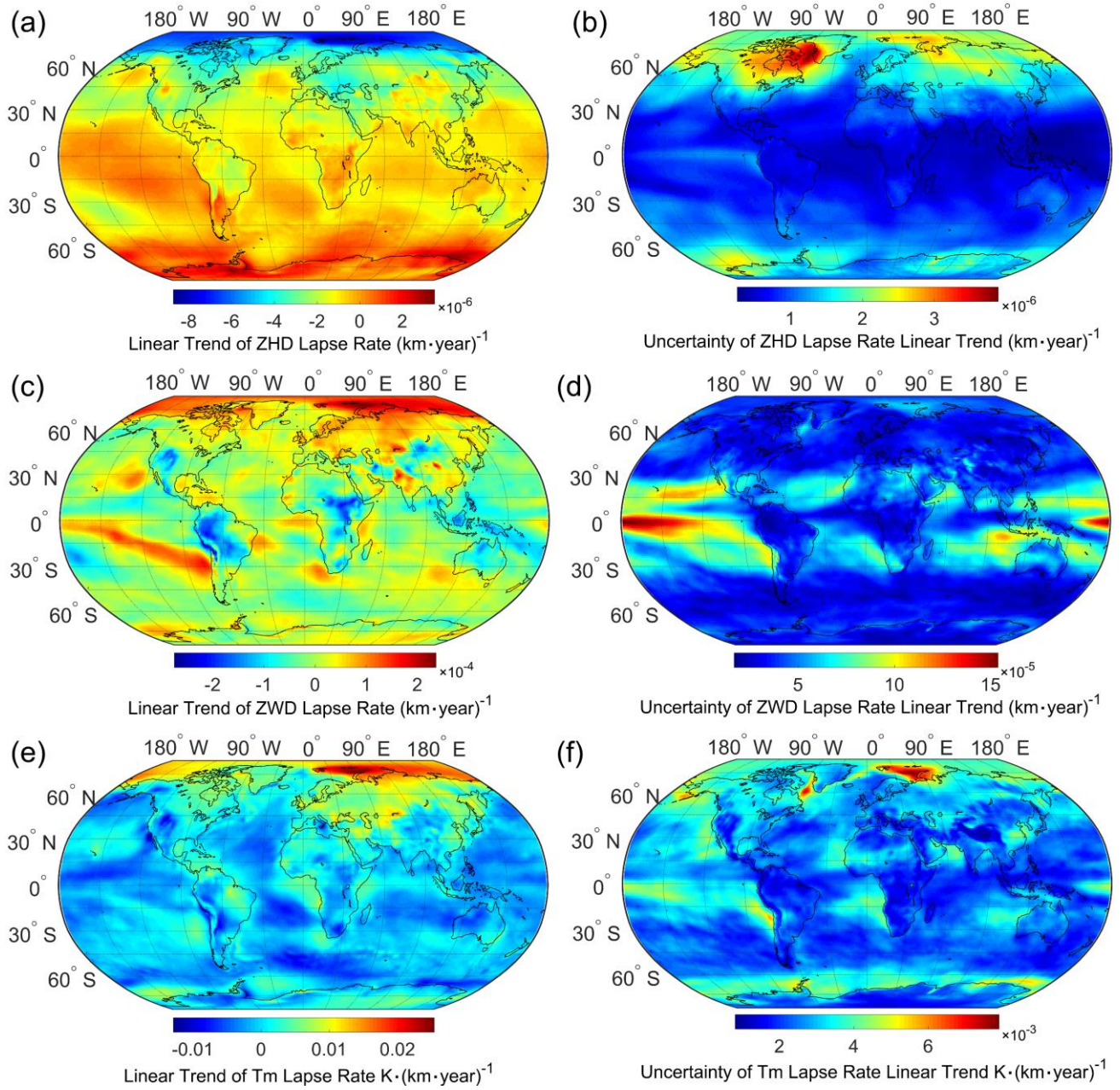
