

Wind Sensor Comparison - Lufft Ventus-UMB vs. RM Young 5103, Summit Station Greenland - July 2015 to April 2016

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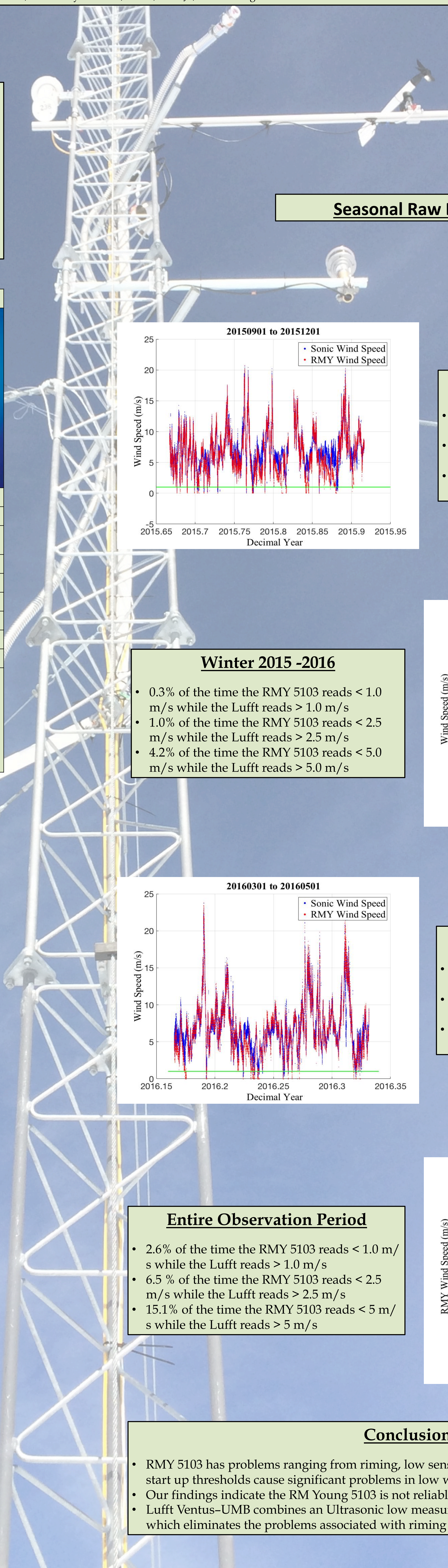
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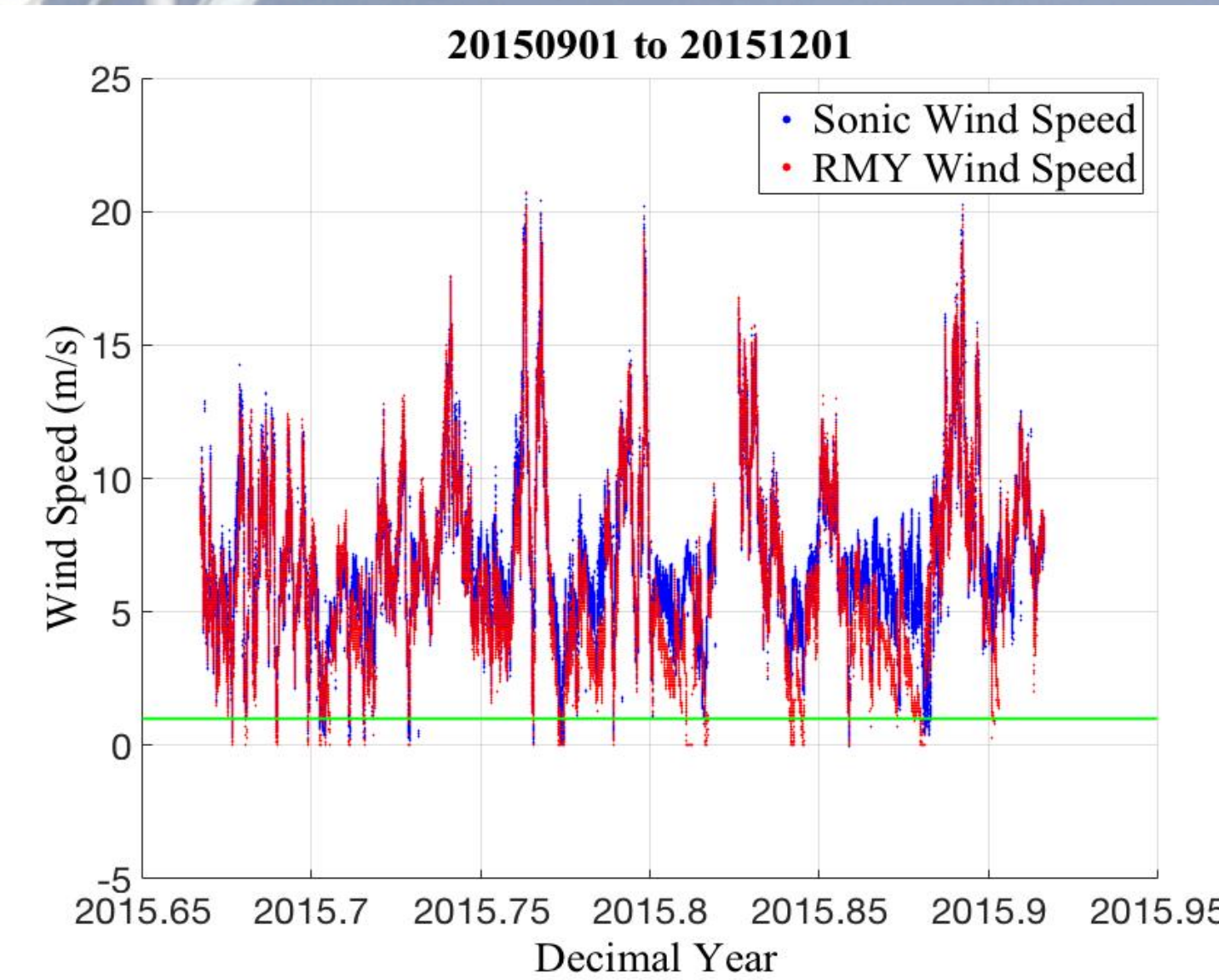
Abstract

