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Preliminary Results of Triple Doppler Wind Lidars During MATERHORN

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ARL Participation of MATERHORN



- Funded by Air Force Weather Agency (AFWA) for 3DWF model validation
- Participated both 2012 and 2013 field observations (Leosphere windcube100)
- Year 2012: IOPs 1-3 at Small Gap; **IOPs 4-6 at East Slope**; IOPs 7-9 at Big Gap
- Year 2013: **IOPs 4 -6 at East Slope**; IOPs 7-10 at North East side of Granite mountain.

* Red color IOPs: triple lidar coordinated observations with UND and UU

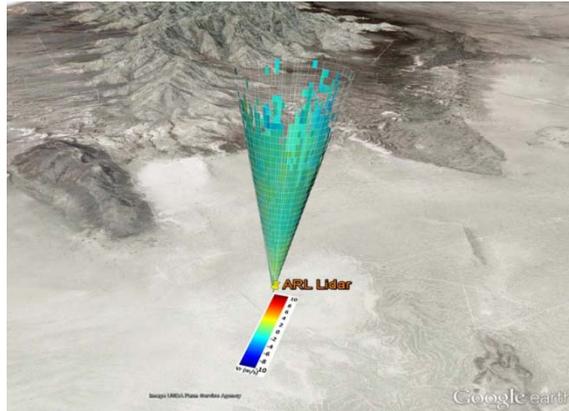


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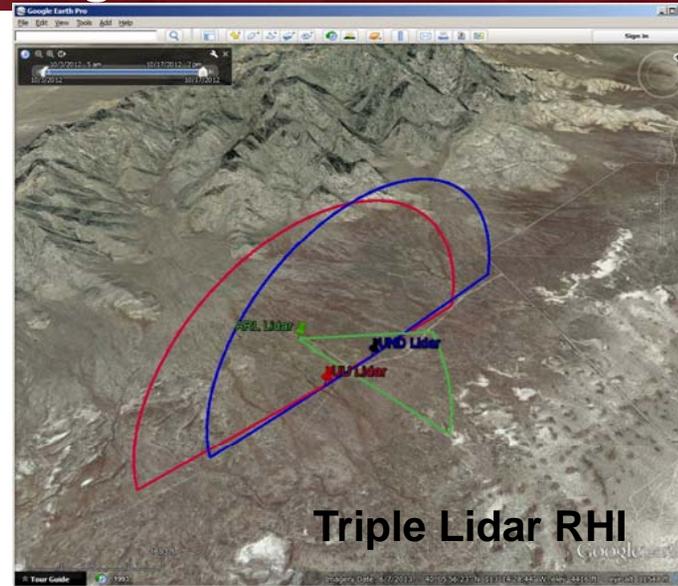
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2012 lidar Locations and Scanning Patterns

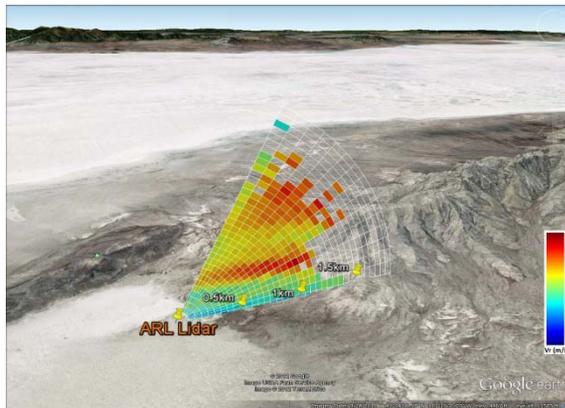
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VAD (PPI) at Big Gap