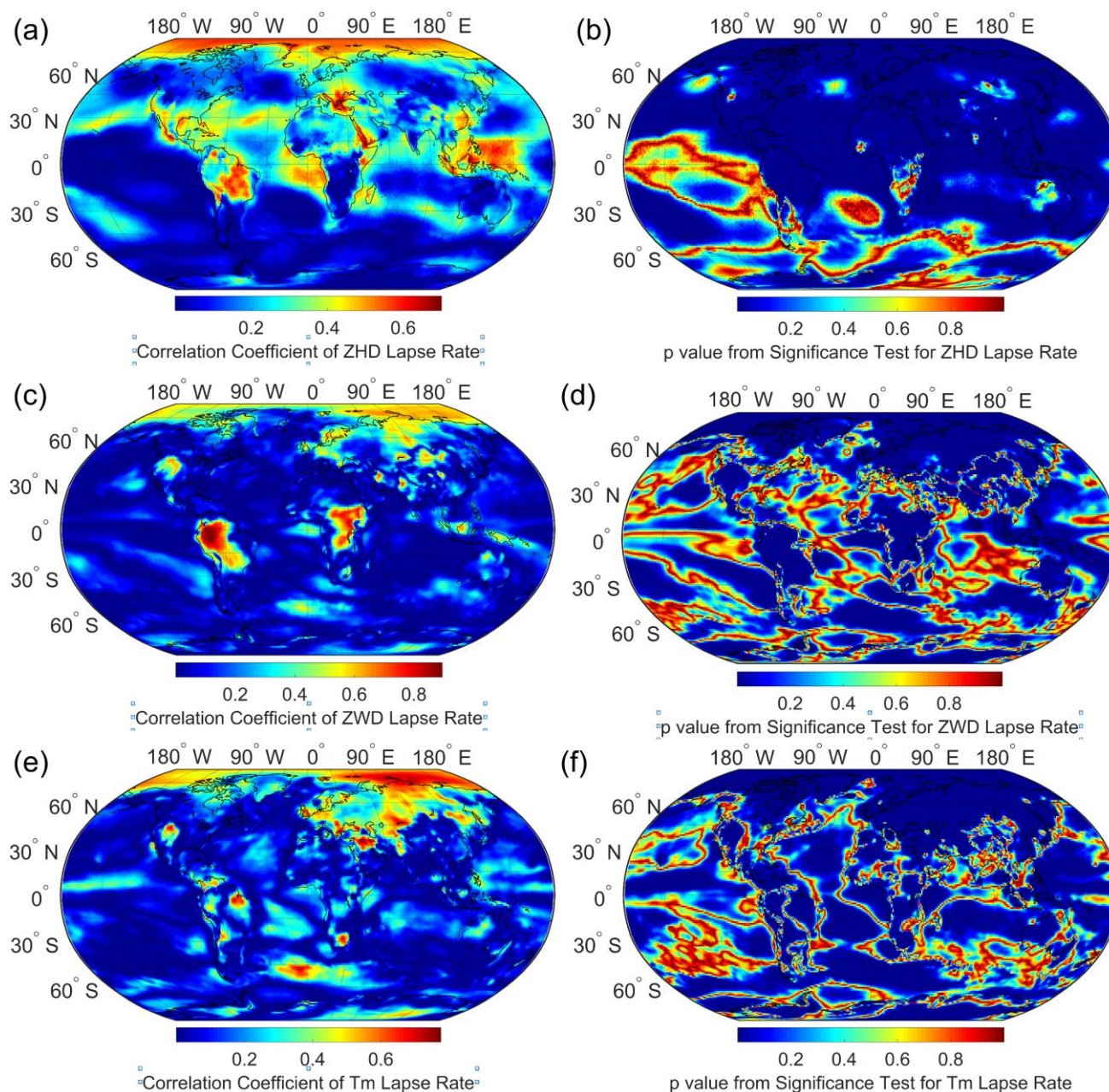