NOAA/ESRL - GMD has been conducting a side by side comparison of a Lufft Ventus-UMB heated ultrasonic wind sensor and a RM Young model 5103 wind monitor at Summit Station, Greenland since July 2015. We compared the performance of three instruments on the tower, located next to the Temporary Atmospheric Watch Observatory. The instruments are co-located at 9, 10 and 14.5 meter heights on the tower. Our analysis shows comparable performance for all wind speeds above 5 m/s but substantial discrepancies below 5 m/s. During the observation period, our analysis also demonstrates that the 5103 wind monitor under-reported the wind speeds ~15% of the time. It also reported conditions that unnecessarily required curtailed station operations for a total of 7.9 days. Our findings indicate the 5103 wind monitor is not reliable below 5 m/s in Arctic conditions.

SPECIFICATIONS	RM YOUNG 5103	Lufft Ventus - UMB
		
Range	0 - 100 m/s (195 kts), 0 - 360°	0-90 m/s (175 kts), 0- 359.9°
Accuracy		
Wind Speed	±0.3 m/s (0.6 mph) or 1% of reading	±0.2 m/s (0.4 mph) or 2% RMS of reading which ever is higher
Wind Direction	±3 °	< 2° RMSE > 1.0 m/
Operating Temperature	-50 to 50°C	-40 to 60°C with heating
Threshold		
	Propeller: 1.0 m/s (2.0 kts)	Wind Speed: 0.1 m/s (0.2 kts)
	Vane: 1.1 m/s (2.1 kts)	Wind Direction: 0.1 m/s (0.2 kts)
Signal Output		
	Wind speed: magnetically induced AC voltage, 3 pulses per revolution, 1800 rpm (90 Hz) = 8.8 m/s (19.7 mph) Wind direction: DC voltage from conductive plastic potentiometer - resistance 10K Ω, linearity 0.25%, life expectancy - 50 million revolutions	Signal Output Analog: 0...20mA, 4...20mA, 0...10V, 2...10V, 2...2,000 Hz only output 1 (instantaneous, avg, min, max)