Triple Lidar RHI



RHI at Small Gap



Near Ground PPI Scan

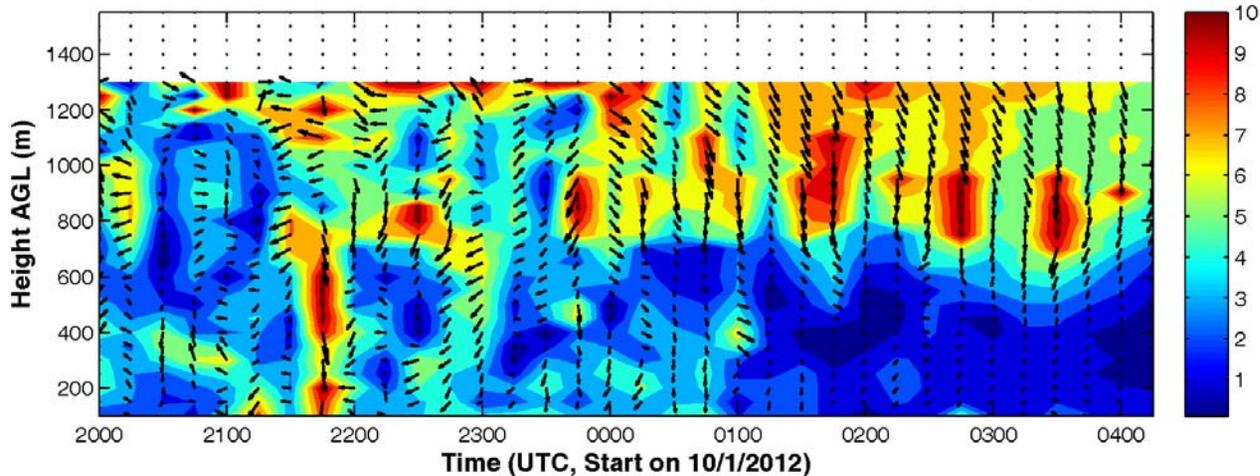
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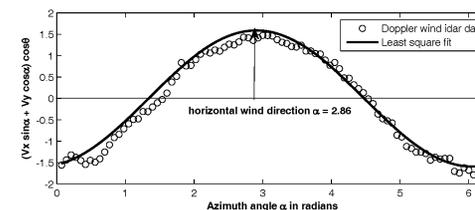
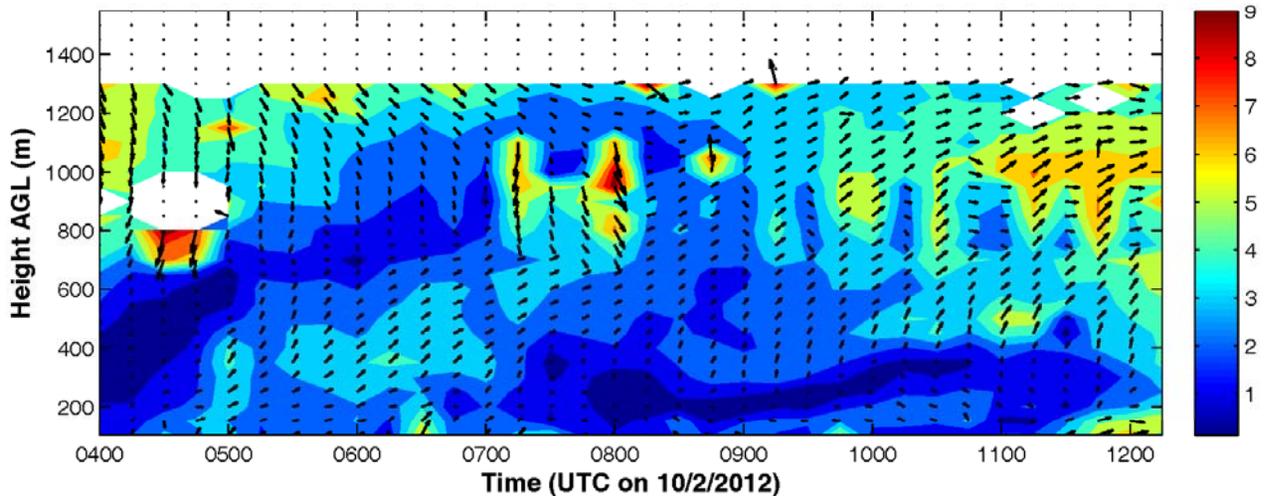
Examples of Wind Profiles from ARL lidar at Small Gap Using VAD Scans