**Figure S1.** Global correlation coefficients and p values from significance tests of ZHD, ZWD, and  $T_m$  derived from European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-Interim data from 1979 to 2017.



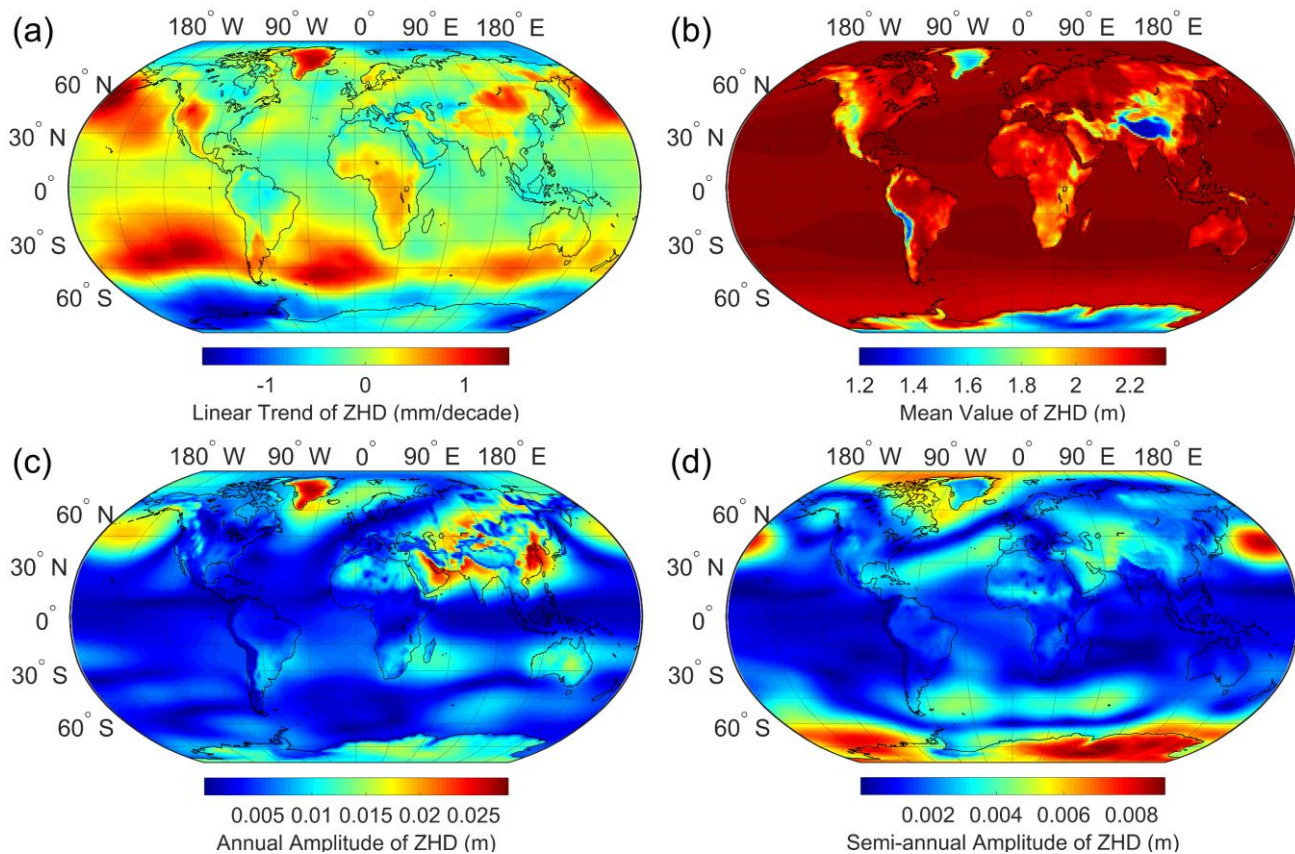
**Figure S2.** Global linear trends and corresponding uncertainties at the 95% confidence level of lapse rates of ZHD, ZWD, and  $T_m$  derived from European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-Interim data from 1979 to 2017. The positive linear trend means the values of lapse rates of tropospheric delay or  $T_m$  show an increasing trend, and the negative trend means they show a decreasing trend.



