General comments

The manuscript written by Qiansi Tu et al. entitled “Intercomparison of Arctic ground-based XH_2O observations from COCCON, TCCON and NDACC, and application of COCCON XH_2O for IASI and TROPOMI validation” shows the observations of column-averaged dry-air mole fractions of water vapor (XH_2O). This multi-year field campaign uses a pair of COCCON spectrometers at two arctic locations, Kiruna and Sodankylä. The observations are first compared with retrievals from two high-resolution FTIR spectrometer as references. One is in the framework of NDACC (Network for the Detection of Atmospheric Composition Change) in Kiruna and the XH_2O is retrieved with the MUSICA (MUlti-platform remote Sensing of Isotopologues for investigating the Cycle of Atmospheric water) processor. The other one is TCCON (Total Carbon Column Observing Network) spectrometer operated in Sodankylä. COCCON observations show a wet bias of about 3.33% compared with MUSICA NDACC and about 3.44% compared with TCCON. Furthermore, a priori profiles used in TCCON and COCCON are investigated compared with in situ radiosonde profiles. Through these, the authors aim to demonstrate how these COCCON measurements could potentially be used for satellite validation. Then the authors present a very interesting comparison of XH_2O between COCCON and two satellite sensors—IASI (Infrared Atmospheric Sounding Interferometer) and TROPOMI (TROPOspheric Monitoring Instrument), showing generally good agreement and similar correlation at both sites. COCCON measures drier XH_2O than IASI, while wetter XH2O than TROPOMI.

Overall, this study presents a valuable comparison that allows COCCON for potentially complementing the TCCON network and for validating satellites. The subject matter of measurement intercomparison and satellite validation is well within the scope of AMT. This paper is well structured and written style is clear. I therefore suggest that the manuscript be accepted for publication in AMT after correcting/considering a few relatively minor points. These are listed below, in order of the manuscript page number and line that they relate to.

1) P1—L1: the title contains a few acronyms and would be complicated if spelling out their full names. I would recommend a brief title, such as “Intercomperison of arctic XH_2O observations from three ground based FTIR networks and application for satellite validation”.
2) P1—L17: it is better to specify the time period here.
3) P3—L92: “ESA” to “European Space Agency (ESA)”. The the full name of an acronym should be spelled out when it first appreas.
4) P4—L99: “European Space Agency (ESA)” to “ESA”, when the full name of an acronym is already mentioned before.
5) P5—L139, L140: spell out the full name of WACCM and ESSD.

6) P6—L174: does a similar airmass bias correction is applied to COCCON as used in TCCON? please elaborate a bit more or a reference here.
7) P7—L198: the formula here defines the total mixing ratio of H_2O (wet mixing ratio) rather than dry mixing ratio. In section 4.3, the map and radiosonde profiles are investigated. Are MAP H_2O a priori profiles also a wet mixing ratio? If so, the use of "XH_2O" as the volume mixing ratio of H_2O by integrating the a priori MAP profiles and radiosonde profiles in Figure 8 will confuse readers, since the XH_2O is defined as "dry-air mole fractions of water vapor" in the very beginning of this work.
8) P8—L215: could you elaborate a bit more on this seasonal variation of XH_2O? or a reference here.
9) P17—L358: MUSICA IASI might be not considered as "network". It is better to change to "…due to the choices for the calibration of XH_2O data product by either dataset."
10) P18—L366: it is better to keep the two subsections' names consistency. Change "Comparison between TROPOMI and COCCON" to "Comparison between COCCON and TROPOMI" or the other way around.