IOP2 ARL lidar horizontal wind profile at small gap (40.066066N, 113.249283W)

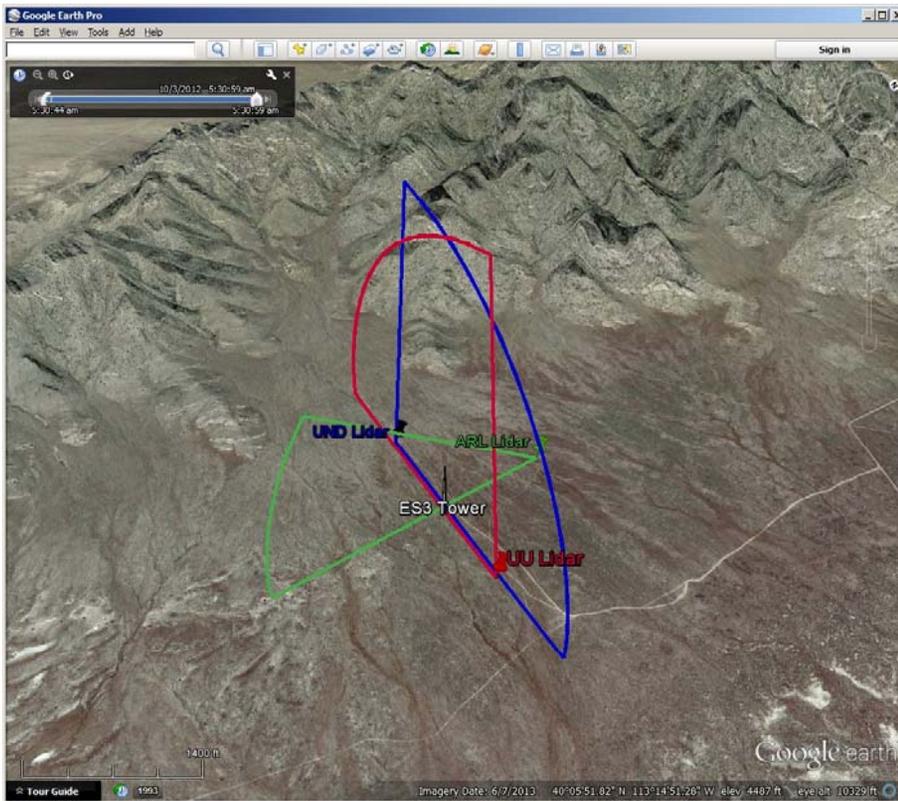


IOP2 ARL lidar horizontal wind profile at small gap (40.066066N, 113.249283W)