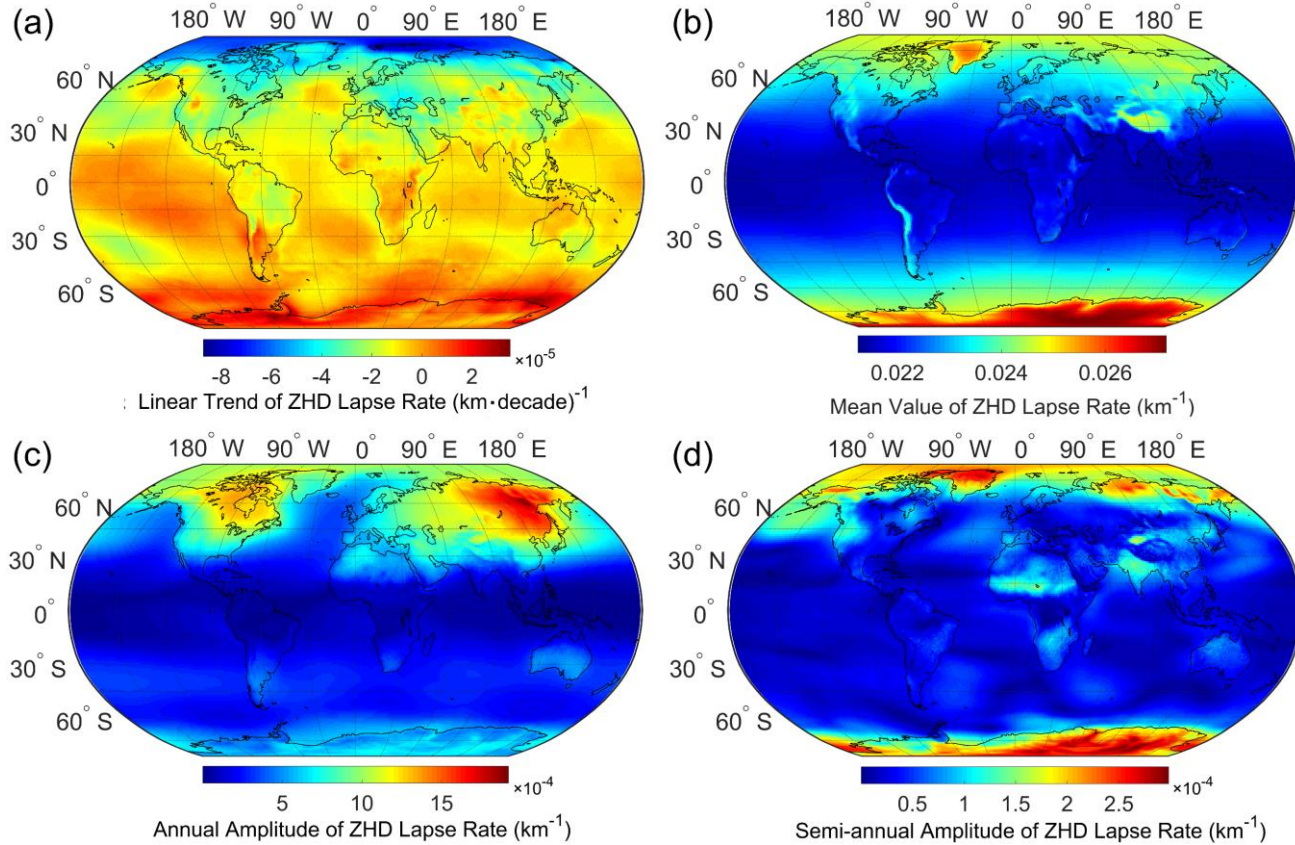


**Figure S3.** Global correlation coefficients and p values from significance tests of lapse rates of ZHD, ZWD, and  $T_m$  derived from European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-Interim data from 1979 to 2017.