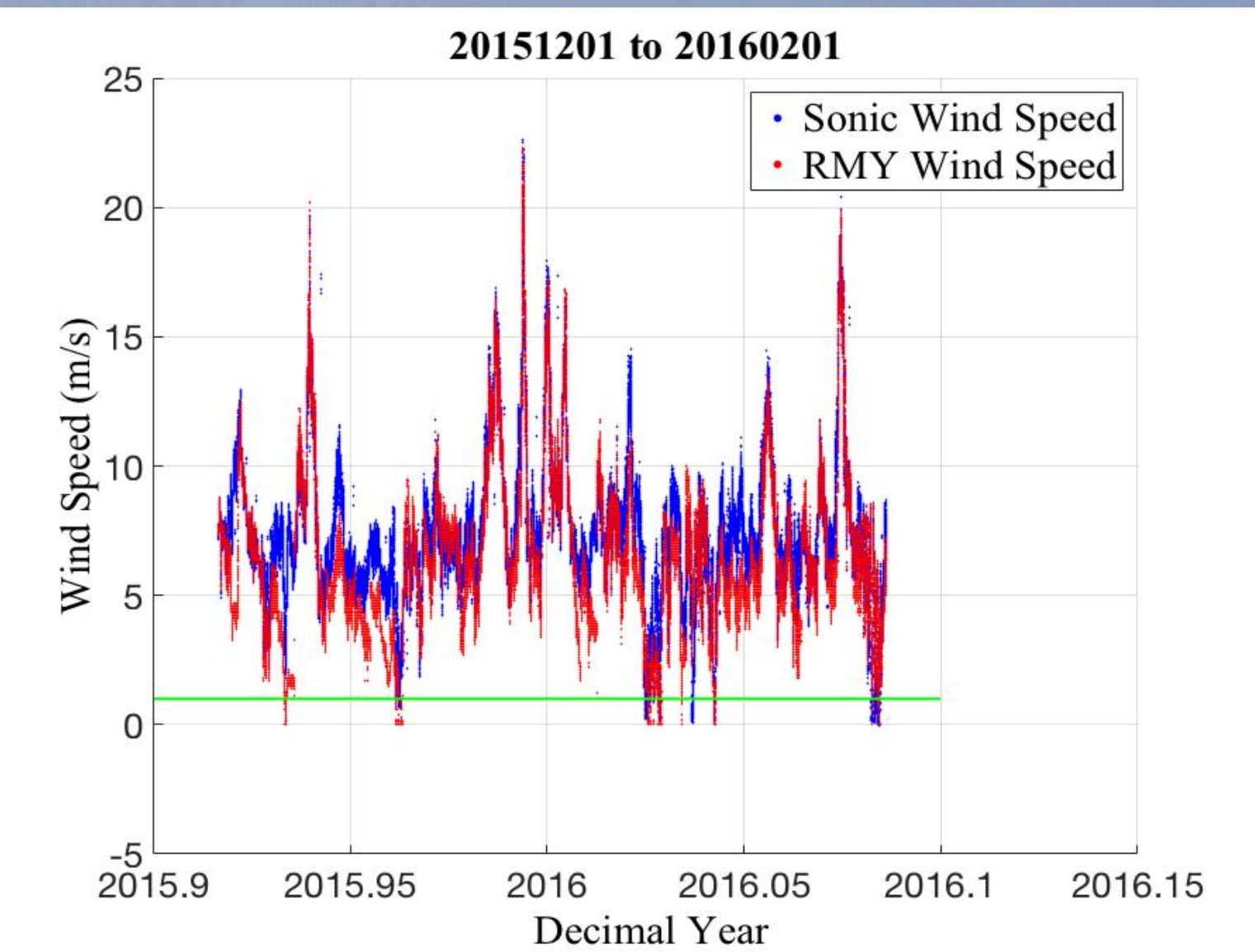


Seasonal Raw Data



Fall 2015

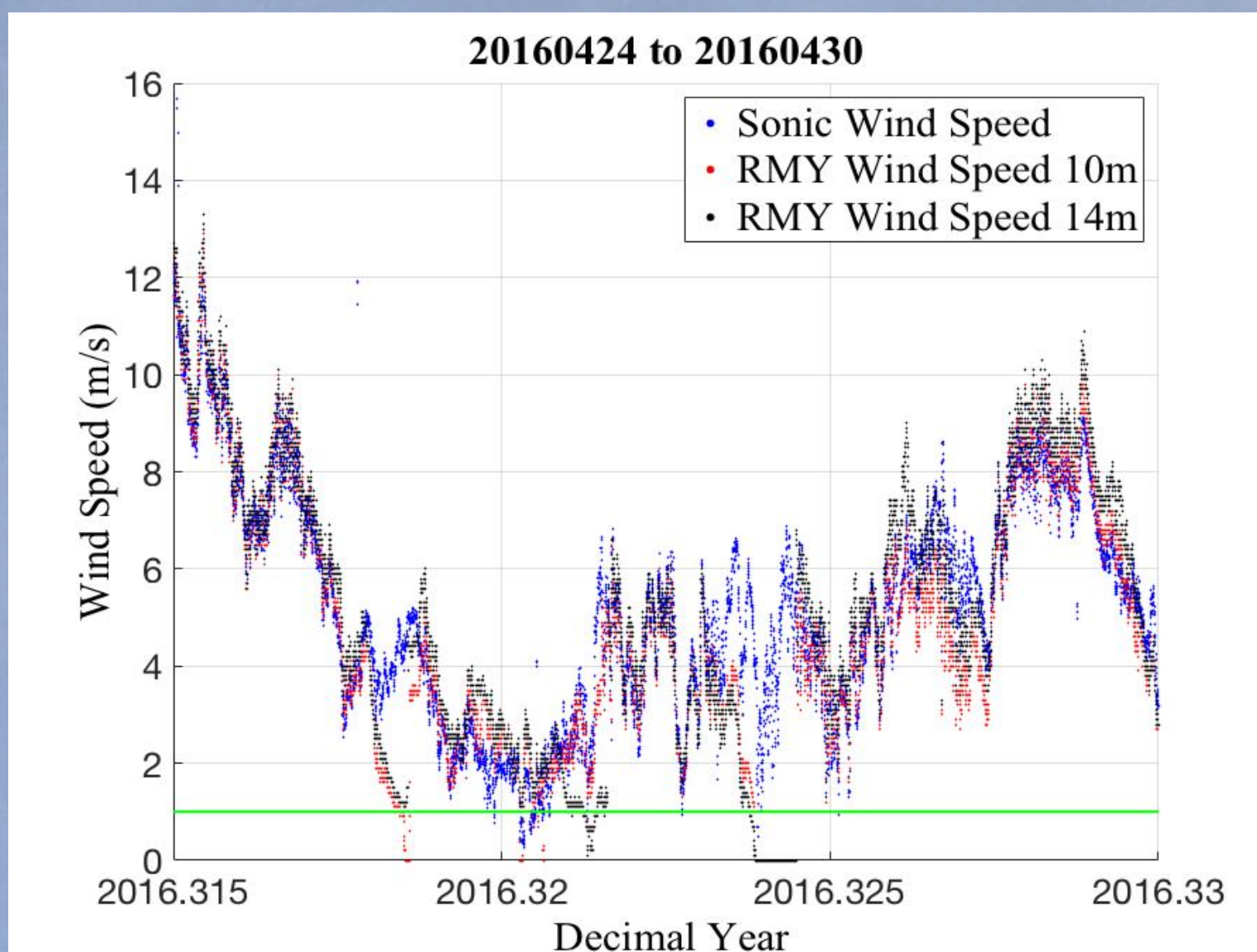
- 0.7% of the time the RMY 5103 reads < 1.0 m/s while the Lufft reads > 1.0 m/s
- 2.5% of the time the RMY 5103 reads < 2.5 m/s while the Lufft reads > 2.5 m/s
- 4.9% of the time the RMY 5103 reads < 5.0 m/s while the Lufft reads > 5.0 m/s