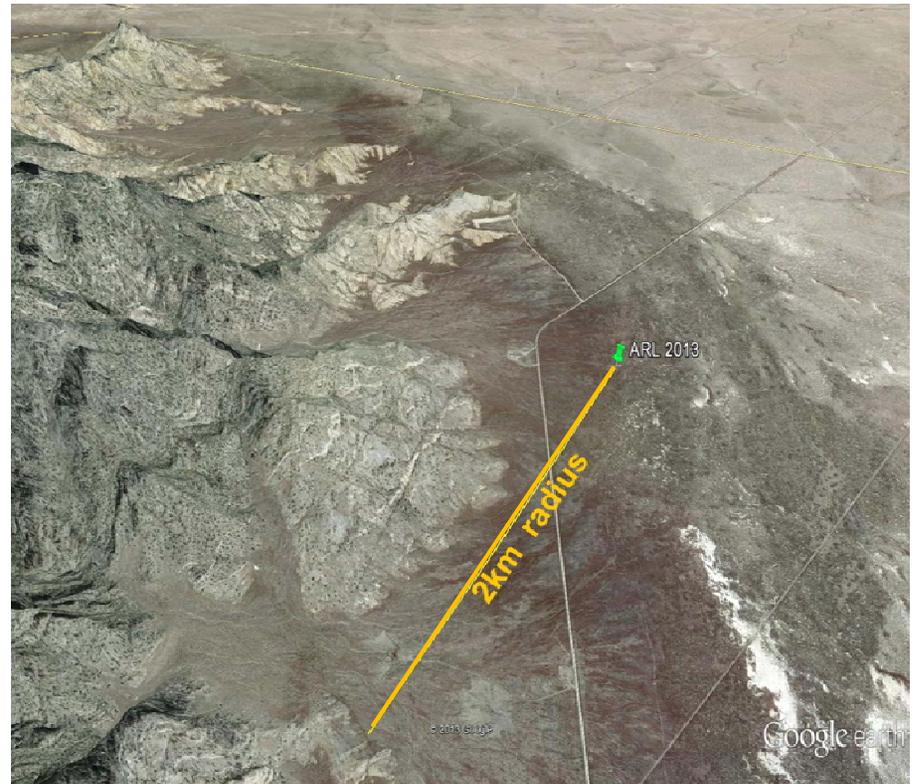




Triple Lidar Scans at East Slope



Single Lidar Scans at NE Slope

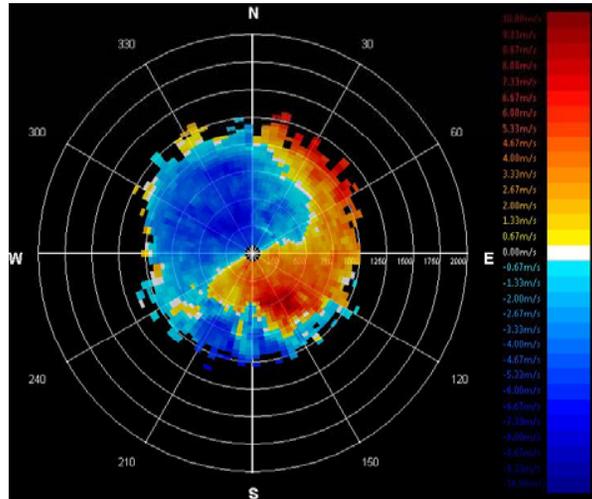




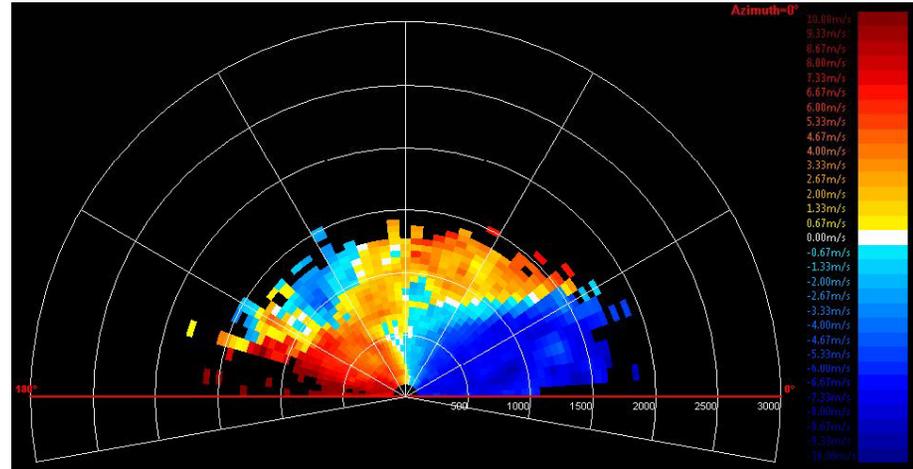
Examples of Lidar Images at NE Slope



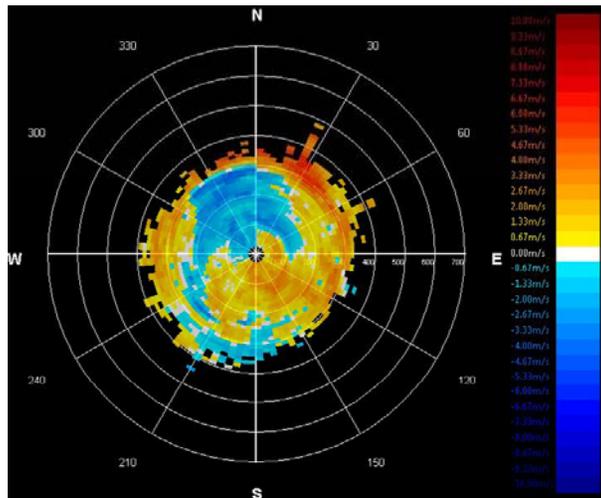
PPI Scan Elev = 45°



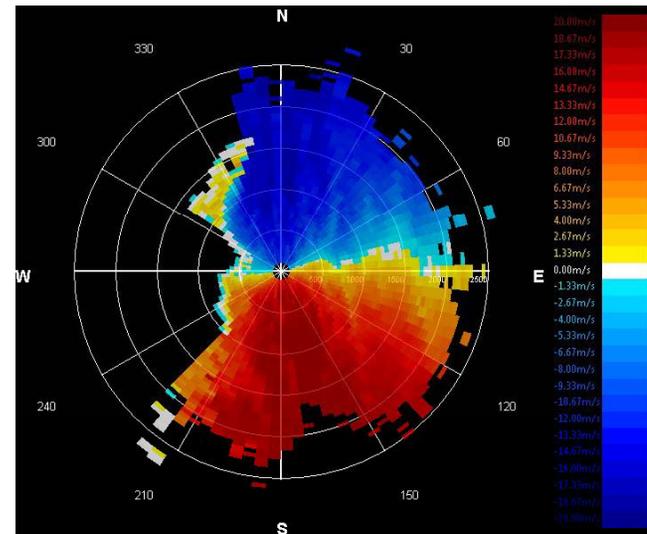
RHI Scan



PPI Scan Elev = 75°



PPI Scan Elev = 3°



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A Simple Retrieval of near Surface Wind at NE Slope 2013