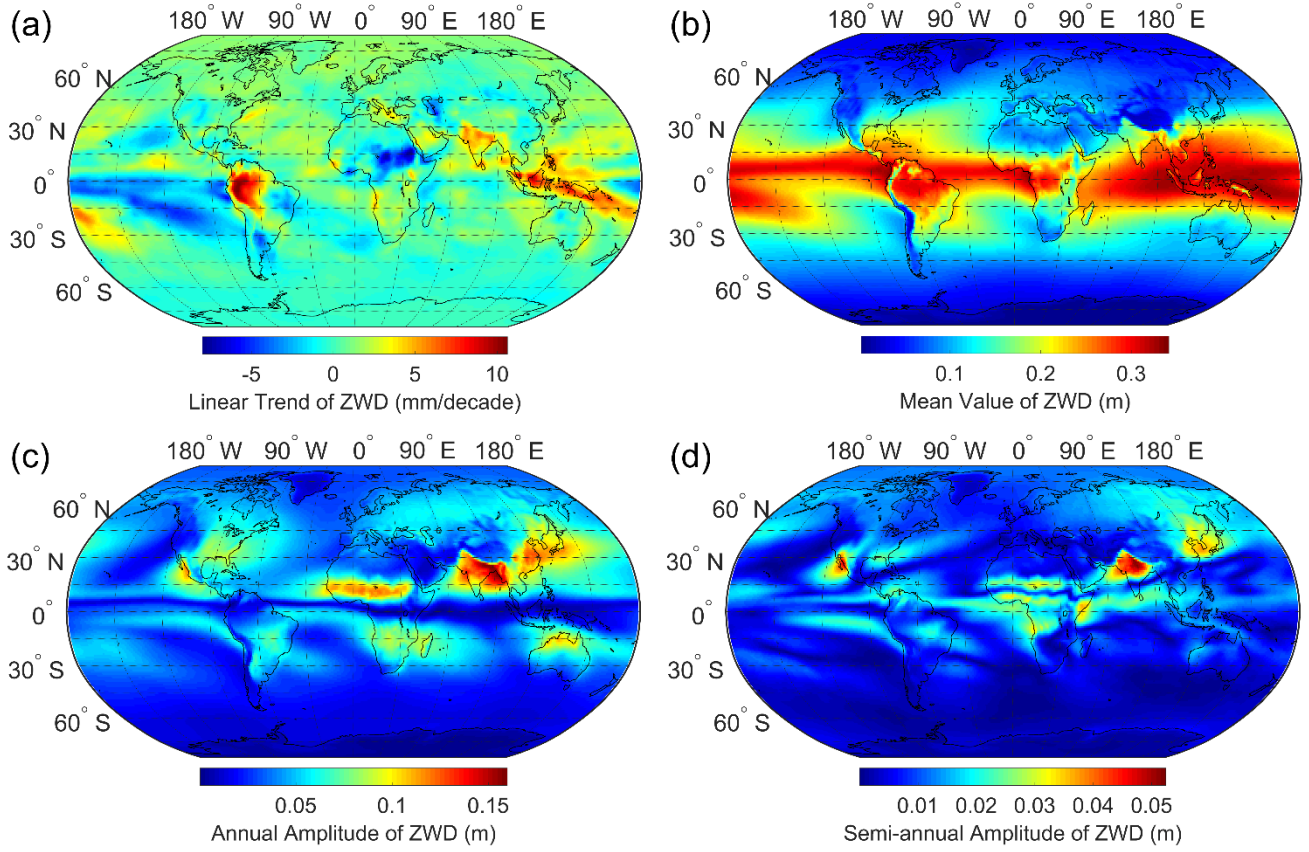


**Figure S4.** Global linear trends, mean values, annual amplitudes, and semi-annual amplitudes of ZHD.

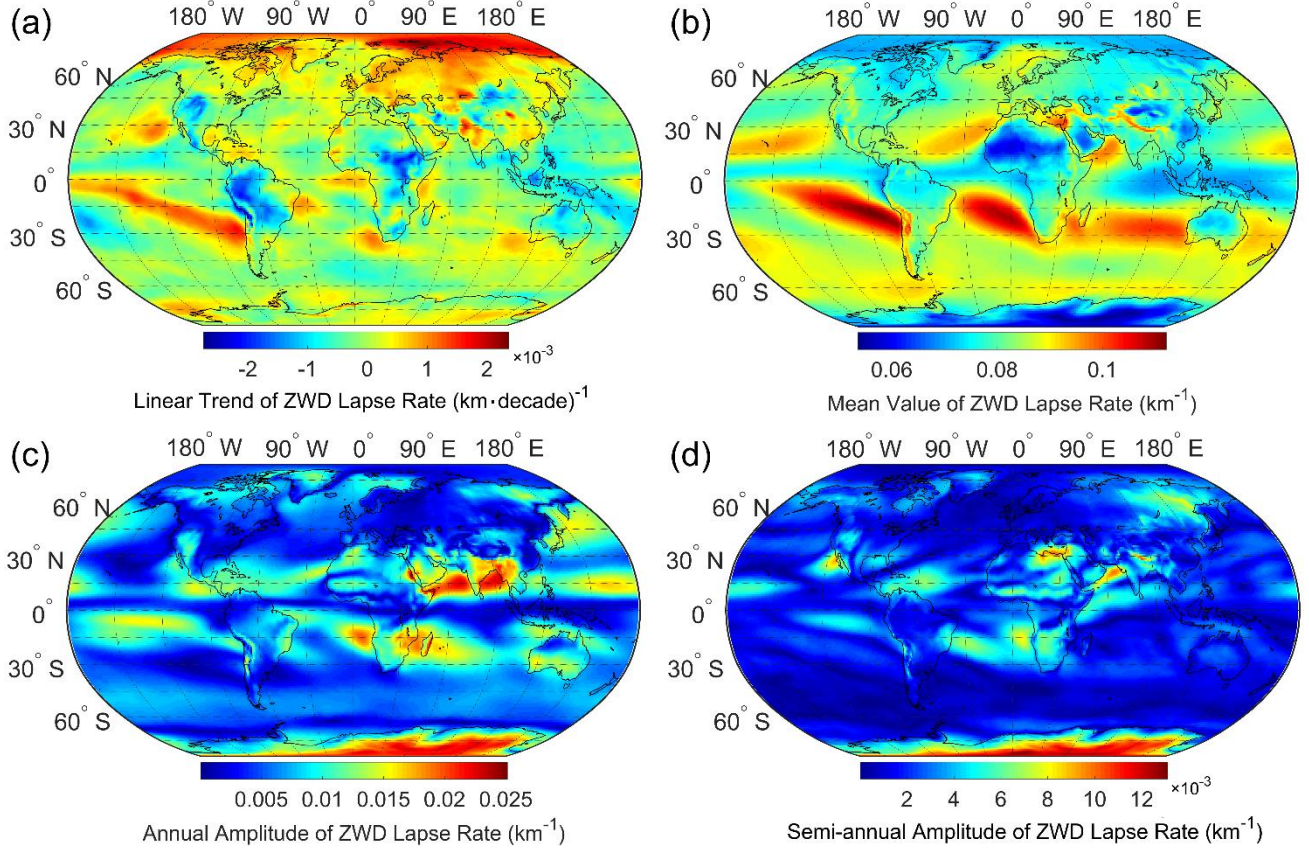


