Validation of Aeolus L2B Rayleigh wind product using Rayleigh Doppler lidar at La Reunion island within AboVE-2 campaign

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LATMOS

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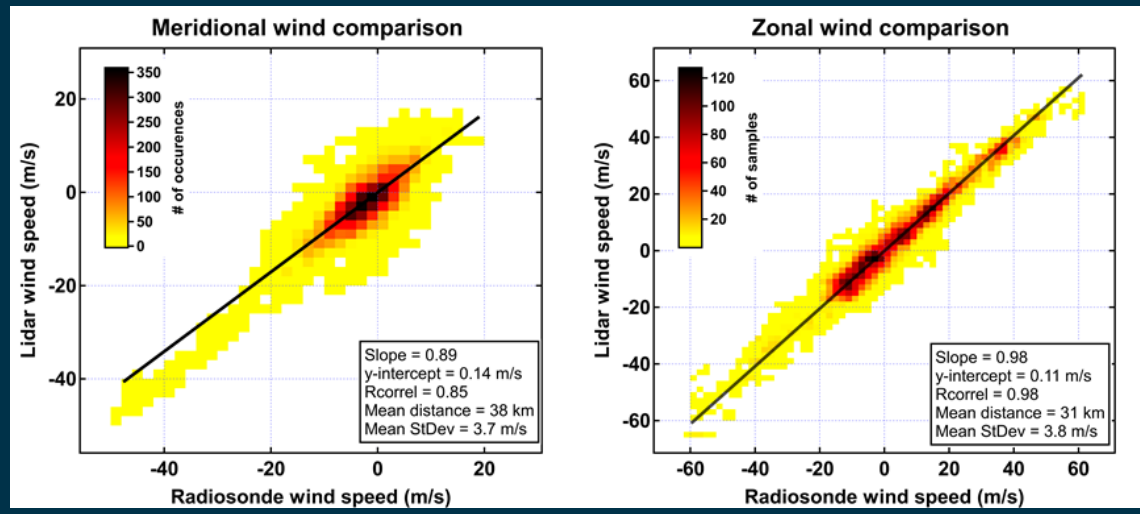
Rayleigh-Mie Doppler wind lidar LiWind

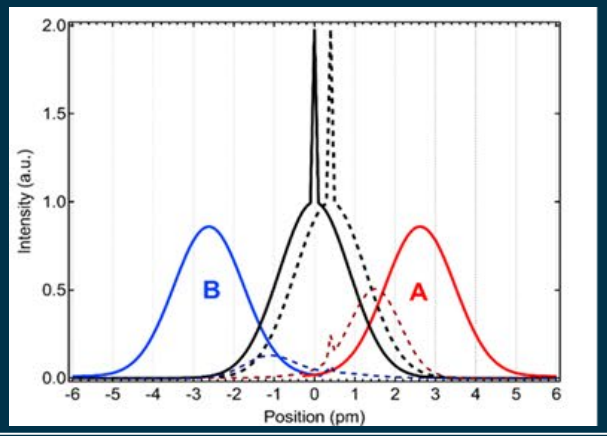
LiWind – Doppler wind lidar at Maïdo observatory (La Reunion island)

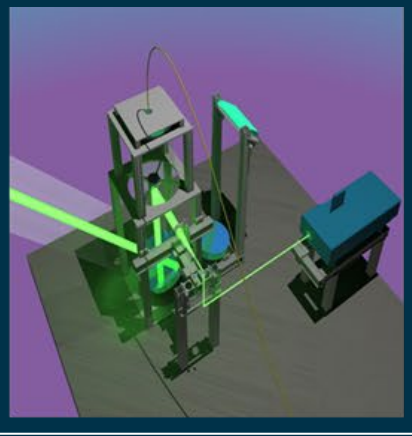
- Double-edge Fabry-Perot interferometry: same as ALADIN Rayleigh channel
- Altitude range: 5 – 65 km, vertical resolution 100 m, temporal resolution 5 minutes, random error < 1 m/s up to 25 km altitude
- Regular operation and intensive measurement campaigns since 2014
- AboVE- Aeolus Validation Experiment: intensive measurement campaigns and punctual cal/val measurements
- Above-Maido1 campaign : 25 sept 2019 to 10 oct 2019
- Above-Maido2 campaign : 31 may 2021 to 24 june 2021

