



How well can we quantify the actinic flux driving catalytic ozone chemistry at high solar zenith angles?

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When chlorine has been heterogeneously activated in the polar stratosphere in winter, two catalytic cycles, the ClO dimer cycle and the ClO-BrO cycle, are largely responsible for the chemical destruction of ozone leading to the so-called ozone hole. These cycles cannot proceed in the absence of light, because they involve photolysis reactions, which are rate limiting at low solar zenith angles typical for the polar regions in late winter/early spring.

The ClOOCl and BrCl photolysis rates are given by the wavelength integrated product of the respective species' photolysis cross section and the actinic flux. While tremendous efforts have been made over the past 25 years to reduce the uncertainties in the photolysis cross sections, in particular for ClOOCl, the focus on variability and uncertainties in the actinic flux, and endeavors to correctly represent them in photochemical models simulating ClO_x partitioning and ozone loss, have been surprisingly small.

Using the radiative transfer model LibRadTran, we quantify the influence of column ozone, surface albedo, clouds (presence, microphysical properties and altitude) and aerosol loading on the actinic flux in the spectral region relevant to ClOOCl and BrCl photolysis. We go on to investigate how our results may influence the interpretation of several studies that use a photochemical model to constrain kinetic parameters from observed ClO_x partitioning and ozone loss.