**Figure S5.** Global linear trends, mean values, annual amplitudes, and semi-annual amplitudes of ZHD lapse rate.

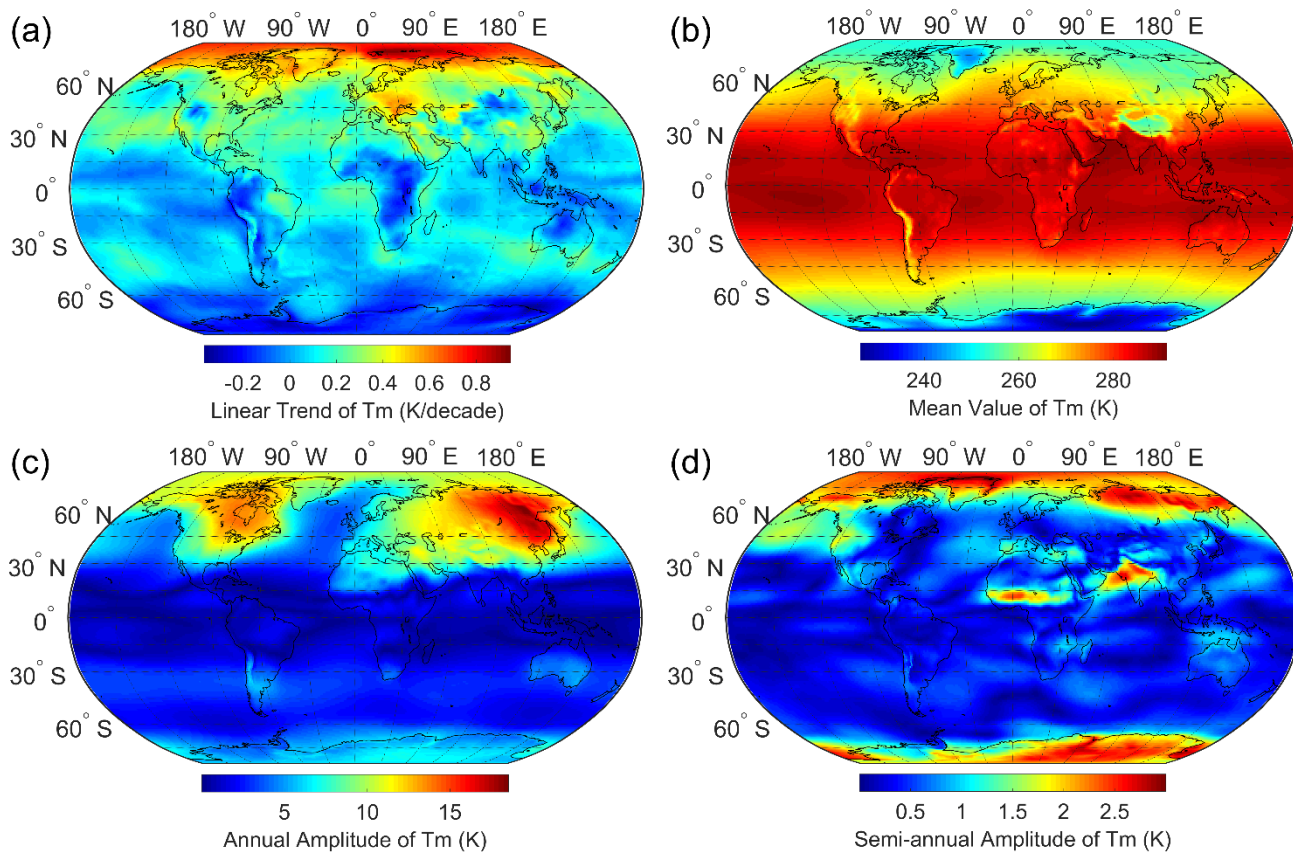