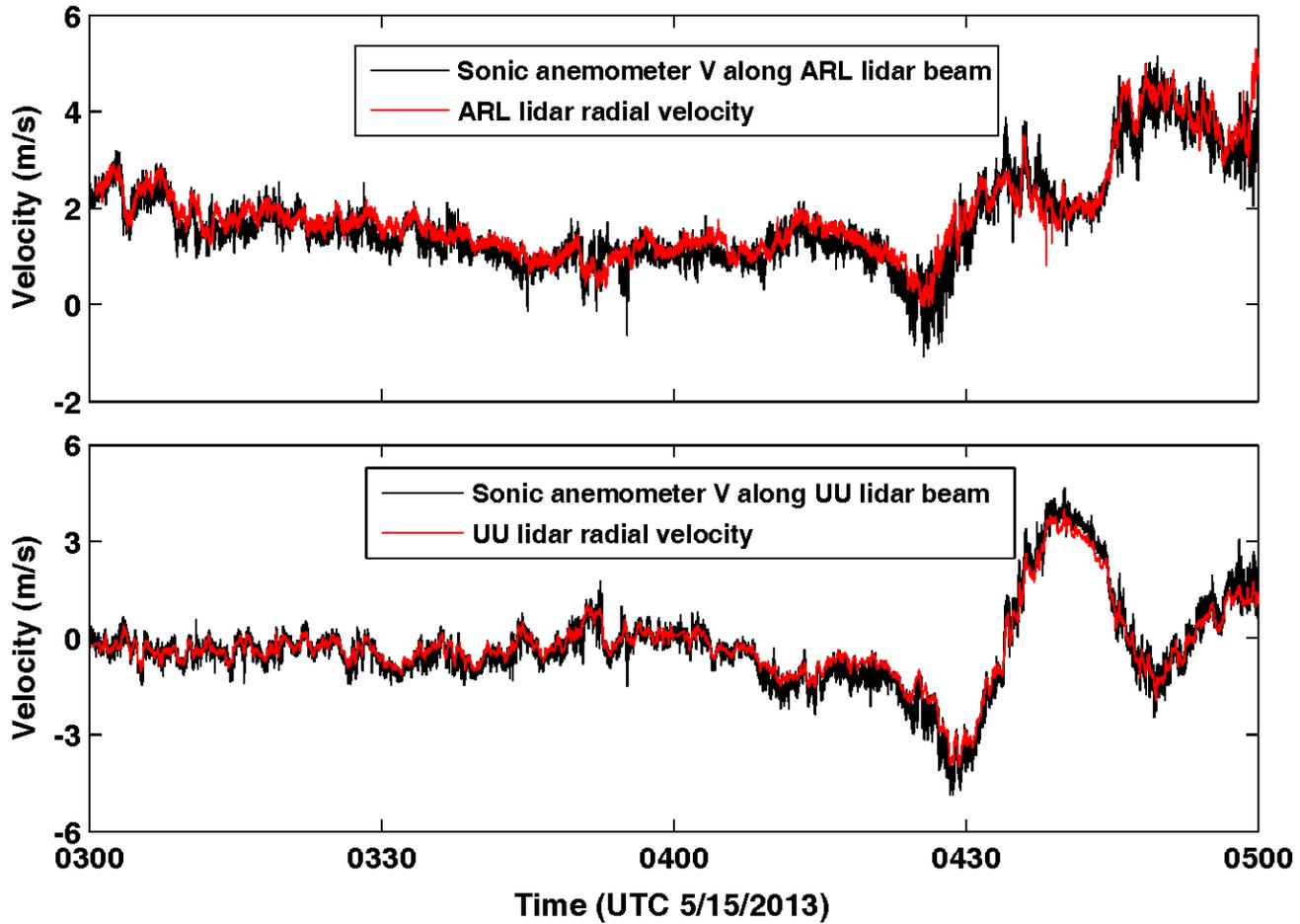
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