Winter 2015 -2016

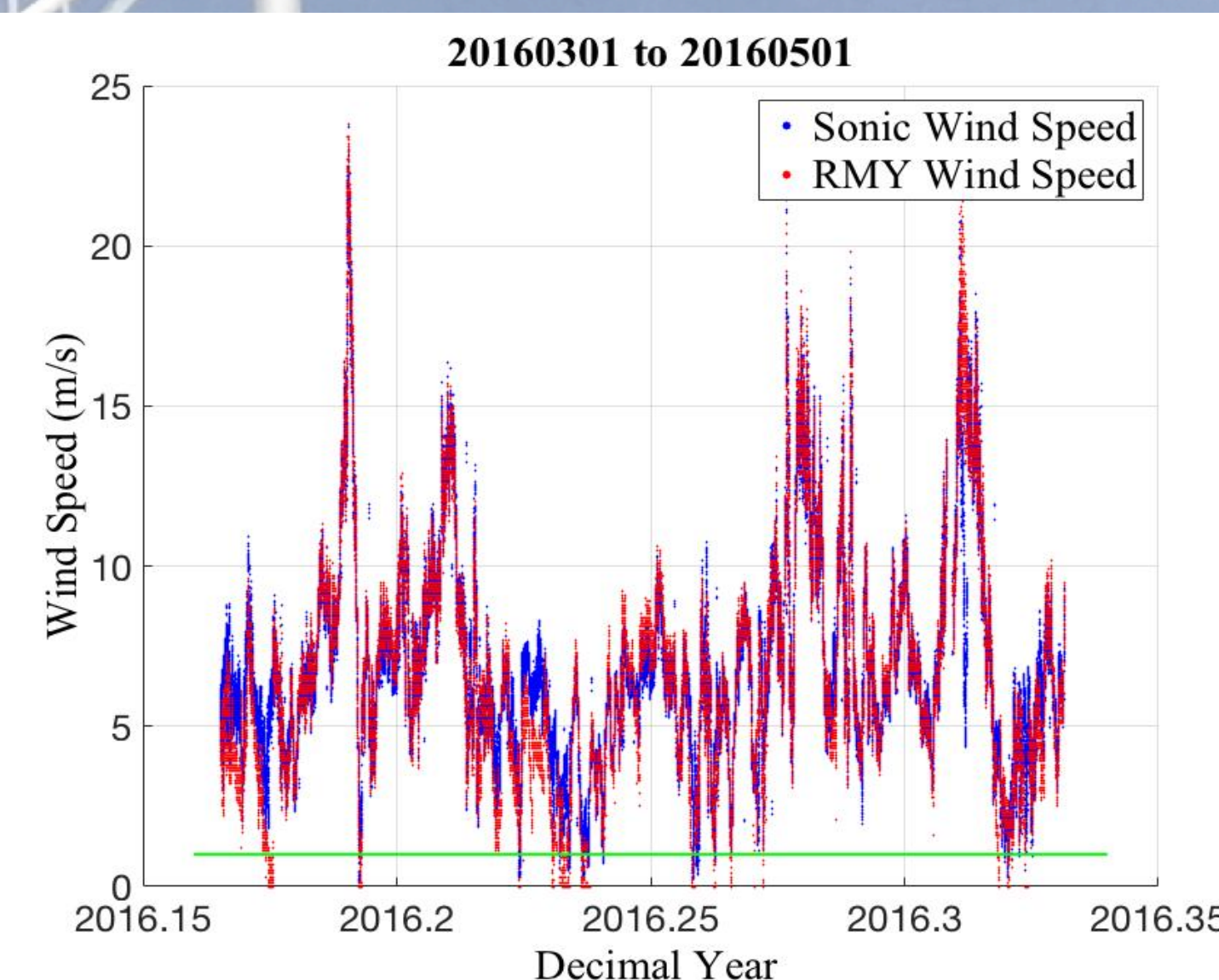
- 0.3% of the time the RMY 5103 reads < 1.0 m/s while the Lufft reads > 1.0 m/s
- 1.0% of the time the RMY 5103 reads < 2.5 m/s while the Lufft reads > 2.5 m/s
- 4.2% of the time the RMY 5103 reads < 5.0 m/s while the Lufft reads > 5.0 m/s

