# Evaluation of the global chemistry transport model CHASER utilizing TROPOMI formaldehyde measurements

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Tropospheric Monitoring Instrument (TROPOMI) has been providing observations of important atmospheric pollutants with an unprecedented horizontal resolution (~7×3.5 $km^2$) since August 2017. Such high-resolution global observations offer a unique opportunity to evaluate regional and global models at higher precision. In this study, TROPOMI formaldehyde (HCHO) measurements from June to December 2019 are used to evaluate the HCHO simulations from the global chemistry transport model CHASER-V4 (based on MIROC 5). In the evaluation's initial steps, the averaging kernel information from the TROPOMI HCHO measurements is applied to the CHASER HCHO. Overall, the CHASER simulations captured the observed global spatial variation of HCHO well, with a correlation coefficient ($R$) ~0.70. On a global scale, the mean bias error (CHASER –TROPOMI) and the root mean square error is -0.23 $\times 10^{16}$ and 0.31 $\times 10^{16}$ molecules $cm^{-2}$, respectively. The $R$ values over eastern China, eastern and western US, and South America were ~ 0.9, indicating excellent agreement between the datasets. A negative correlation was observed over India and Southeast Asia during the monsoon season (June –August). One of the potential reasons for such disagreement could be the intense wet deposition of HCHO during the monsoon months, which the model might not capture well. However, previous studies reported that CHASER reproduced the OMI (Ozone Monitoring Instrument) nitrogen dioxide columns over India very well, including the monsoon season. Moreover, the lower TROPOMI HCHO columns over India and Southeast Asia during the monsoon are consistent with the ground-based MAX-DOAS (multi-axis differential optical absorption spectroscopy) HCHO observations in India and Thailand. Thus, the reason for the disagreement between CHASER and TROPOMI HCHO columns over India and Southeast Asia during the monsoon is not apparent yet. Other potential causes such as sources of HCHO other than biogenic emissions, high and low NOx conditions, etc., are required to be investigated.

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