39 Comparison of LiWind and Radiosondes



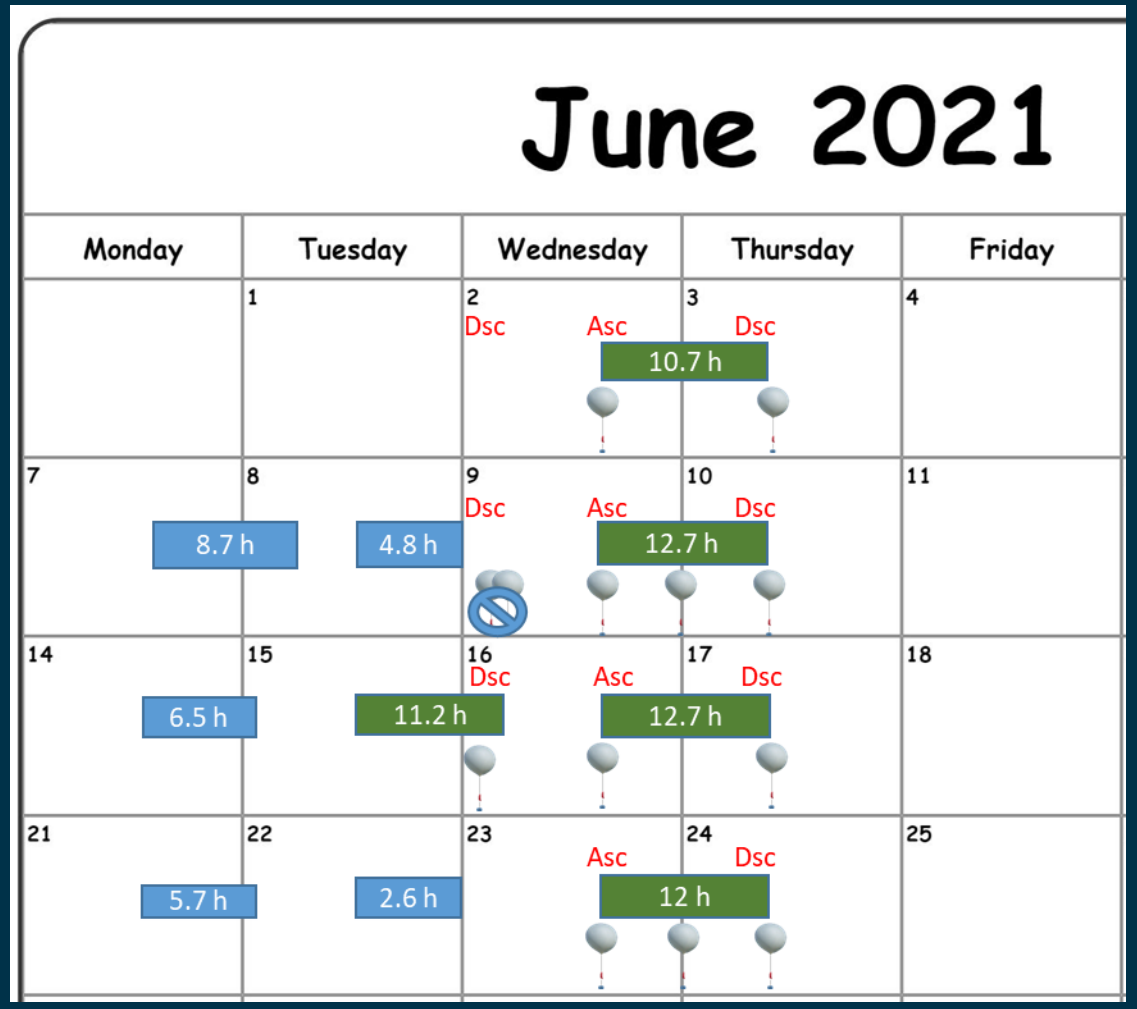
Mean difference with collocated RS: <0.2 m/s, SD = 3.8 m/s