Analysis



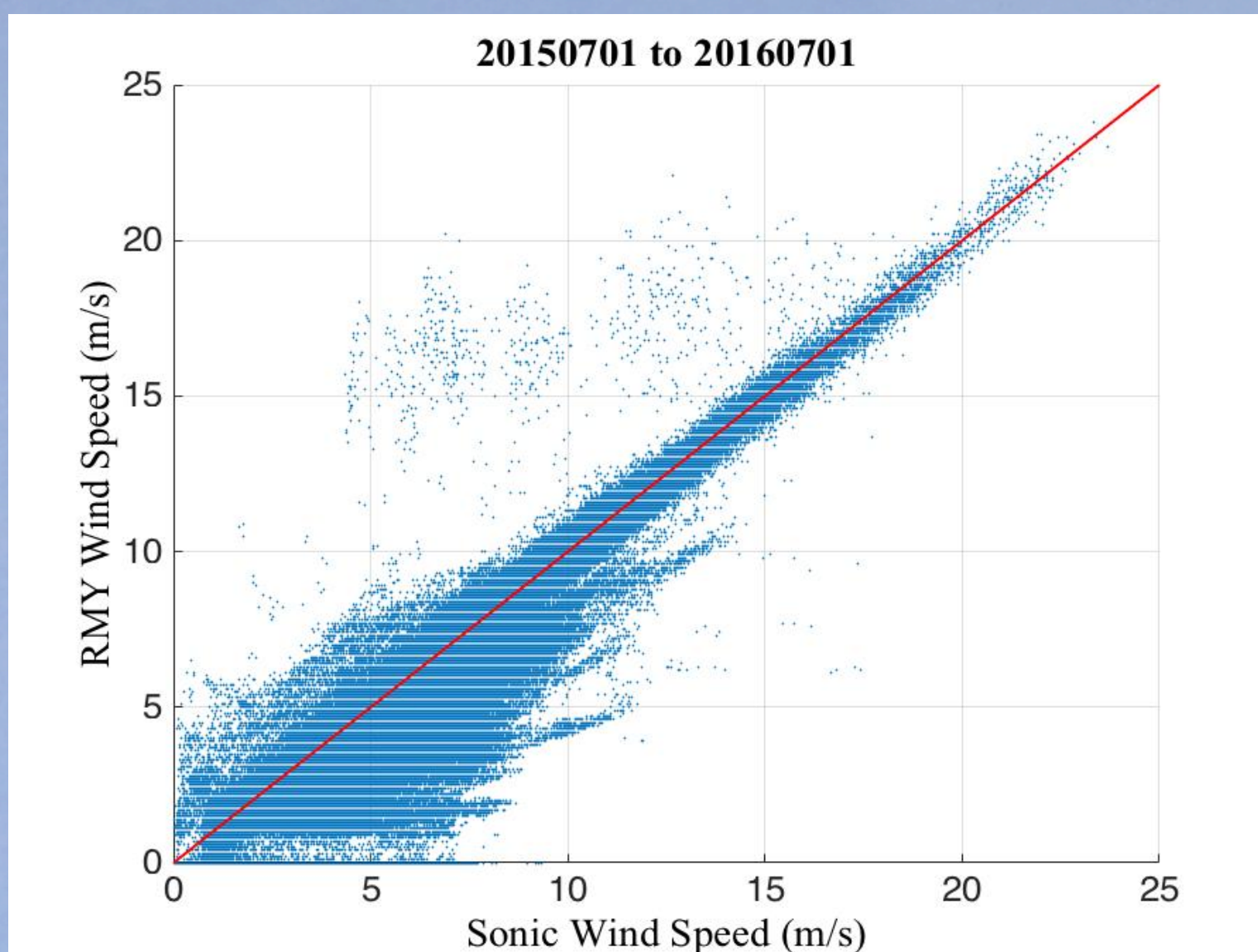
Detailed Look at a Low Wind Period

- RMY 5103 at both 10 and 14.5 meters drop offline during riming event from 2016.318 to 2016.319
- Lufft continues to show Wind Speeds above 3.5 m/s during same period



