

The influence of mid-latitude cyclones on European background surface ozone,

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General Remarks

The topic of an elevated stratospheric ozone contribution at the surface has been in the focus of numerous recent studies driven by air-quality considerations. In particular, it has been a mystery to me why Mace Head is reached by descending air masses, which has not been observed that frequently elsewhere. The paper is well written and deserves publication, but I recommend considering a few amendments.

Details

- (1) Introduction: Consider mentioning the role of STT in some of the recent air-quality studies, such as:

Lefohn et al., *Atmos. Environ.* 45 (2011), 4845-4857

Langford et al., *JGR* 117, D00V06 (2012)

M. Lin et al., *JGR* 117, D00V22 (2012)

Lefohn et al., *Atmos. Environ.* 62 (2012), 646-656

Ma et al., *ACP* 14 (2014), 5311-5325

Dempsey, *Atmos. Environ.* 98 (2014), 111-122

M. Lin et al., *Nature Communications* 2015

Itoh and Narazaki, *ACP* 16 (2016), 6241-6261

Langford et al., *JGR* 122 (2017), 1312-1337

High-lying sites are more affected by STT (western US, Alps (Zugspitze, Jungfrauoch), Tibet).

- (2) Introduction/Discussion: The penetration of STT air into the PBL has been rarely observed (you cite Davis and Schuepbach (1994); some more words can be found in Eisele et al., *J. Atmos. Sci.* 56 (1999), 319-330). The probability of entrainment into the PBL seems to be low, which suggests subsidence during night-time followed by day-time turbulent mixing (Eisele et al., 1999; Ott et al., *JGR* 121 (2016), 3687-3706; Langford et al., 2017) to be a more reasonable mechanism. Is there anything different at the seaside (Cooper et al., *JGR* 100 (2005), D23310; Itoh and Narazaki (2016))? You mention a fraction around 50 %. Could this be related to the chance of night-time subsidence?

- (3) Also constituents from originally lofted Canadian fire plumes were observed at Mace Head (Forster et al., *JGR* 106 (2001), 22887-22906)

- (4) P. 4, line 28: The spatial resolution seems to be sufficient to resolve STT layers. This is an important issue (e.g., Roelofs et al., *J. Geophys. Res.* **108** (2003), 8529; Eastham and Jacob, *ACP* 17 (2017), 2543-2553). However, there is, still, the issue of mixing even in high-resolution models that can lead to a loss of information (two rather bad comparisons between

measurements and a high-resolution ECMWF model results: Trickl et al., ACP 16 (2016), 8791-8815). This topic should be addressed somewhere in the paper.