Supplement to "Evaluation of the Convective Cloud Field Model (CCFM) with a new treatment of triggering by explicit sub-cloud dry convection in the ECHAM6–HAM2 global model"

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July 8, 2016

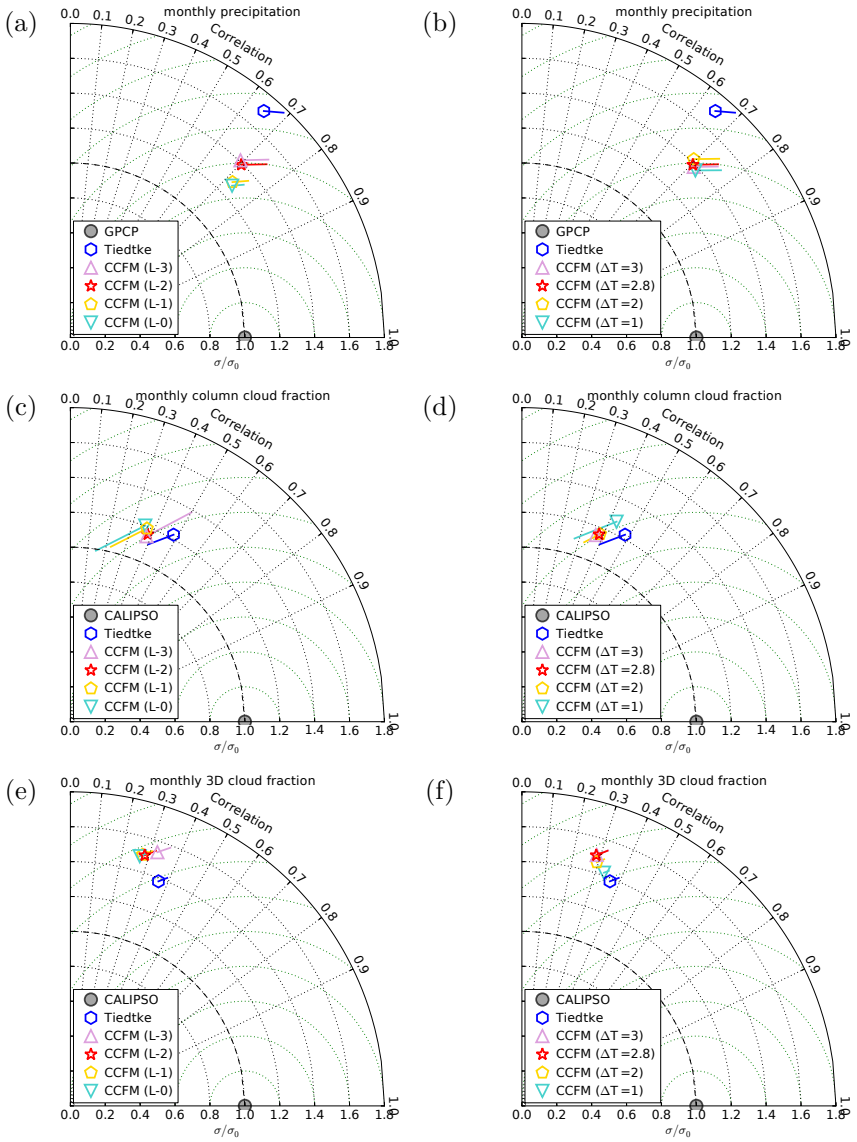

Figure S1: Taylor diagrams comparing (a,d) monthly mean precipitation, (b,e) COSP-simulated column cloud fraction, and (c,f) COSP-simulated 3D cloud fraction between one-year simulations using ECHAM–HAM with Tiedtke–Nordeng convection and with CCFM in each configuration, and the Global Precipitation Climatology Project (GPCP) and CALIPSO–GOCCP respectively. The left column (a–c) shows the use of different initiation levels in the CCFM sub-cloud model (all with a temperature perturbation of 2.8 K; the right column (d–f) shows the use of different temperature perturbations (all in L−2 configuration). The line segments extending from each point indicate the normalised mean bias as suggested in Taylor (2001).

