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Atmospheric Measurement Techniques Discussions

Interactive comment on "The pilatus unmanned aircraft system for lower atmospheric research" *by* G. de Boer et al.

Anonymous Referee #2

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General Comments:

The manuscript describes a new remotely piloted aircraft system (Pilatus) developed by the University of Colorado. It is an electrically powered fixed wing airframe with a wingspan of 3.2 m and a maximum take-off weight of 25 kg. The described system has been developed with a focus on atmospheric radiation (longwave and shortwave) and aerosols, but is also able to provide measurement of the mean thermodynamic parameters temperature, pressure and humidity, while wind measurements are obviously absent. The paper presents sensors and system development in great detail before shortly presenting the results of a few car-based (IMU) test measurements and a few hours of test flights during one day. The motivation for the development and scientific questions to be addressed in the future are mentioned, but of course not worked on

within this limited data set from the test flights. In my opinion this paper shows a clear progress in the use of unmanned systems toward radiation and aerosol measurements, with a particular potential for applications in polar regions with limited infrastructure and harsh environmental conditions, although it will be interesting to see how it really will work out in low temperatures. My main criticism for the manuscript is the inconsistency (e.g. label size and style; line thickness;) in the presented figures and the poor quality of several of them that make it difficult to follow the argumentation and conclusions of the authors. I will give detailed comments on this at the end of my specific comments. Overall I suggest this paper for publication after revisions.

Another general question to raise (that might also be shortly included somewhere in the manuscript) is if it is worth to deal with all the angular correction hassle for the radiation measurements by using a fixed wing aircraft while it seems to be much easier to use a rotary wing airframe, potentially in combination with a gimbal system for that purpose.

Specific comments:

p.11993, line 26: "sensor response time of approximately 0.4 s" for which temperature is this response time valid; in my experience the response time of temperature sensors has also a temperature dependency, although usually not as distinct as for the humidity

p.12000, line 24 and figure 4: are the profiles consequently taken from either ascending or descending profiles and in which average vertical velocity of the aircraft, or is it a mixture or a completely different flight pattern?; would be important to know for the interpretation of the data and their variability

p. 12003: how is tilt defined; as deviation from the vertical and therefore a combination of the pitch and roll angles of the aircraft? Obviously only the shortwave radiation data are tilt corrected, as there is no IMU flown together with the pyrgeometers? Do you have an estimate which level of uncertainty that can add to your longwave radiation measurements?; this issue should be mentioned/discussed

p. 12004, line 8: ". . ..by the time of the second flight"; in figure 10 it is flight 4?;

p. 12004, line 26: replace "from the first and the second flight" by "from the first to the second flight"

p. 12005, description of figure 10: have all flights along the race track pattern shown been made in the same direction (clockwise/counterclockwise) or was there a switch in between different flights

comments on figures: figure 2: labels in b) and c) by far too small; I also see plot b) as very little informative, a terrain profile or the values of the local slope along the track would fit much better. I think you should even combine that with panel c), by plotting everything against the x-axis that should be the along-track distance

figure 3: I would like to see a zoom-in on one of the tracks to see a bit more of the detail structure in the measurements. This could be done as inset or as separate panel side by side

figure 5: the closed circle for the mean cannot be distinguished from the interquartile range; please modify

figures 6 and 7: labels (and potentially also line thickness) too massive

figure9: too small to follow the relevant information; maybe better to have two panels on top of each other?; labels can also be shrinked a bit

figure 10: too big labels, too small figures

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 11987, 2015.