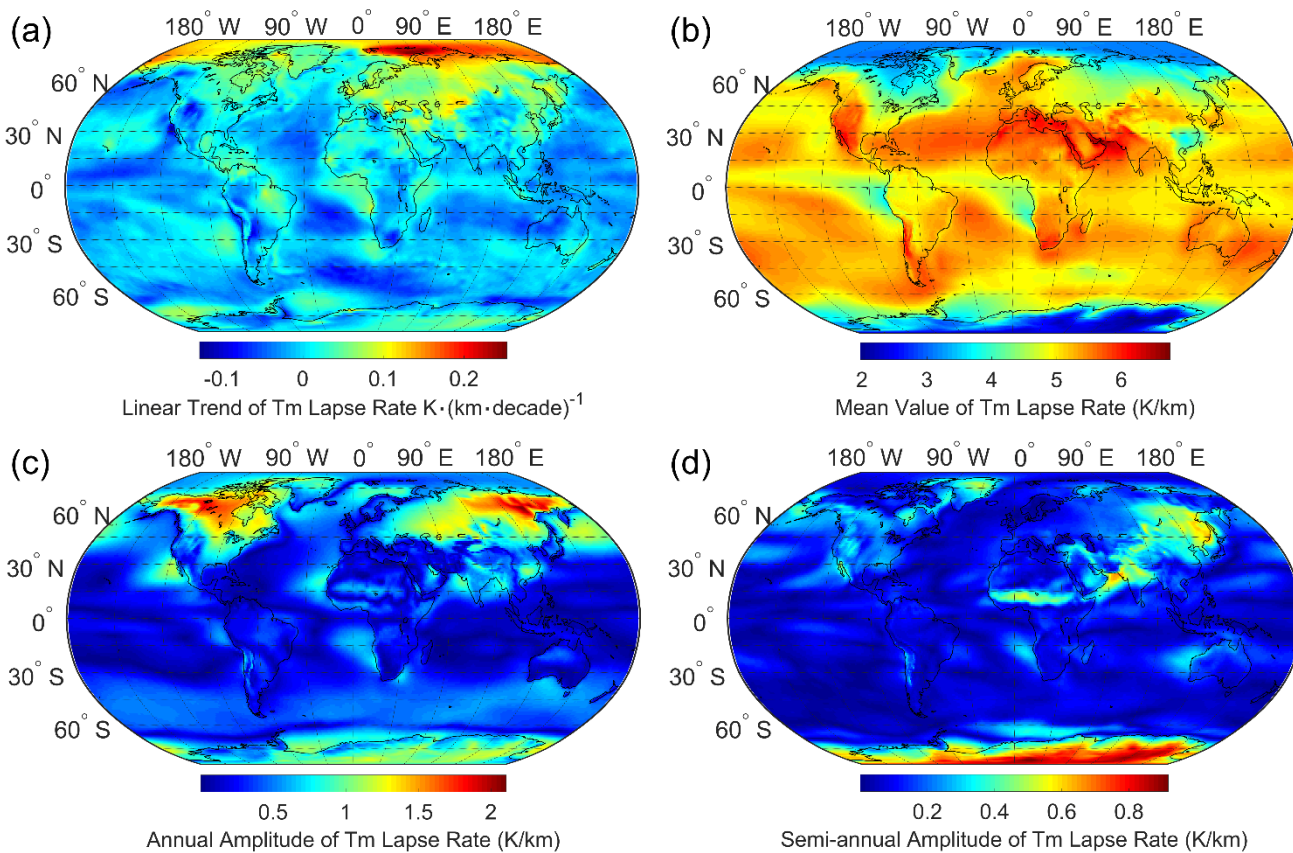
**Figure S6.** Global linear trends, mean values, annual amplitudes, and semi-annual amplitudes of ZWD.