Experimental method applied

Aeolus Validation Experiment at Maido, AboVE-Maido 2

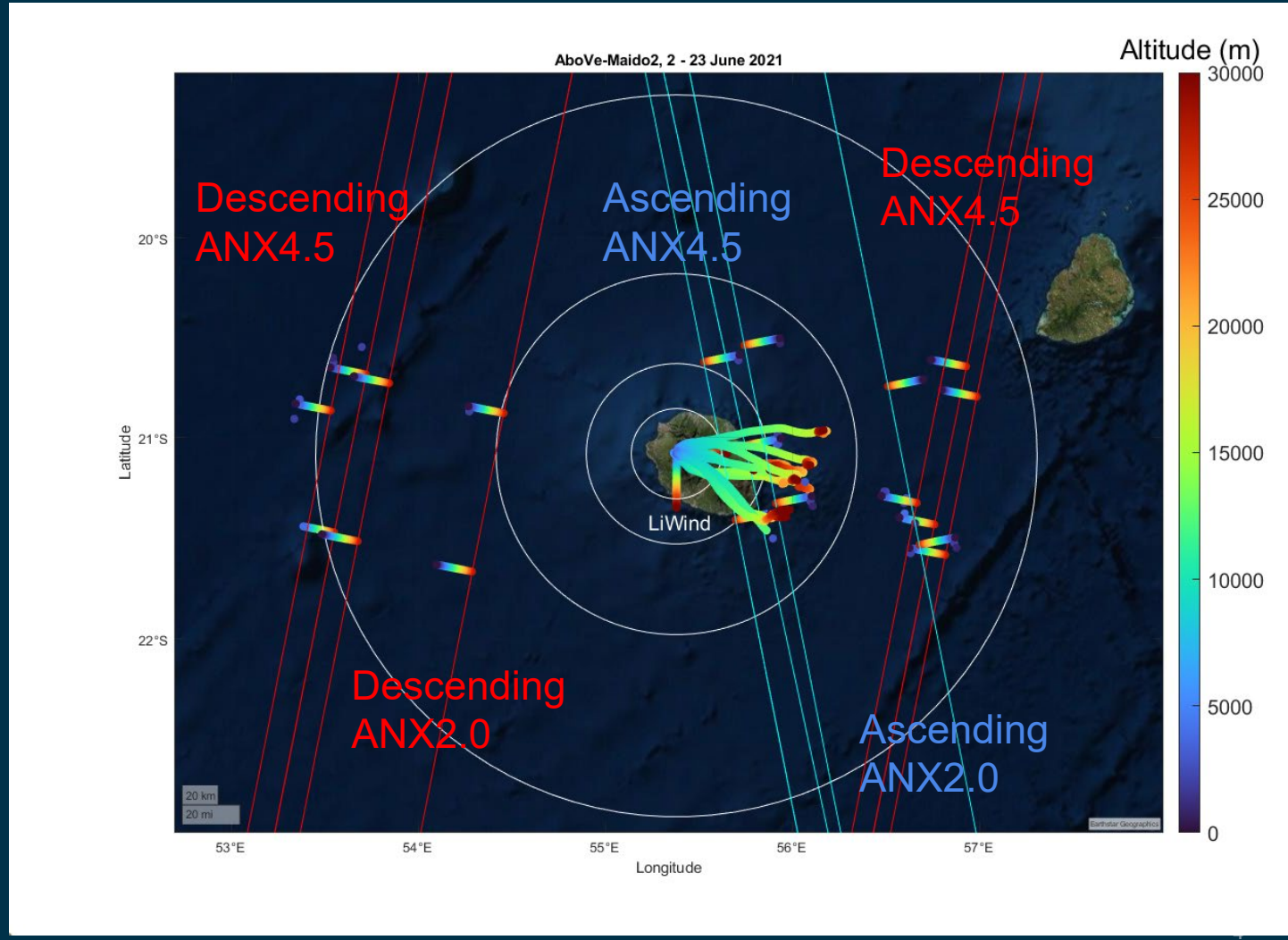


- **31 May – 24 June 2021**
- 10 nights of lidar measurements (5 nights of 10+ hours duration)
- 13 radio soundings of which 11 successes and 9 reaching 30+ km
- 9 RS Collocations | 8 LW Collocations | 4 Ascending | 5 Descending

