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The vertical profiles of O₃, CH₄, and N₂O into the polar stratosphere of the SH. Model investigation with CCM SOCOL

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We have used the chemistry-climate model (CCM) SOCOL-3 to calculate the annual cycle of the O₃, CH₄, and N₂O vertical profiles in the southern polar stratosphere. The sensitivity of the model results was estimated against the main factors influencing the composition of the polar stratosphere of the SH: (1) photo-dissociation rates of ozone for large zenith angles of the Sun; (2) intensity of the meridional species transport on the model sub-grid scales into the polar area. For this purpose, a series of 5-year model runs were performed for each of the factors with a range of their variability. Comparisons of the model results with the correspondent calculations of other CCM models (CMAM and GEOSCCM), reanalysis data (ERA5), and data of the satellite measurements (Aura MLS) allowed us to evaluate the main biases of the CCM SOCOL-3 species profiles in the polar stratosphere and to define the ways to improve the model representation of the polar ozone through (1) and (2) factor corrections.

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