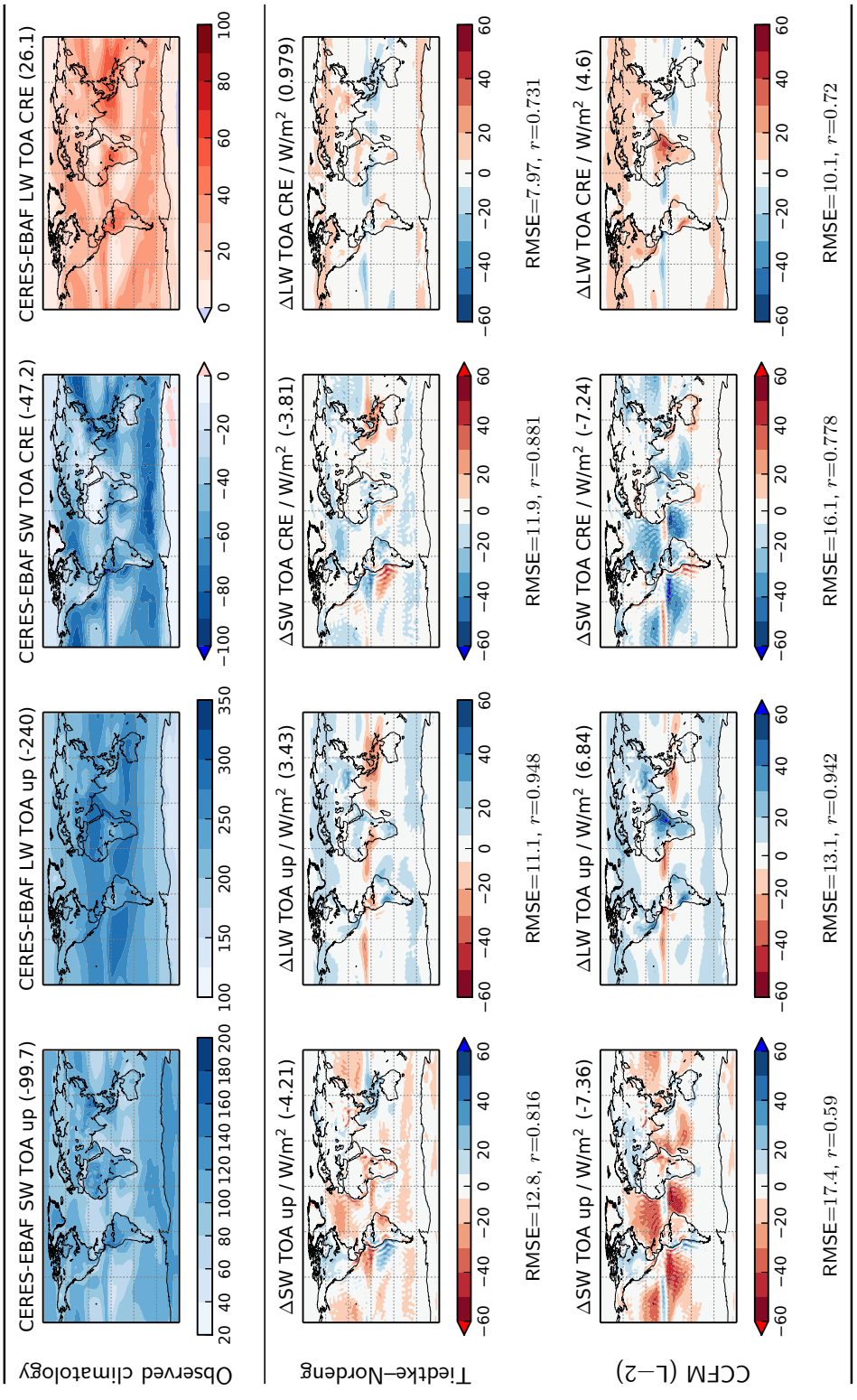

Figure S2: Difference in short- and long-wave upwelling radiative fluxes and cloud radiative effects at the top of the atmosphere between 30-year AMIP-type simulations using ECHAM–HAM with Tiedtke–Nordeng and CCFM (L−2) convection, and a CERES–EBAF climatology.

