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## Atmospheric phenomena affecting the methane lifetime on Mars

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We investigate a range of atmospheric phenomena concerning their potential to address the Martian methane lifetime discrepancy. This refers to the over-estimate of the modelled lifetimes compared to observations by a factor of up to six hundred. We apply a newly developed atmospheric photochemical model where we vary in a Monte Carlo approach the chemical rate and Eddy mixing coefficients within their current uncertainties. We also investigate the effect of air shower events due to galactic cosmic rays and solar cosmic rays. Our results suggest that the current uncertainty in chemical rates and transport together with seasonal changes in the water column can likely account for up to a factor of about thirty in the Mars methane lifetime discrepancy whereas the air shower effects are likely to be of secondary importance.