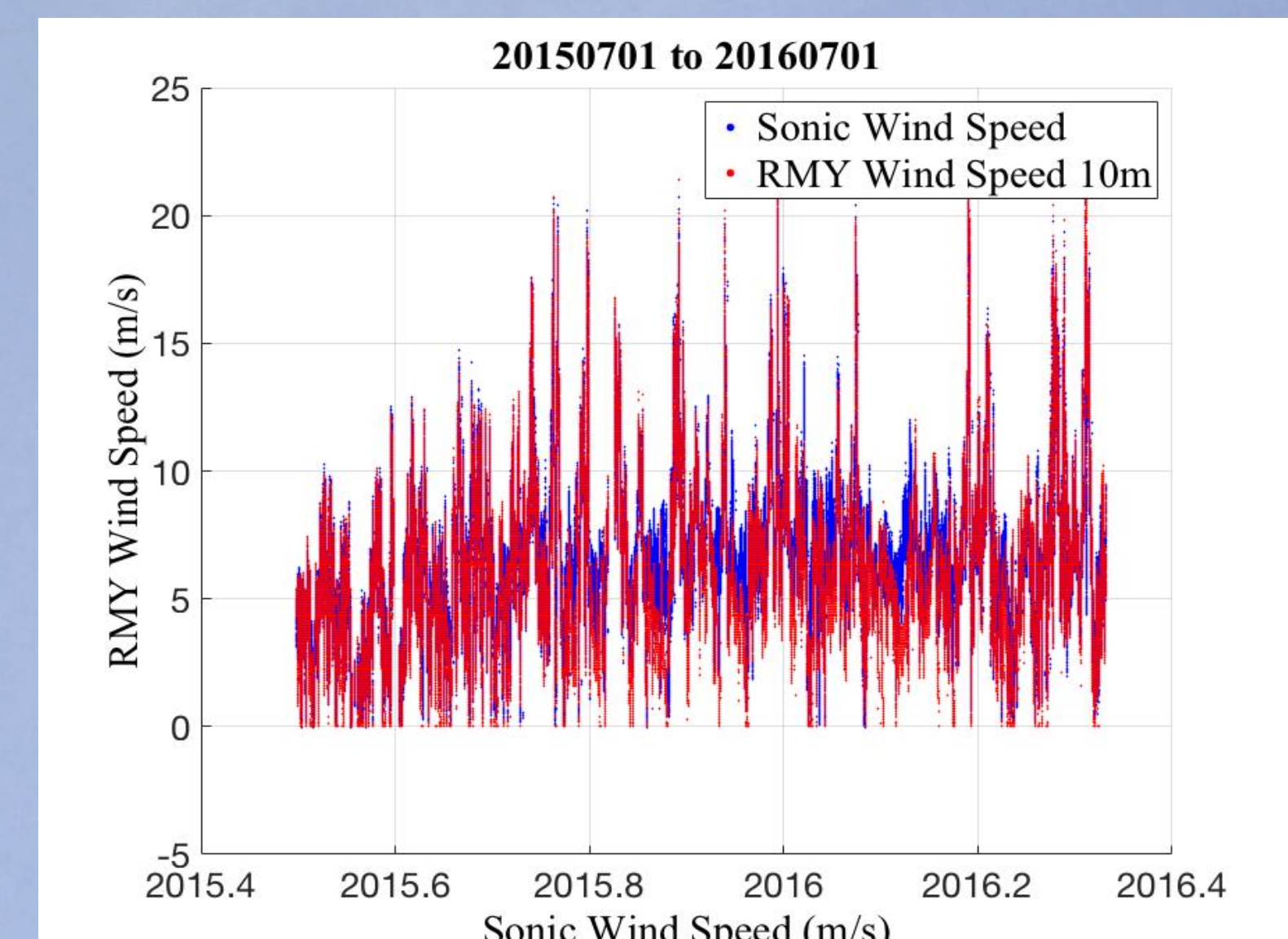
Spring 2016

- 0.6% of the time the RMY 5103 reads < 1.0 m/s while the Lufft reads > 1.0 m/s
- 1.0% of the time the RMY 5103 reads < 2.5 m/s while the Lufft reads > 2.5 m/s
- 4.2% of the time the RMY 5103 reads < 5.0 m/s while the Lufft reads > 5.0 m/s



Entire Observation Period

- 2.6% of the time the RMY 5103 reads < 1.0 m/s while the Lufft reads > 1.0 m/s
- 6.5% of the time the RMY 5103 reads < 2.5 m/s while the Lufft reads > 2.5 m/s
- 15.1% of the time the RMY 5103 reads < 5 m/s while the Lufft reads > 5 m/s



One to One Plot of Raw Data

- The RMY 5103 shows that 15% of the time it has an offset of up to 5 m/s when compared to the Lufft.
- The RMY 5103 shows good correlation with the Lufft above 10 m/s

Conclusions

- RMY 5103 has problems ranging from riming, low sensitivity to wind shifts and relatively high start up thresholds cause significant problems in low wind conditions.
- Our findings indicate the RM Young 5103 is not reliable below 5 m/s in these conditions.
- Lufft Ventus-UMB combines an Ultrasonic low measurement thresholds with a heated shell which eliminates the problems associated with riming events.