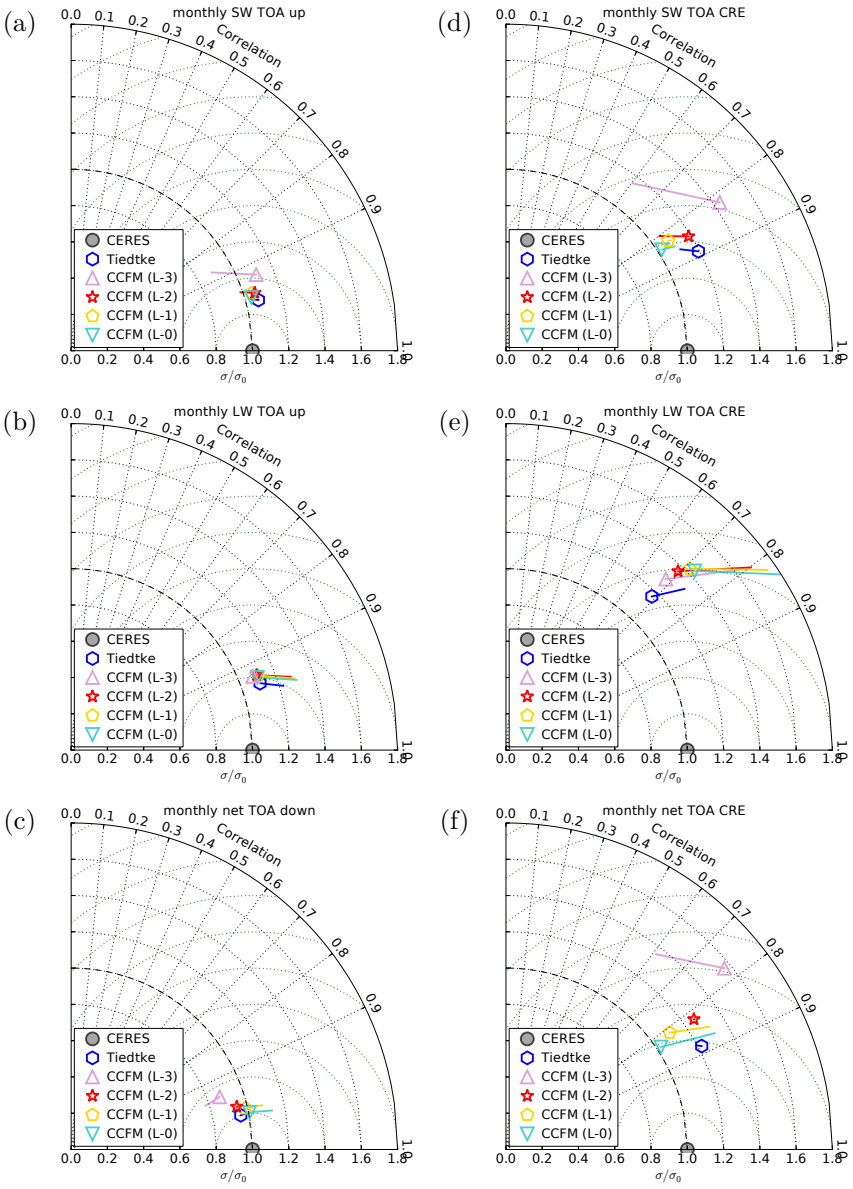

Figure S3: Taylor diagrams comparing monthly mean short-wave (a), long-wave (b) and net (c) radiative fluxes (left) and corresponding cloud radiative effects (right, d–f) at the top of the atmosphere between one-year simulations using ECHAM–HAM with Tiedtke–Nordeng convection and with CCFM in each configuration, and a CERES–EBAF climatology. The line segments extending from each point indicate the normalised mean bias as suggested in Taylor (2001).

