

# ***Interactive comment on “Using sonic anemometer temperature to measure sensible heat flux in strong winds” by S. P. Burns et al.***

## **”Wind Tunnel Tests”**

**S. P. Burns et al.**

sean@ucar.edu

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Dear Reviewers and Commenters,

We thank you for the helpful comments about our manuscript. The purpose of this post is: (1) to point out a correction to the text, and (2) provide an independent test that shows the CSAT3 sonic temperature is sensitive to firmware version.

(1) On p.455 line 28 we mistakenly wrote,

”Finally, we also considered the  $\overline{w'q'}$  and  $\overline{u'w'}$  terms in Eq. 3, but found them too small to explain the discrepancy between  $H_{\text{CSAT}}$  and  $H_{T_{tc}}$  (results not shown).”

The  $\overline{u'w'}$  term is not small and we rely on the CSAT3 firmware to do the cross-wind correction. In the revised manuscript this sentence will be changed to:

”Finally, we also considered the  $\overline{w'q'}$  term in Eq. 3, but found it too small to explain the discrepancy between  $H_{\text{CSAT}}$  and  $H_{T_{tc}}$  (results not shown).”

(2) A theme within many of the AMTD comments have been whether the CSAT3 heat flux issue observed at the Niwot Ridge forest AmeriFlux site is due to an artifact of: the despiking method, the CSAT3 setup on our tower, site location (e.g., within complex terrain), or environmental conditions. These are all valid questions and we will answer them as best we can in our replies to your specific comments (which are still being composed). In the meantime, we would like to introduce evidence that the  $T_s$

issue we observed goes beyond our specific setup at the Niwot Ridge forest. In the manuscript (p. 458, lines 16-17) we wrote, “They (*i.e.*, *Campbell Scientific*) subsequently performed their own independent experiments to confirm the sonic temperature issues we have presented.”. This was our attempt to convince the readers that this problem is beyond our tower; however, we readily acknowledge that without supporting details this statement is rather weak. We are currently working with Campbell Scientific (CSI) to include more specific details but CSI has considerations that go beyond our paper and needs time to fully synthesize their results. In addition, CSI has their own procedures for announcing product updates so we can only include information which they are comfortable having published in our manuscript.

However, to show that the CSAT3  $T_s$  issue extends beyond the Niwot Ridge tower, Tom Horst performed an experiment with a CSAT3 in the NCAR EOL wind tunnel (Fig C1). This test was with a single CSAT3 running firmware ver3 or ver4 as specified in the legend of Fig C1. Note that the temperature differences observed in the wind tunnel are not completely consistent with those observed at the tower (e.g., compare Fig C1 below to Fig. 5 in the manuscript) which is something we are still pondering. A discussion of the wind tunnel tests will be included in our revised manuscript.

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Comment on Atmos. Meas. Tech. Discuss., 5, 447, 2012.

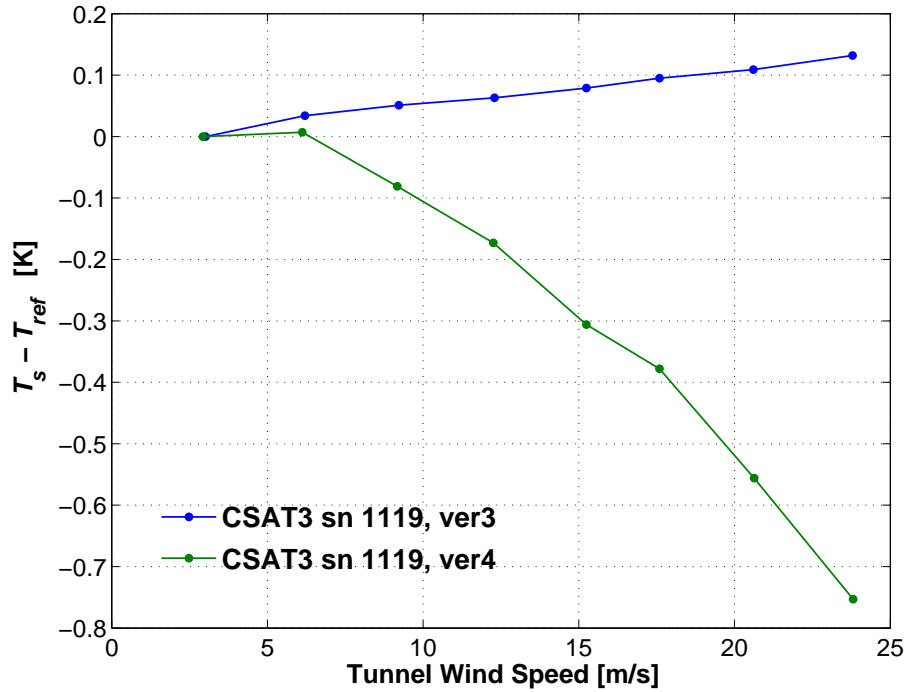


Figure C1: The mean temperature difference ( $T_s - T_{ref}$ ) versus wind tunnel pitot tube wind speed for CSAT3 (sn 1119) using either embedded code ver3 or ver4. Mean values were calculated over 30-minutes at each tunnel wind speed. The temperature difference has been shifted so that the value at the lowest tunnel speed equals zero.  $T_{ref}$  is the speed-of-sound temperature calculated from the wind tunnel reference air temperature and relative humidity (Vaisala 50Y sensor) and static pressure (e.g.,  $T_{ref} = T_{50Y}(1 + 0.51q)$  where  $q$  is specific humidity). The Campbell Scientific factory calibrations of CSAT3 sn 1119 were performed on 6 June 2006 for ver3 and 5 October 2010 for ver4.