**Figure S7.** Global linear trends, mean values, annual amplitudes, and semi-annual amplitudes of ZWD lapse rate.

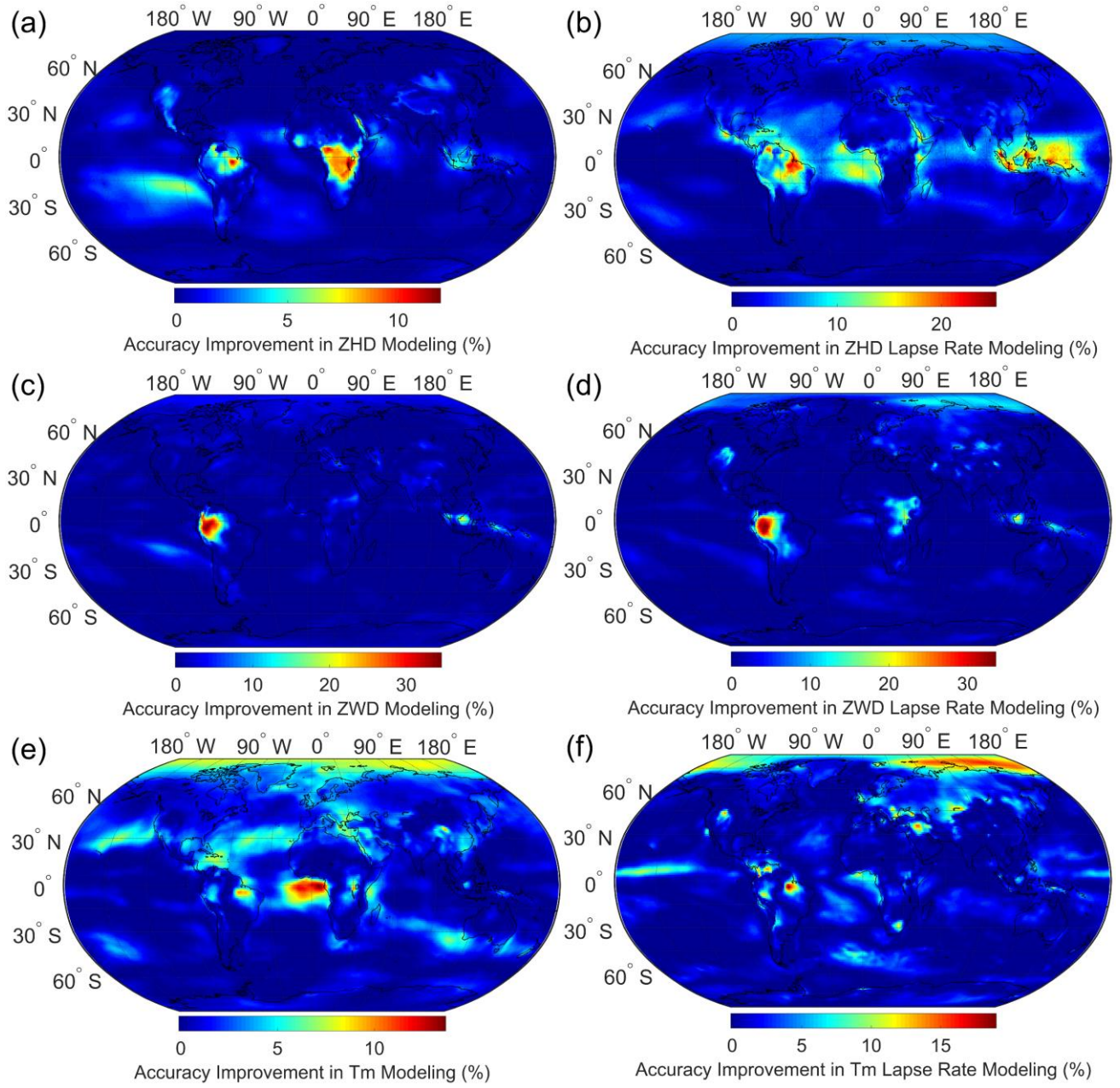


**Figure S8.** Global linear trends, mean values, annual amplitudes, and semi-annual amplitudes of  $T_m$ .



**Figure S9.** Global linear trends, mean values, annual amplitudes, and semi-annual amplitudes of  $T_m$  lapse rate.





**Figure S10.** Improvements of fitting results compared with the model without considering linear trends.