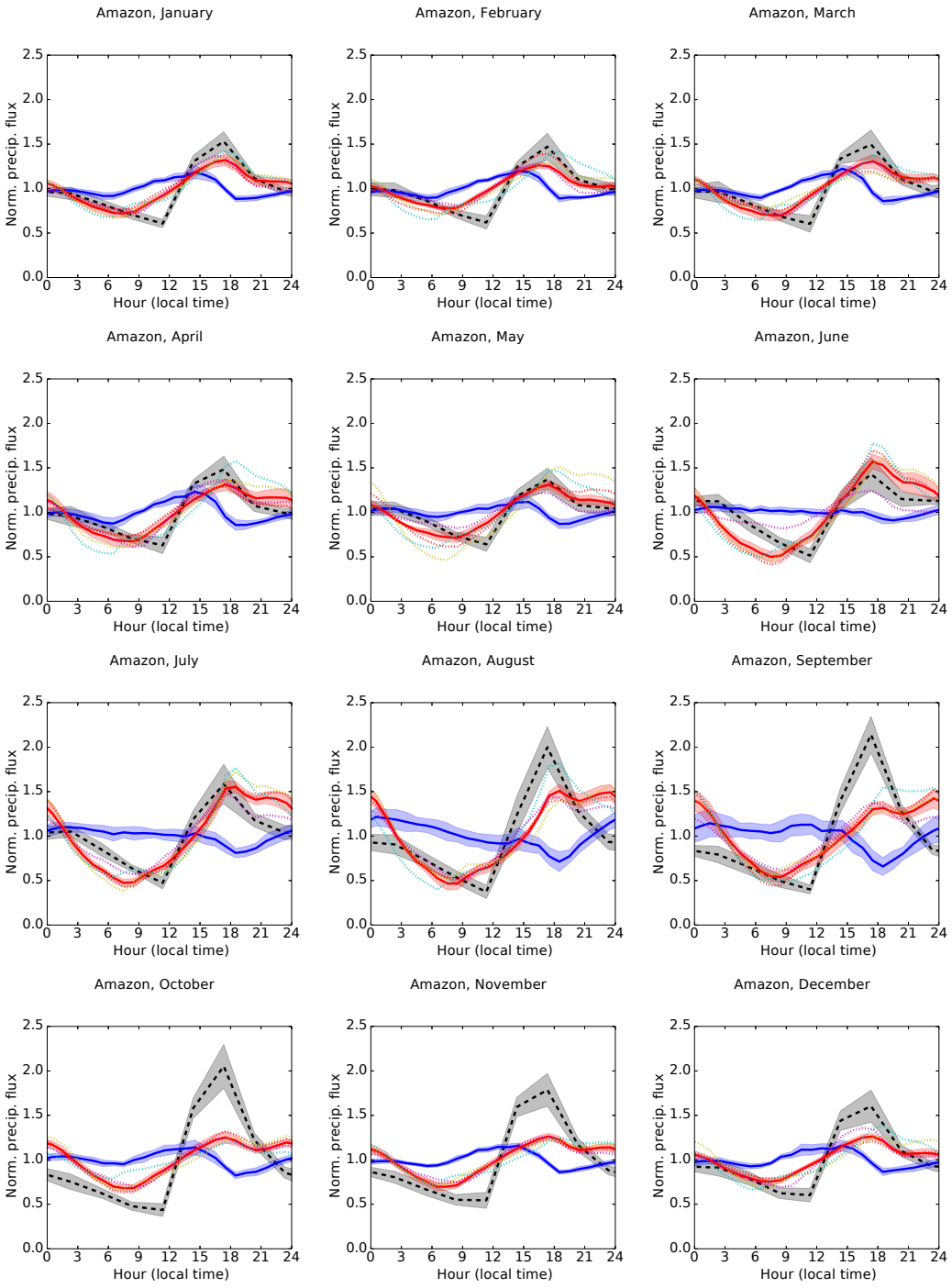

Figure S4: Normalised diurnal cycles of precipitation in the Amazon region from a ten-year overlap between the TRMM 3B42 product and AMIP-type simulations using ECHAM–HAM with Tiedtke–Nordeng and CCFM (L−2) convection. The shaded regions indicate the inter-annual standard deviation of each data set. The dotted lines show the cycles from one-year simulations using alternative CCFM configurations. The diurnal cycles are in the local time of each region. Line colours and styles as per Figure 9 in the main article.

