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Model study of the organic photochemistry in the atmosphere of Mars in the context of the upcoming NOMAD/ExoMars mission

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Several detections of atmospheric methane on Mars have been reported over the last years (Krasnopolsky et al., Icarus, 2004, Formisano et al., Science, 2004, Mumma et al., Science, 2009, Fonti and Marzo, A&A, 2010 , Webster et al., Science, 2015). However those results have been disputed (Zahnle et al., Icarus, 2011) given that the observed lifetime of methane is apparently several orders of magnitude shorter than expected by the known photochemistry (Lefèvre and Forget, Nature, 2009). Until now it remains unclear whether a sink process has still to be discovered or the photochemistry itself is not fully well described. The NOMAD instrument onboard the ExoMars Trace Gas Orbiter (Vandaele et al., PSS, 2015, Robert et al., PSS, 2016) is thus expected to provide key information and make one able to better understand the fate of methane on Mars.

Furthermore it has been recently shown that, instead of spreading uniformly in the atmosphere, the methane may form transient layers at 40-50 km in height during the first weeks after surface release (Viscardy et al., GRL, 2016). In this context, we aim to reinvestigate the organic photochemistry using a 3D Global Circulation Model (GCM) in the light of this result. In addition, it has been suggested that there could be a simultaneous release of methane and water vapor (Mumma et al., Science, 2009), e.g. resulting from the destabilization of methane clathrate hydrates. We will thus study how much this can affect the evolution of the atmospheric methane.