Review of the paper acp-2011-522
The evolution of microphysical and optical properties of an A380 contrail in the vortex phase
by Gayet et al.

This paper describes the analysis of in situ measurements of the microphysical and optical properties of a contrail generated by a large transport aircraft. Compared to previous literature, this study focuses on the vortex phase -up to about 5 minutes after emission- when contrail properties are mainly driven by the dynamics of the aircraft wake. In this sense, this study is a useful contribution to contrail research and provides unique data for case study validation of physical/computational models. On the other hand, I found somehow frustrating at some point that there is little or unclear explanation of the physical processes that are behind or at least could explain the observed data. For example: why should ice particles become more non-spherical when they sublimate in the vortex phase? I mean on the basis of which physics? Are there microphysical models/equations that can relate these processes? When making statements like this, adding comments based on physical grounds would help the reader understand what causes what and why.

In my opinion, the paper can be published once the authors have clarified the points and addressed the questions raised below. Since I cannot comment the instrumentation/optics part, I will only focus on the physical aspects of the study.

- Introduction. I think that the objectives of the paper could be more clearly outlined: software validation for the reconstruction of optical properties? Providing accurate data for model validation? I suggest adding a paragraph in this section.
- Page 26869, line 20: Since you mention the numerical simulations by Unterstasser et al. 2008, you may also cite other literature of contrail simulations in the vortex phase. I suggest: Lewellen and Lewellen, JAS 2001, Unterstrasser and Gierens, ACP 2010, Paugam et al, ACP 2010.
- Page 26876, lines 11-14. This part contains some inaccuracies: the theoretical vortex descent $z = -\frac{\Gamma}{2\pi b_0} t$ (with Γ the aircraft circulation, $b_0 = \pi/4\, b$ the initial vortex spacing, and b the wingspan) is a robust estimation of the vertical position of the primary wake. What is difficult to predict is its vertical extent which is much more sensitive to the specific aircraft and ambient conditions (vortex instability, turbulence, shear, etc.)
- Page 26875, lines 18-20. The way the sentence is written, you get the impression that NOy and Conc1 are not correlated because of some plume internal heterogeneity whereas in fact it is just that the measurement is taken when the Falcon is crossing the boundary of the plume as reiterated on page 26877.
- Page 26877, lines 5-11. Same as above, I don't like the way this part is logically formulated. The cause of data mismatch is that one of the instruments is inside the plume and the other is outside. If both were inside and you could see the same mismatch in Fig 3, then it would be a signature of plume heterogeneity.
- Page 26678, line 21 to page 26679, line 8. This part is confusing me, you may consider rephrasing it. What is the message you're trying to convey?
- Page 26679, lines 11 to l4. Since this is quite a strong statement, do you have an explanation why particles are becoming non-spherical (I could not find it in Sec. 4)? Could it be possible that ice crystals sedimented from the above cirrus into the contrail?
- Page 26882, line 4. Could you think of any particular reason why the retrieved particle distribution in case C does not reproduce the measured distribution?