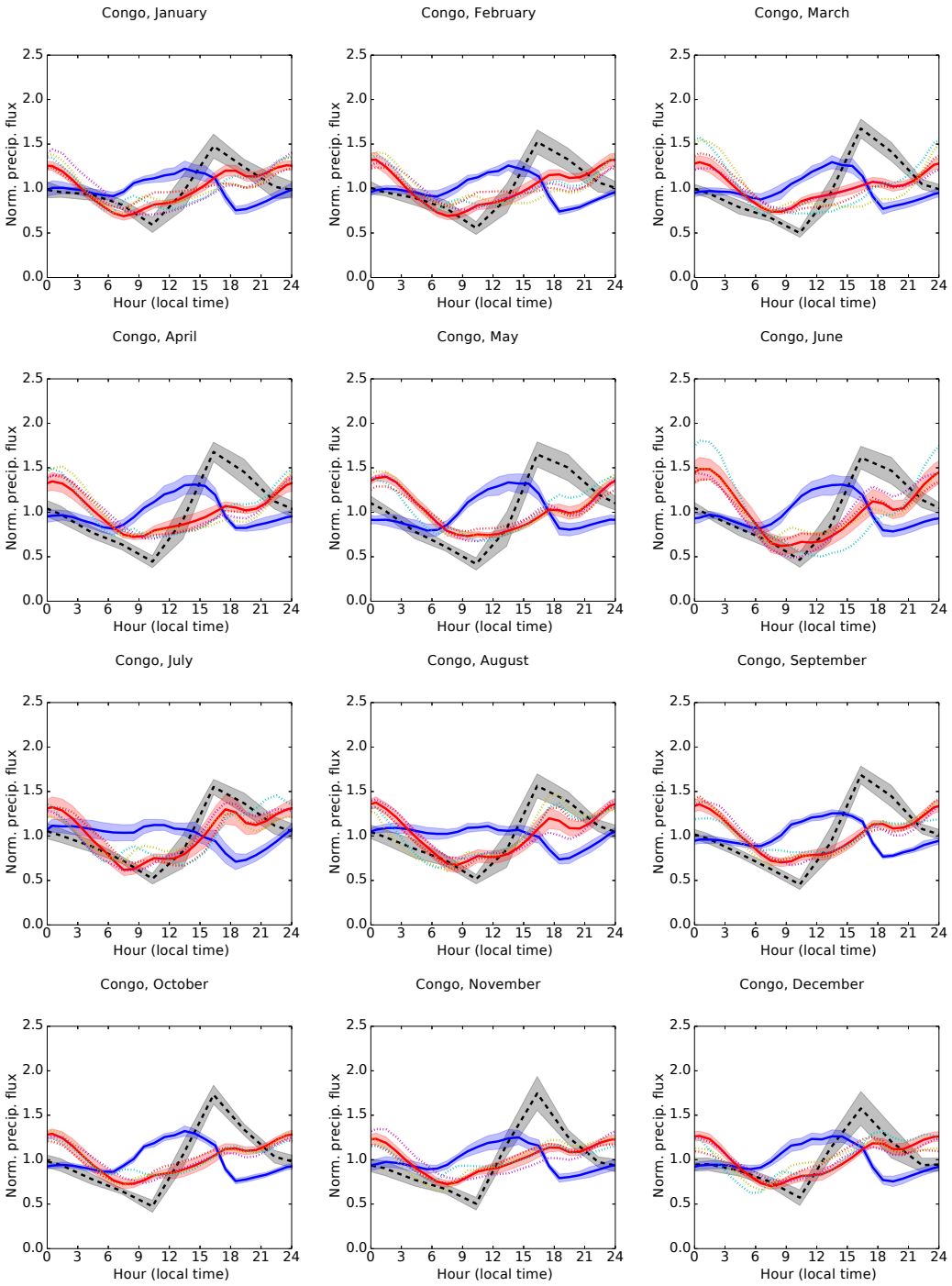

Figure S5: Normalised diurnal cycles of precipitation in the Congo region from a ten-year overlap between the TRMM 3B42 product and AMIP-type simulations using ECHAM–HAM with Tiedtke–Nordeng and CCFM (L−2) convection. The shaded regions indicate the interannual standard deviation of each data set. The dotted lines show the cycles from one-year simulations using alternative CCFM configurations. The diurnal cycles are in the local time of each region. Line colours and styles as per Figure 9 in the main article.