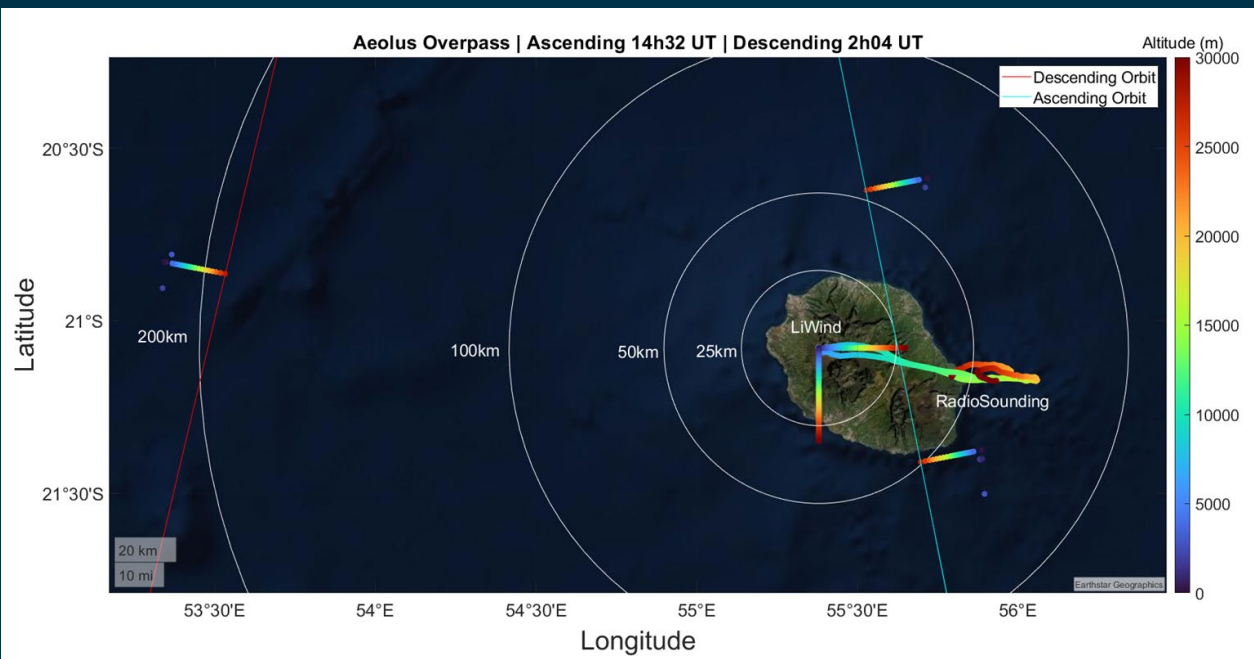
Experimental method applied

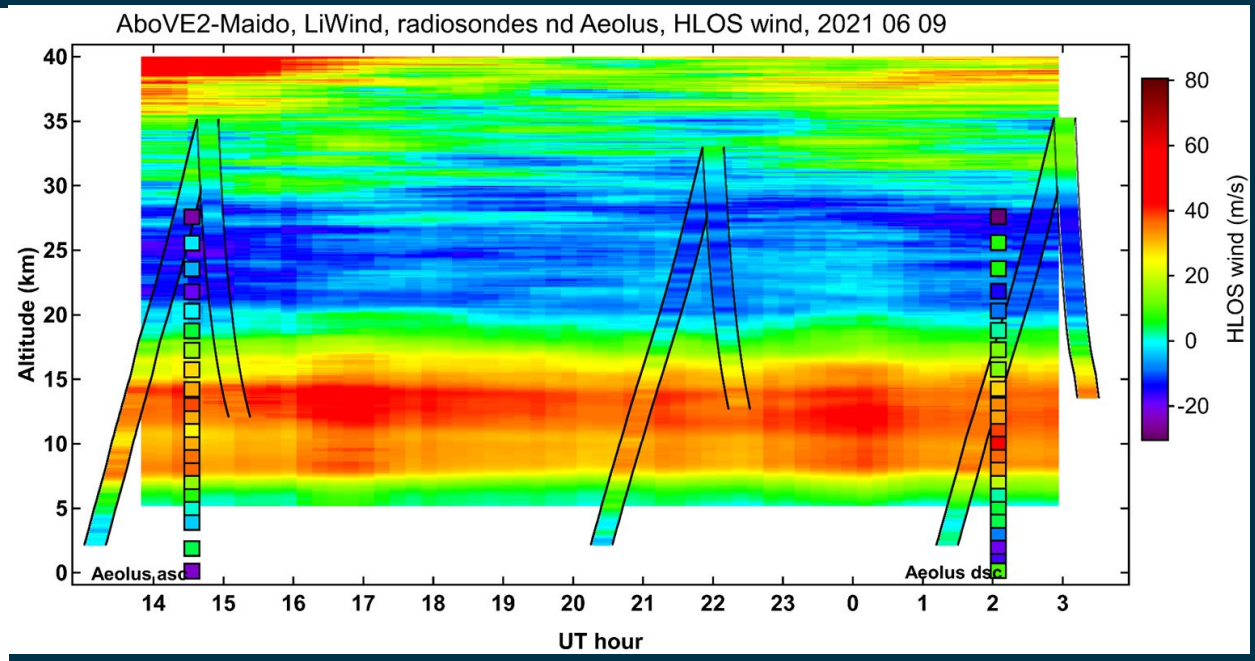
Aeolus Validation Experiment at Maido, AboVE-Maido 2

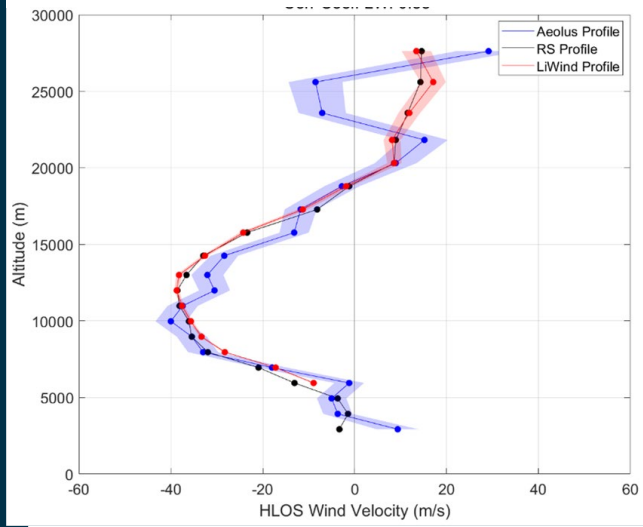
- Distance to overpass :
  21 km- 132 km (asc)
  113 km-257 km (dsc)
- Orbit shift from ANX 4.5 to ANX 2.0 during the last week of campaign
- The Reunion RBS : evaluation of ALADIN performance up to the maximum achievable altitude (28700 m) from the 27/05/2021 to 01/01/2022

