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Photochemistry of O(^{1}D) and O(^{1}S) lines in the coma of 67P/Churyumov-Gerasimenko

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We present here a chemistry-emission coupled model to study the production and loss mechanisms of the O(^{1}D) and O(^{1}S) states, for comet 67P/Churyumov-Gerasimenko. The recent discovery of O_2 in significant abundance relative to water (3.80% +/- 0.85%, Bieler et al. 2015) within the coma of 67P has been taken into consideration for the first time in such models. We evaluate the effect of the presence of O_2 on the green to red-doublet emission intensity ratio, which is traditionally used to assess the CO_2 abundance within cometary atmospheres. Model simulations, solving the continuity equation with transport, show that not taking O_2 into account leads to an underestimation of the CO_2 abundance within 67P. This strongly suggests that the green to red-doublet emission intensity ratio alone is not a proper tool for determining the CO_2 abundance, as previously suggested. O_2 might indeed be a rather common and abundant parent species, following the re-analysis of the comet 1P/Halley data (Rubin et al. 2015). Therefore, it is likely that earlier determinations of the CO_2 abundance in cometary atmospheres have to be revisited.