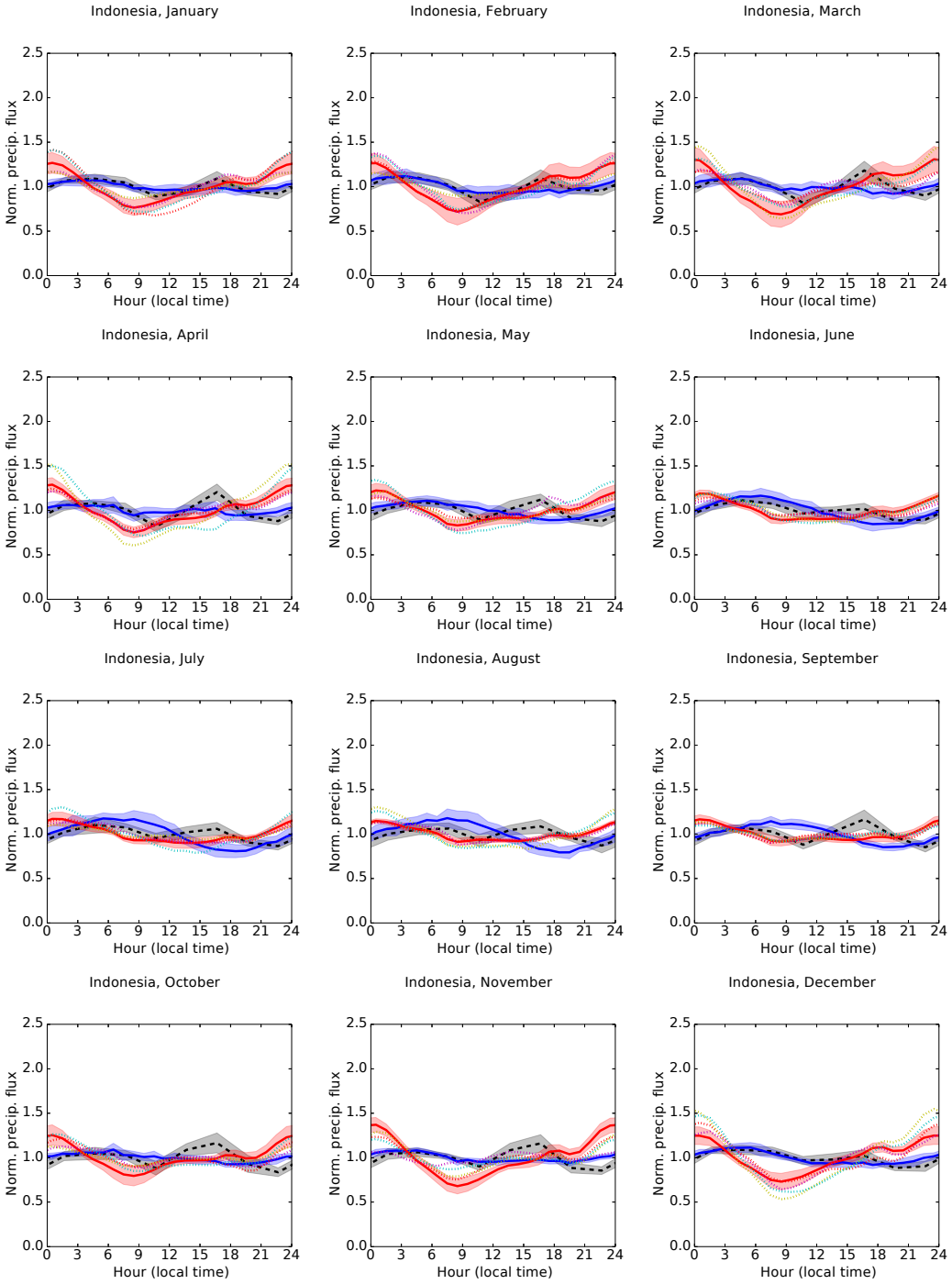

Figure S6: Normalised diurnal cycles of precipitation in the Indonesia region from a ten-year overlap between the TRMM 3B42 product and AMIP-type simulations using ECHAM–HAM with Tiedtke–Nordeng and CCFM (L−2) convection. The shaded regions indicate the inter-annual standard deviation of each data set. The dotted lines show the cycles from one-year simulations using alternative CCFM configurations. The diurnal cycles are in the local time of each region. Line colours and styles as per Figure 9 in the main article.

