

Version 1.0 – Water Content Despiking

Water content was measured with the TDR technique; measured every five minutes and averaged every half hour. Unfortunately, over the course of the experiment every TDR sensor sporadically yielded poor waveforms and bad measurements. A couple of sensors were on the verge of failure for much of the experiment. Thus, these bad data were removed and replaced with the median despiker.

There were two sources of water content data: five-minute samples and half-hour averages. When the five-minute samples were recorded and available they were used for despiking. Otherwise, the half-hour averages were used. The five-minute samples were despiked and averaged every half-hour. Both sets of half-hour data (those originally calculated on the datalogger and those calculated with the five-minute despiked data) were further despiked using the exact protocol.

In each despiking step, data was removed, except in the end when the data was gap filled. Also, for each step the despiker was repeated until all spikes were identified.

Five-minute samples

1. Five-minute samples were despiked using L_a/L values between 2.75 and 25, a 5th order median-filter (55 minute window), with a threshold of ± 0.35 .
2. The five-minute data was averaged every half-hour.

Half-hour samples

3. All half-hour averages were despiked using L_a/L standard deviations between 0.0035 and 0.65 (5 cm depth TDR sensors) or 0.35 (15 cm depth TDR sensors), a 5th order median-filter (five-and-a-half hour window), with a threshold of ± 0.65 (5 cm depth TDR sensors) or ± 0.35 (15 cm depth TDR sensors).
4. Half-hour averages were then despiked using θ_v values between -0.01 and $0.40 \text{ m}^3\text{m}^{-3}$, a 5th order median filter (five-and-a-half hour window), with a threshold of $\pm 0.03 \text{ m}^3\text{m}^{-3}$.
5. Two TDR sensors (Rep2SlashCenter-15cm and Rep2SlashEdge-15cm) performed very poorly, and were further despiked using θ_v values between -0.01 and $0.40 \text{ m}^3\text{m}^{-3}$, a 167th order median-filter (one-week window), with a threshold of $\pm 0.015 \text{ m}^3\text{m}^{-3}$. This was applied after the sensor began deteriorating (in 2004 for the center sensor and 2005 for the edge sensor).
6. All half-hour averages were gap filled using a 5th order median-filter (five-and-a-half hour window). Gaps larger than two-and-a-half hours were not filled.
7. Finally, all data were inspected for other bad data or unreasonable gap filling, which were manually removed.

A despiking protocol and an example using the TDR probes can be found with the despiker source code and executable files.