Wavelet-based microburst detector code validation

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**Detector parameters**

Here, we explore the brute force validation of the wavelet-based microburst detector code. The microburst detector code had the following properties: wavelet=”DOG”, cadence=0.1 [s], with other parameters set to default. They are: j1 = 80, zero padding = True, dj = 0.125, s0 = 2\*cadence (0.2 [s]), siglevel=0.98, lag1autocorr calculated from the data. Period filtering was done between s0 (0.2 [s]) and 1 [s] periods. The filtered data threshold for detection was set to 0.1 c/s.

**Data parameters**

10 Hz data from AC6-A was used in this validation. The data from 2016-10-14 was used. This day had many microbursts, with some instrument noise, and a few periods of saturation. Suggestion for future validation studies is to use another day such as 2015-04-14 where there is much more instrument noise.

**Methodology**

Go through the entire day by hand, and characterize the number of microbursts detected (true-positives), number of microbursts not detected (true-negatives) and number of times random data was wrongly flagged as a microburst (false-positives). While I populated these categories, I paid attention to the data which differentiates one category over another.

**Results**

From the entire day, a total of 458 events were flagged. Out of these events, 397 of them were true-positives, and 61 were false-positives. So with these flagged detections, 13% of them were false positive. Furthermore, 134 microbursts were missed. This corresponds to an detector efficiency of 75%.

Overall, I am satisfied with the false-positive rate and detector efficiency.

**Observations**

1. The microbursts which were not flagged by the detector are usually:
   1. too low of amplitude to meet the threshold criteria
   2. A multi-peaked microburst
2. Microbursts that were correctly flagged are typically higher amplitude.
3. Flagged false positives are usually at transmitter noise, and counting noise at high amplitude backgrounds.
4. High amplitude count rates (> 1k c/s) is typically a sign of saturation. There are lots of false positive detections made in this case.
5. Overall, I would like to reduce the threshold to increase the detector efficiency, but that will allow more false positives through. The current settings represent a good balance. It will be good to characterize Paul’s method(s) as well.

**Plots to make**

1. Microburst detector panels: a) dos1 time series, b) wavelet power spectra with the filtered out parts grayed out, c) filtered time series with a horizontal line indicating the threshold. The time series above the threshold should be highlighted by a different color.
2. False positive detections at high count rates, and transmitter noise.
3. Multi-peaked microburst detections.