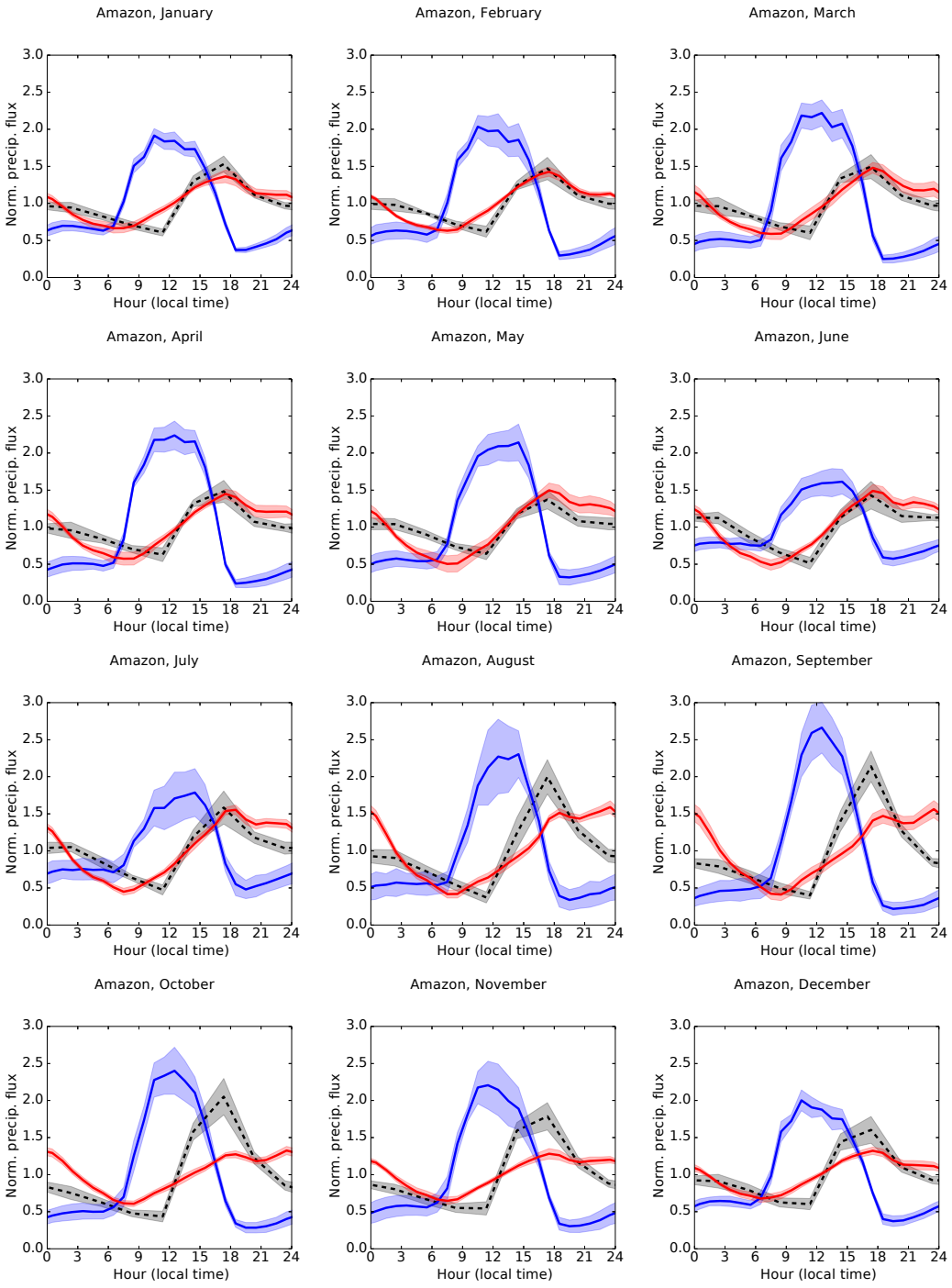

Figure S7: Normalised diurnal cycles of precipitation in the Amazon region from a ten-year overlap between the TRMM 3B42 product and AMIP-type simulations using ECHAM (without HAM) with Tiedtke–Nordeng and CCFM (L−2) convection. The shaded regions indicate the interannual standard deviation of each data set. The dotted lines show the cycles from one-year simulations using alternative CCFM configurations. The diurnal cycles are in the local time of each region. Line colours and styles as per Figure 9 in the main article.

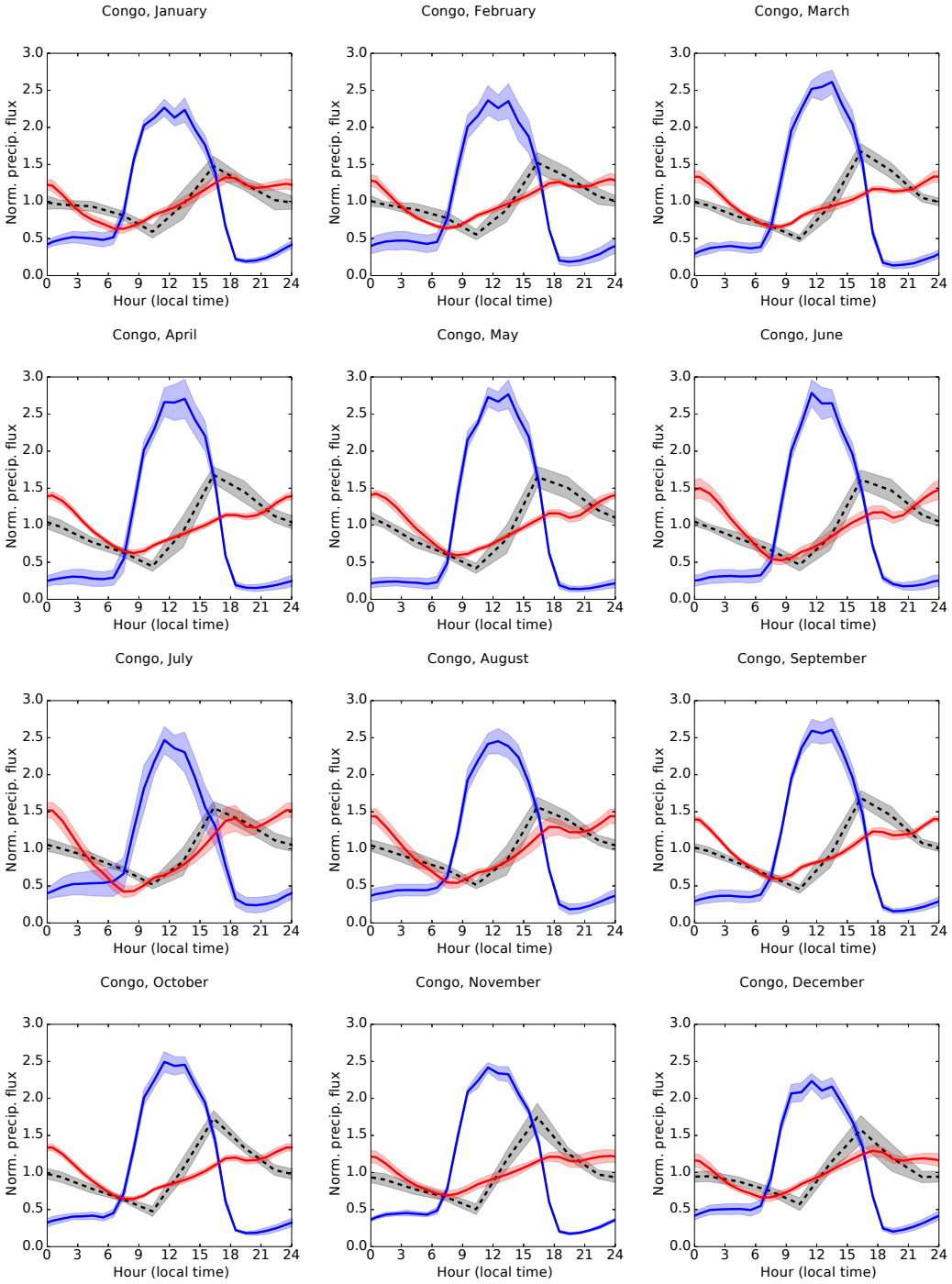

Figure S8: Normalised diurnal cycles of precipitation in the Congo region from a ten-year overlap between the TRMM 3B42 product and AMIP-type simulations using ECHAM (without HAM) with Tiedtke–Nordeng and CCFM (L−2) convection. The shaded regions indicate the interannual standard deviation of each data set. The dotted lines show the cycles from one-year simulations using alternative CCFM configurations. The diurnal cycles are in the local time of each region. Line colours and styles as per Figure 9 in the main article.

