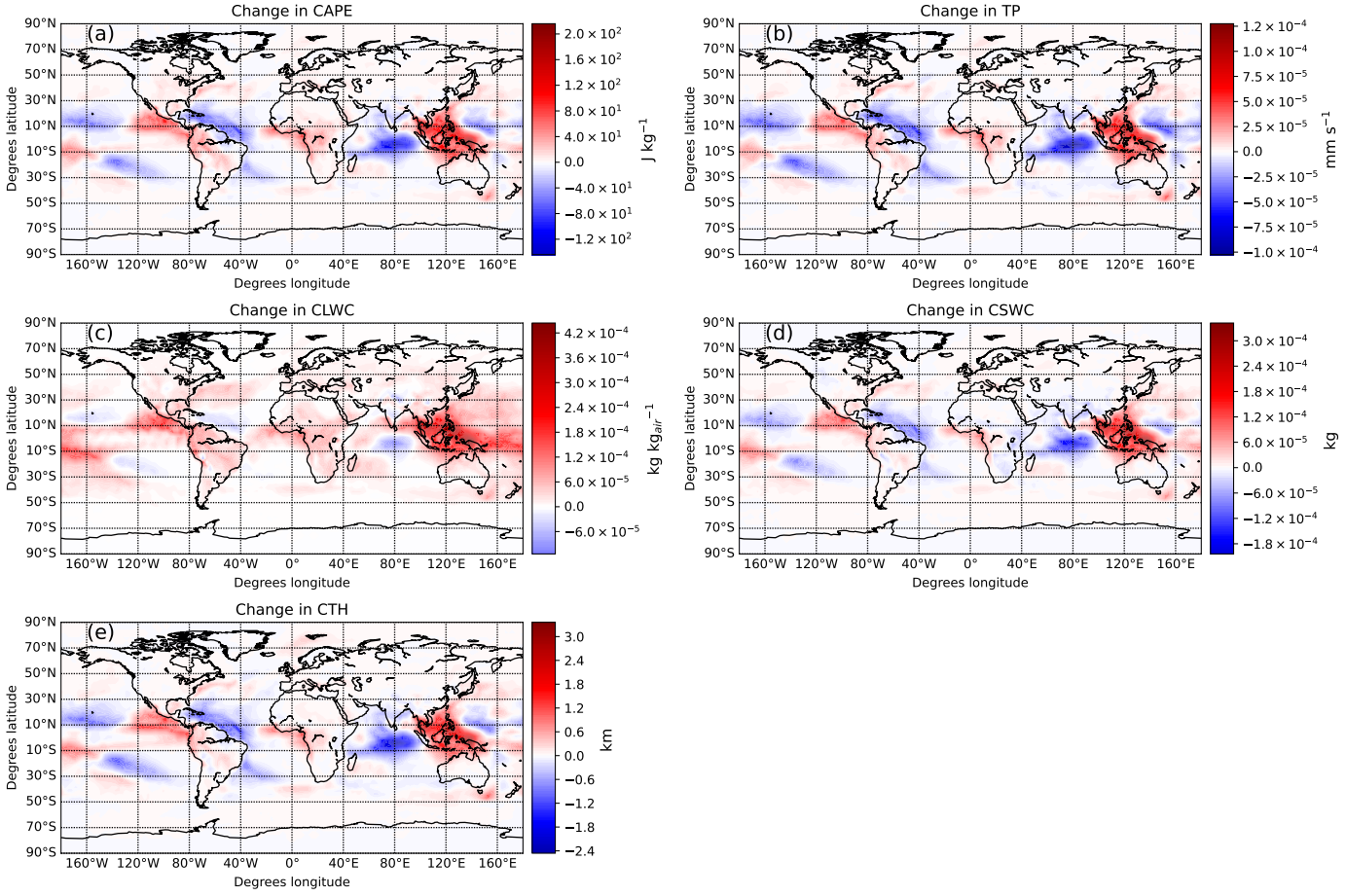

Figure S9. Annually averaged change of CAPE, Total Precipitation (TP), Cloud Liquid Water Content (CLWC) at 440 hPa, Cloud Snow Water Content (CSWC), and Cloud Top Height (CTH) at 440 hPa. The values are taken only during thunderstorm occurrence. Changes have been calculated between the Representative Concentration Pathway RCP6.0 and present-day simulations.

References

Soler, S., Gordillo-Vázquez, F., Pérez-Invernón, F., Luque, A., Li, D., Neubert, T., Chanrion, O., Reglero, V., Navarro-González, J., and Østgaard, N.: Global distribution of key features of streamer corona discharges in thunderclouds, Journal of Geophysical Research: Atmospheres, p. e2022JD037535, 2022.