Reviewer Comments

In my original review I wrote:

.... my overall rating is major revisions because of two points emphasized here:
– ....
– Some numbers in Table 2 needs to be checked, the mean and median IWC and,
especially, the mean and median of Ntotal for CC are too high for natural cirrus – see
comment 20). This number is definitely not ok, obviously contrails are mixed in the
natural cirrus class.

Here is the specific point of my review:

Point 20 c)
Mean/median of Ntotal for CC are 6.06/3.75 cm-3. This is too high for natural
cirrus. From Voigt et al. (2017), I would expect something around 0.1 cm-3 or even
lower.

And here is the answer to it:

PSD of natural cirrus are significantly different according to measurement location and
the different probes used. Here, the new clustering method shows lower number
concentrations for the "natural cirrus".

In the new manuscript one finds:

Mean/median of Ntotal for CC are 5.092 / 3.444 cm-3

which is nearly the same as before (and not lower !!) - and it is still much too high (see
the plot below), so the authors didn't take this major comment seriously.

Wrt the argument that N_ice greatly vary with measurement location: yes,
but observations> 1 cm-3 are exceptions, and unrealistic as mean or median values at
any location....

In the middle plot (Voigt et al. 2017, ML-Cirrus, 18 hours of N_ice observations) you
can see that already a value of 1 cm-3 is rarely exceeded. During ML-Cirrus lots of
contrails were observed, representing almost all higher values in the Figure, in natural
cirrus the frequency of cirrus with N_ice > 1 cm-3 is much smaller. Voigt et al. (2017):

In Table 3, the median of Ntotal of AC1 (Aged Contrail 1) is 1,696 cm-3, while in CC it is 3,444 cm-3. Also, the 25% and 75% percentiles are lower for AC1 than for CC. How can mean/median the ice particle concentrations be lower in aged contrails than in natural cirrus ?

If the mean/median ice particle numbers in CC in Table 3 are not typos (what I thought when I first read the paper), but are now 5.092 / 3.444 cm-3, then either the method is called into question (that was the reason that I rated this point as major) or the data base is too small.

How large is the data base, and how much sampling time is spend in the different classes ?
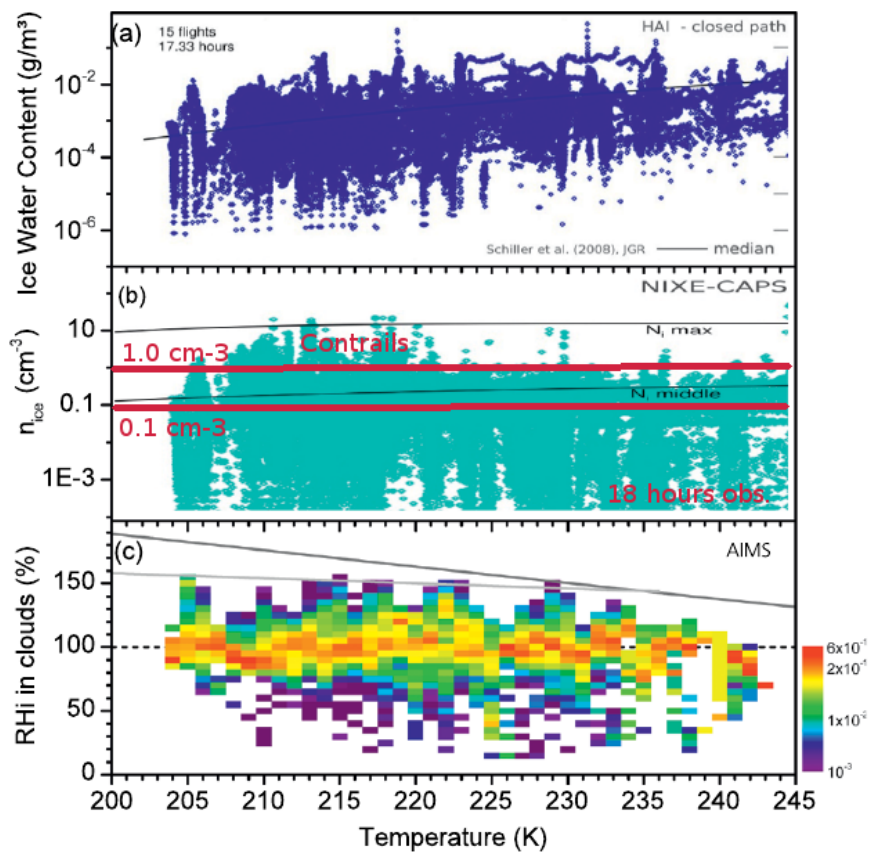
FIG. 6. (a) Range and temperature dependence of the IWC detected during ML-CIRRUS derived from HAI/SHARC hygrometers (blue dots) and median from Schiller et al. (2008) (black line). (b) Ice number densities in the size range of 3- to 937-μm diameter (N_i) in cirrus from NIXE–CAPS and middle and maximum N_i from Krämer et al. (2009). (c) Relative frequency of RHi in cirrus from AIMS–H2O (Kaufmann et al. 2016) and Basic Halo Measurement and Sensor System (BAHAMAS) temperature data in 1-K temperature bins. The light gray line shows the homogeneous nucleation threshold from Koop et al. (2000) and the dark gray line shows the liquid water saturation (Murphy and Koop 2005).