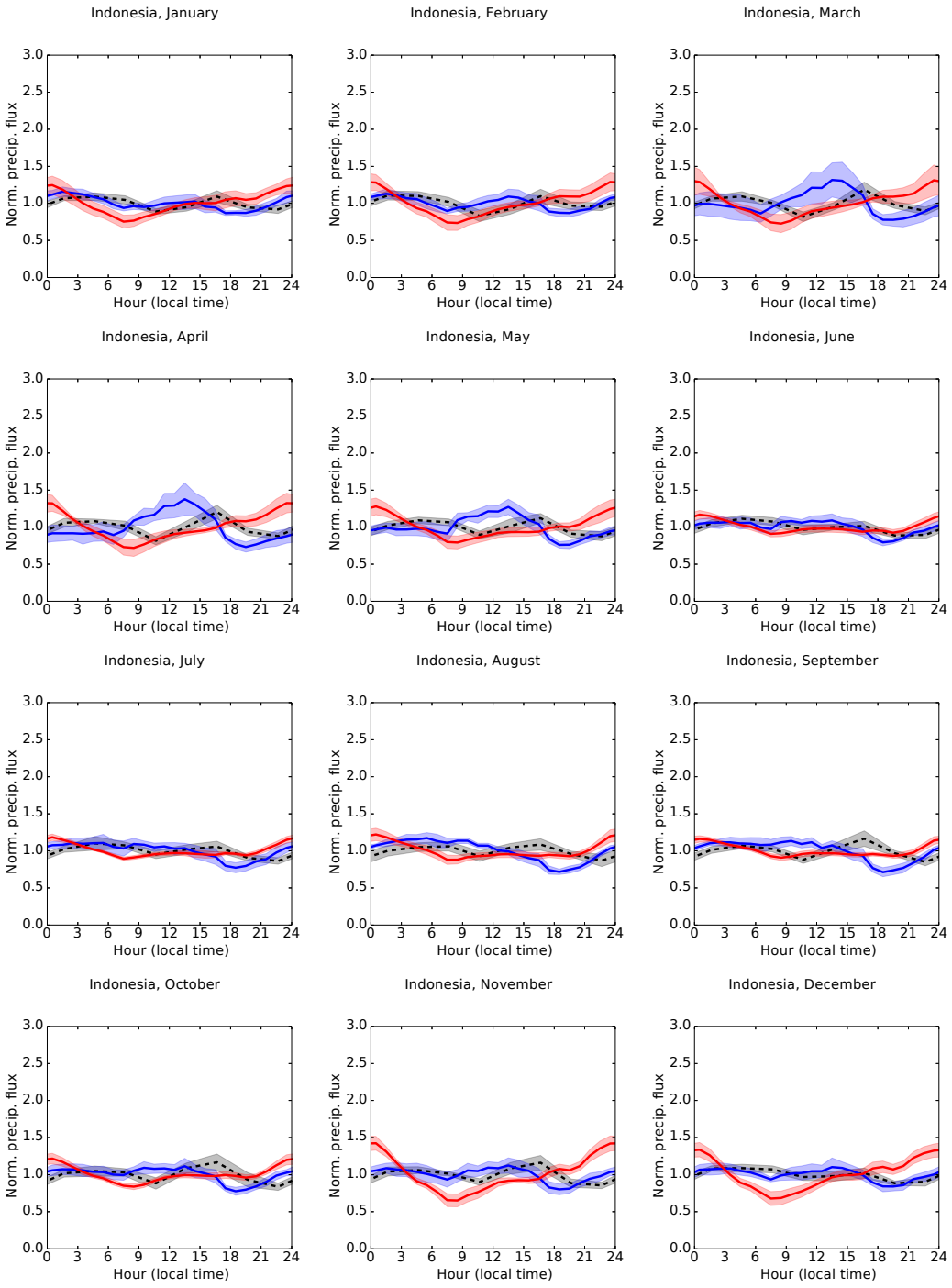

Figure S9: Normalised diurnal cycles of precipitation in the Indonesia region from a ten-year overlap between the TRMM 3B42 product and AMIP-type simulations using ECHAM (without HAM) with Tiedtke–Nordeng and CCFM (L−2) convection. The shaded regions indicate the interannual standard deviation of each data set. The dotted lines show the cycles from one-year simulations using alternative CCFM configurations. The diurnal cycles are in the local time of each region. Line colours and styles as per Figure 9 in the main article.