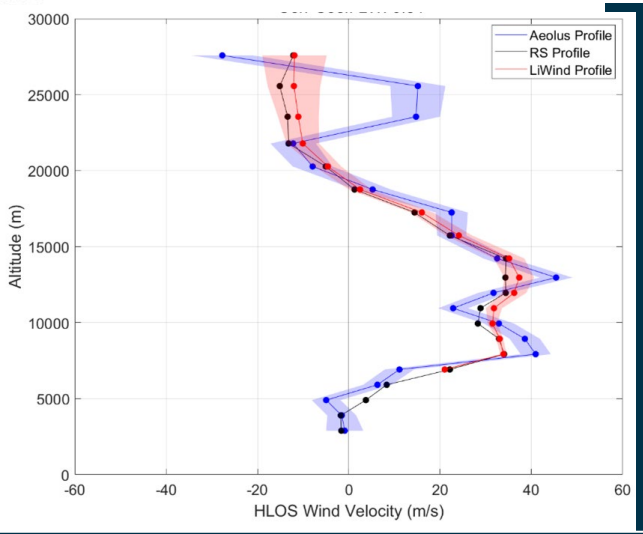


Experimental method applied









Ascending overpass at 14h30 June 9 2021

Distance to collocation RS : 21 km | LW : 28.5 km

Random Error [all bins] : 11.21 m/s | [5-22 km] : 5.99 m/s

Descending Overpass at 2h04 June 10 2021

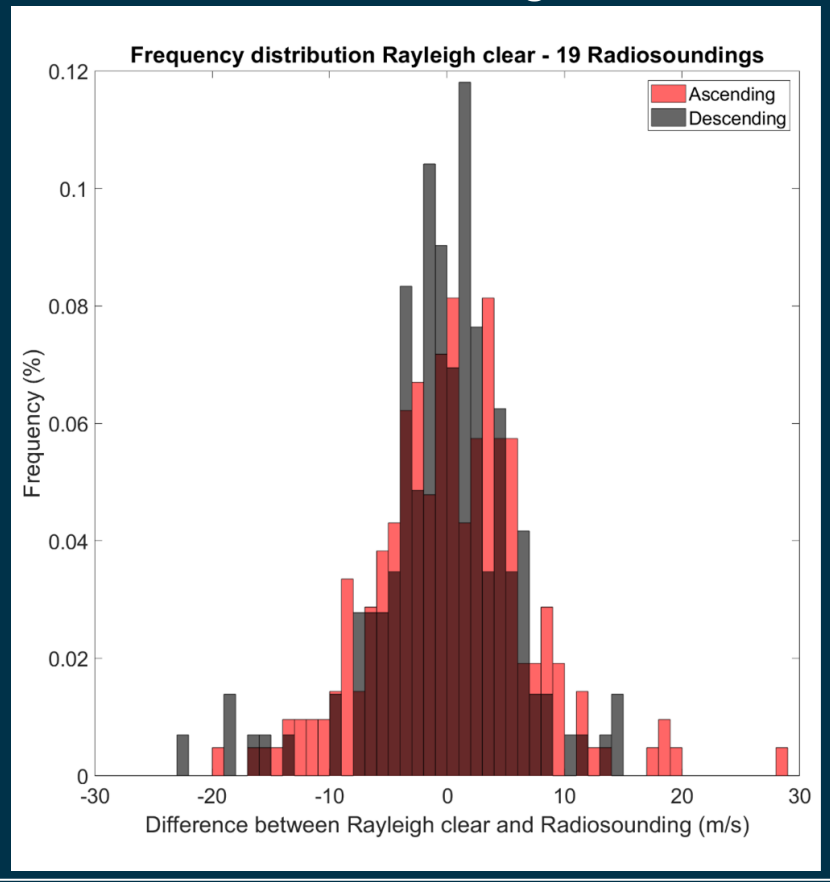
Distance to collocation RS : 257 km | LW : 214 km

