The paper is clearly written and makes a valuable scientific contribution with the derivation of equation (23), an equation based on first principles that can be used to compute high frequency air temperature from measurements with closed path eddy covariance systems. As shown in the paper, equation (23) is an advance beyond the previously used approximations, equations (4) and (5). And, as described in the paper, high frequency air temperature computed from equation (23) has potential to improve flux calculations with the eddy covariance technique. The paper should be published, but full consideration should be given the comments below, as there is opportunity to improve the paper before publication.

While the paper does make a valuable scientific contribution with the derivation of equation (23), there are three things that would make the paper much stronger, and a more useful scientific contribution:

1. A more thorough analysis and discussion of the why the temperatures derived from the CPEC310 measurements in the field and equation (23) did not more closely match the temperature used as a reference (the platinum resistance thermometer (PRT) inside the fan-aspirated radiation shield). There is a small section about this in lines 440-445. The suggestion that the PRT inside the fan-aspirated shield might be reading low, in lines 442-443, could be further investigated. For example, was the PRT calibrated before or after it was used to make measurements in the field? If so, was it reading low? It is likely that the PRT was not reading low, at least not by about 0.5 C, which suggests the temperatures derived from equation (23) are biased high (about 0.55 C in January and about 0.44 C in July). In lines 517-518 there is some brief commentary on systematic error in Ts measurements due to fixed deviation in measurements of sonic path lengths. Seems possible that this systematic error is the source of the bias in temperature from equation (23) when compared to temperature from the PRT in the fan-aspirated shield. There is also a suggestion that some of the difference in temperature may be due to non-ideal weather conditions, in lines 497-502. Given that weather variables were measured, it should be possible to filter the data for ideal weather conditions.
2. A more thorough analysis and discussion of the error in temperature computed from equation (23) in relation to the applications. From lines 544-558, it seems the main application of computing temperature from equation (23) and high frequency measurements is an accurate estimate of high frequency dry air density (ρ_d) for water vapor flux calculations, and calculation of sensible heat flux from air temperature, without the need of a humidity correction. If this is the case, then it would be useful to have an indication of how accurate high frequency ρ_d and air temperature need to be and some commentary on whether the temperatures derived from the field data collected in this study and equation (23) are within this accuracy range. As stated above, it appears from field data that fixed deviation in the sonic path length may be the cause of the bias of about 0.5 C. If high frequency air temperature is high by about 0.5 C when computed with equation (23), can it practicably be used to improve flux calculations?
3. This study was conducted with only Campbell Scientific instruments. It would be helpful if there was some commentary on use of the proposed technique with other instruments. While Campbell Scientific instruments are widely used for flux measurements using the eddy covariance technique, other companies make 3D sonic anemometers and high frequency gas analyzers that are also widely applied for eddy covariance. Even if brief, any discussion the authors can provide about applicability of the proposed technique with non-Campbell Scientific instruments will make the paper more general. Right now, the information in the paper is specific to only those users who have Campbell Scientific instruments.

Beyond these three content recommendations, there are two things that would improve organization of the paper:

1. Move sections 6 and 7 to an appendix. These sections contain important material, but provide a level of detail that is not essential to the main body of the paper.
2. Use headers to better separate the material. For example, section 1 is the Introduction, section 2 is the Background, and section 10 is the Discussion. Following this formant, sections 3 and 4 could be called Theory. Section 5 could be called Materials and Methods. If sections 6 and 7 are not moved to an appendix, they should be included with section 5 under Materials and Methods. Sections 8 and 9 could be called Results.

Some necessary edits:

Line 17: temperar should be temperature.

Line 20: senosrs should be sensors.

Line 30: CPEC300 is a specific product and needs to be defined (meaning the instruments included with this model should be listed and the manufacturer should be listed).

Line 44: Panofsky and Dotton (1984) is cited, but is not found in the reference list.

Line 66: suffered to should be changed to suffered by.

Line 110: contaminated should be contamination.

Line 152: a should be removed after unmeasurable by.

Lines 243-244: CSAT3A and EC155 are specific Campbell Scientific products, so they should be denoted as such (like at the beginning of the sentence where CPEC310 is denoted as a Campbell Scientific product).

Line 262: Multiple temperature variables are used in equation (27). Subscript c appears to denote calibration, subscript z appears to denote zero, subscript s appears to denote sonic, and unclear what subscript r denotes. Some clarification and definition is required.

Lines 323-324: EC100 is a specific Campbell Scientific product and needs to be denoted as such. It seems the EC100, EC155, and CSAT3A are all components of the CPEC310. If this is the case, it would be helpful if there is a better description of the CPEC310.

Line 341: CR6 needs to be defined as a datalogger and denoted as a Campbell Scientific product.

Line 357: Sentence needs to be reworded. The phrase even impossible is out of place. Perhaps remove the phrase even impossible from the sentence and then write another sentence to describe how it is impossible to sample fast enough to capture all eddies.

Line 527: Acronym OPEC is used without being defined. Needs to be defined as open path eddy covariance.

Line 609: thermometry can be removed.

Line 674: Diving should be dividing by.

Lines 682 and 685: expending should be expanding.