

## ***Interactive comment on “How stratospheric are deep stratospheric intrusions? – LUAMI 2008” by Thomas Trickl et al.***

### **Anonymous Referee #2**

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The submitted manuscript provides a very nice insight in a case study of a deep stratospheric intrusion using water-vapour profiling measurements from high quality ground-based instruments at four observational sites in Central Europe (in particular the CFH sonde, differential-absorption and Raman lidar systems) as well as an air-borne lidar system creating a transect of humidity profiles between all four stations. The study is further supported by a thorough trajectory analysis of the event using LAGRANTO trajectory model. I suggest the manuscript can be accepted for publication after considering a few minor comments.

Comments 1) Introduction, Page 2, lines 5-7: There a few other studies of stratosphere to troposphere transport using lidar systems (e.g. Ancellet et al., JGR, 1991; Galani et al., JGR, 2003; Papayannis et al., Ann. Geophys., 2005). 2) Introduction: Since the study refers to a case study of a deep intrusion down to the lower troposphere, the

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authors may add a few lines about the scarcity of these vigorous events and refer to similar cases studies that have been published in the literature indicating an influence even down to near surface. 3) Page 7, lines 11-12: Maybe you could provide rather more details for the methodology applied using LAGRANDO model. Furthermore when the authors state that " set of five-day trajectories was started in the entire region covering the Atlantic Ocean and Western Europe (20° E to 120° W and 40 to 80° N) between 200 and 600 hPa" do they mean that 5 forward trajectories were released at each grid point with 1x1 deg resolution within the domain from 20° E to 120° W and from 40 to 80° N for all model levels between 200 and 600 hPa? My estimate counts roughly at least 100000 trajectories. Hence it would be nice to provide some numbers of the total number of trajectories calculated and how many of these are selected as stratospheric intrusion trajectories. 4) Page 7, line 30: The authors state "in agreement with typical behaviour". Please describe what is a typical behaviour and provide the appropriate references. 5) Page 8, lines 11-15: Here, a bit more discussion on the enhanced aerosol content following Fig. 2 would be helpful for the reader. 6) page 10, line 34 as well as page 11, line 6: Does the time 17:02 CET refer to 16:55 CET shown in Figure 12? 7) page 11, lines 7-8: The authors state that the aerosol peak is located in the upper half of the intrusion layer. My impression from Figure 12 is that the aerosol layer covers the largest part of the dry intrusion layer. 8) Page 11, line 25: " ... fulfilling the deep-intrusion criteria ... " Are the deep-intrusion criteria those referred in Section 2.1.6 for the stratospheric intrusion trajectories? 9) Page 12: lines 25-26: The sentence " In any case ... of Fig.9" needs further elaboration as it is not clear enough. 10) Page 12, lines 32-36: This paragraph needs further elaboration as it is not clear enough. 11) Page 13, lines 1-2: There are also other recent modelling studies that share a similar perspective indicating that the role of stratosphere to troposphere transport to near surface background ozone may be of greater importance than previously anticipated in 1990s and 2000s (Lin et al., JGR 2012; Lefohn et al., Atmos. Environ., 2014

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