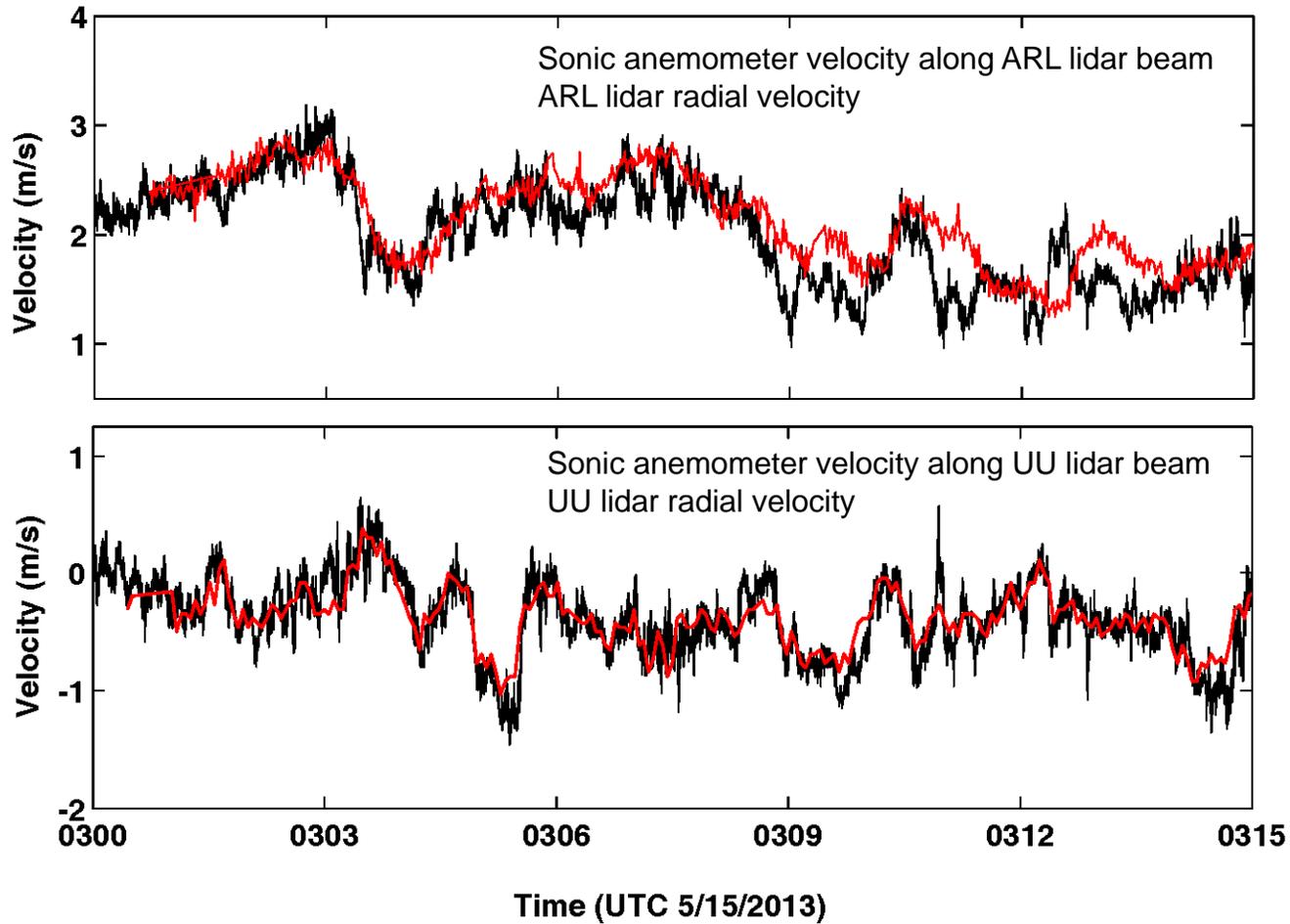
Lidar Steer Data compared with Sonic





