Supplement of Atmos. Chem. Phys., 16, 4171–4189, 2016
http://www.atmos-chem-phys.net/16/4171/2016/
doi:10.5194/acp-16-4171-2016-supplement

Atmospheric Chemistry and Physics Open Access EGU

Supplement of

Diurnal cycle and multi-decadal trend of formaldehyde in the remote atmosphere near 46° N

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Table S1. Monthly parameters determined by adjusting the fitting parametric model (Eq. 1) to the observed monthly intra-day cycles of HCHO total column above Jungfraujoch, on the basis of the 1995 – 2015/06 BRUKER data set. The modelled intra-day variations represented in Figs. 1 and 3a may be reproduced by including these parameters in Eq. 1.

	a	**b**	**c**	$\mathbf{x_0}$
January	1.138E+15	209.919	43.581	12.826
February	1.181E+15	11.982	2.454	12.749
March	1.441E+15	13.507	2.835	12.615
April	1.736E+15	26.432	4.663	12.561
May	2.148E+15	18.963	2.850	12.859
June	2.520E+15	33.567	4.410	13.108
July	2.701E+15	204.648	23.096	12.682
August	2.644E+15	33.803	4.203	12.253
September	2.204E+15	17.361	2.378	12.304
October	1.846E+15	13.844	1.905	12.634
November	1.459E+15	3.068E+06	5.481E+05	12.074
December	1.186E+15	113.108	20.708	12.036

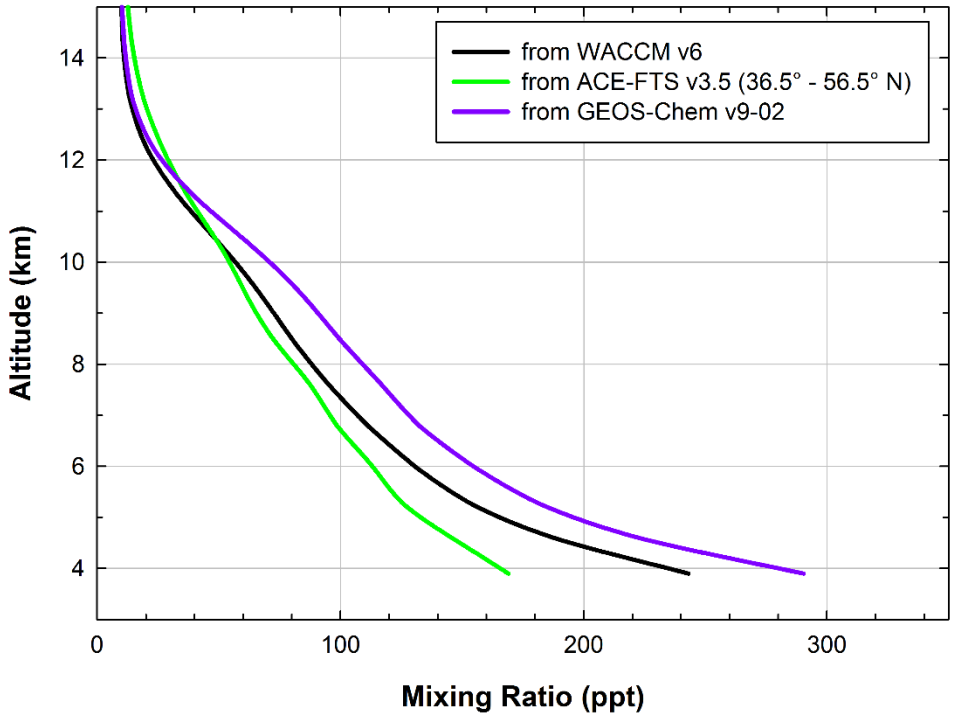

Figure S1. A priori profiles of HCHO over the ISSJ derived from 1980 – 2020 WACCM v.6 simulations (in black), from nearly 2000 ACE-FTS solar occultation measurements (version 3.5) between 36.5 and 56.5° N (in green) and from a 2005.5 – 2013.5 simulation with GEOS-Chem v9-02 (in purple). The WACCM profile is used for the standard HCHO retrievals at the ISSJ, while the ACE-FTS and GEOS-Chem profiles are used for sensitivity tests (see text).

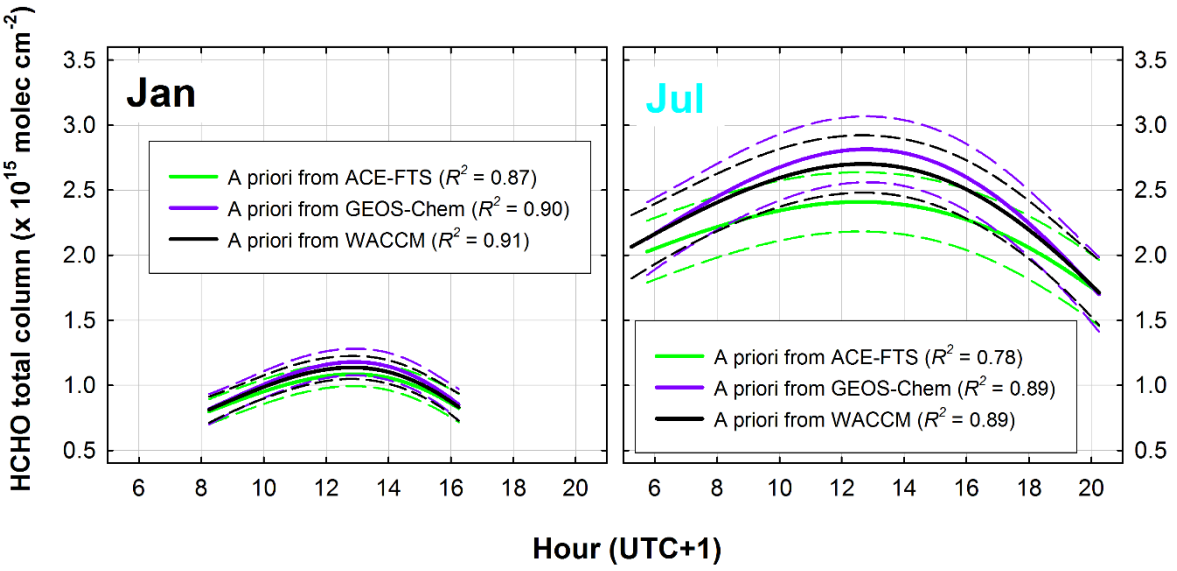

Figure S2. Same as Fig. 1, but according to sensitivity tests adopting either a lower (in green) or a higher (in purple) realistic a priori profile than WACCM (used in Franco et al., 2015b; in black) to retrieve the entire BRUKER time series of HCHO total columns. These profiles are presented in Fig. S1. For both new time series, we re-fitted the monthly intra-day variations of HCHO column using our parametric model (see Eq. 1). We found that the amplitude of the fitted diurnal cycle is lower or higher according to the adoption of a lower or higher a priori profile, respectively. Consistent with the lower DOFS values around noontime, the bias to the WACCM-based diurnal cycles is higher for the summer months and reaches a maximum during the 12-14h (UTC+1) time range: in between this time range, the maximum systematic bias is ±3.6% in January and ±10.2% in July.