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Lidar Steer Data compared with Sonic (Zoomed in)





Triple Lidar retrieved virtual towers (Examples)



Time (10/7/2012) (UTC)	Lat.	Lon.	Z(m AGL)	U(m/s)	V(m/s)	W(m/s)
11.15837	40.09638	-113.23779	57.65129	-0.22	1.21	-0.44
11.15863	40.09638	-113.23779	71.24123	-0.74	-0.64	-0.12
11.15890	40.09638	-113.23779	84.59879	-1.01	-0.34	0.03
11.15918	40.09637	-113.23779	98.46066	-1.26	-1.10	-0.75
11.15976	40.09637	-113.23779	128.68462	-1.88	-3.50	-0.52
11.16002	40.09637	-113.23779	143.01363	-1.37	-2.45	1.63
11.16058	40.09637	-113.23779	173.25742	-1.15	-3.14	-1.16
11.16085	40.09637	-113.23779	189.31435	-0.76	-2.13	0.86
11.16421	40.09607	-113.23782	16.99265	0.96	2.95	-0.17
11.16448	40.09607	-113.23782	30.61205	0.60	2.22	-0.42
11.16474	40.09607	-113.23782	43.35239	0.30	2.85	-0.56
11.16558	40.09607	-113.23782	83.66534	-1.12	-1.56	-0.01
11.16586	40.09607	-113.23782	97.08382	-1.11	-0.93	0.04
11.16641	40.09607	-113.23782	124.89384	-1.32	-1.88	0.13
11.16669	40.09607	-113.23782	139.67776	-1.58	-2.00	1.24



Summary

- A lot of lidar data were taken during MATERHORN 2012 and 2013 field campaigns. Analysis is on going.
- The lidars were located in several strategic places and the data contains rich information about wind field over mountainous terrain.
- Triple lidar work with UND and UU indicated that the combined lidars have the potential to observed the large turbulent eddies. Some advantages of lidars are that they can reach higher altitudes and can be easily located in different places.
- In order to get the accurate 3-D wind vector retrieval, the temporal and spatial synchronizations are critically important! (suggestion to lidar manufactures, put scanner controller for multiple lidars in one unit for this type of work).



- Analysis on the steer data using wavelet/spectral method see if how different between lidar and sonic data
- Triple Doppler wind lidar retrieved virtual towers, statistics compared with sonic and other observations when is possible.
- Comparison between triple and dual lidars retrieved virtual tower data
- Accuracy studies on the retrieved winds under different kind wind conditions (i.e. strong/weak, stable/unstable)