Random Error [all bins] : 9.34 m/s | [5-22 km] : 4.68 m/s

Main results from L2B product quality analysis

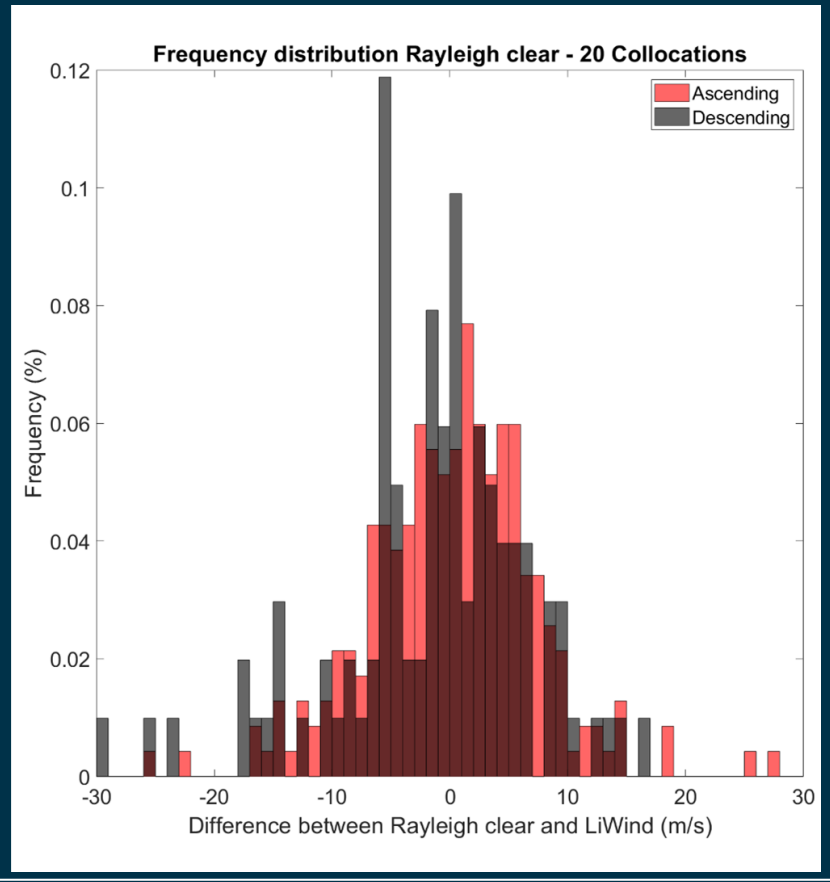
- Rayleigh clear only : Obs Type 2 / Validity flag 1
- FM-B period : Sept 2019 to Nov 2021
- 19 Radiosoundings, 20 LiWinds, 15 Ascending overpasses, 9 Descending overpasses

Radisoundings



Good overall gaussian shape for both instruments

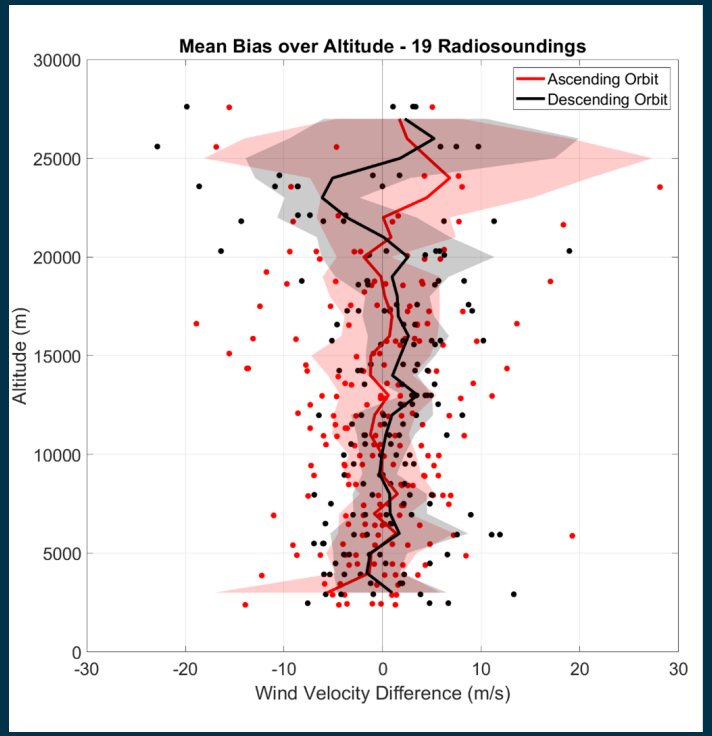
LiWind

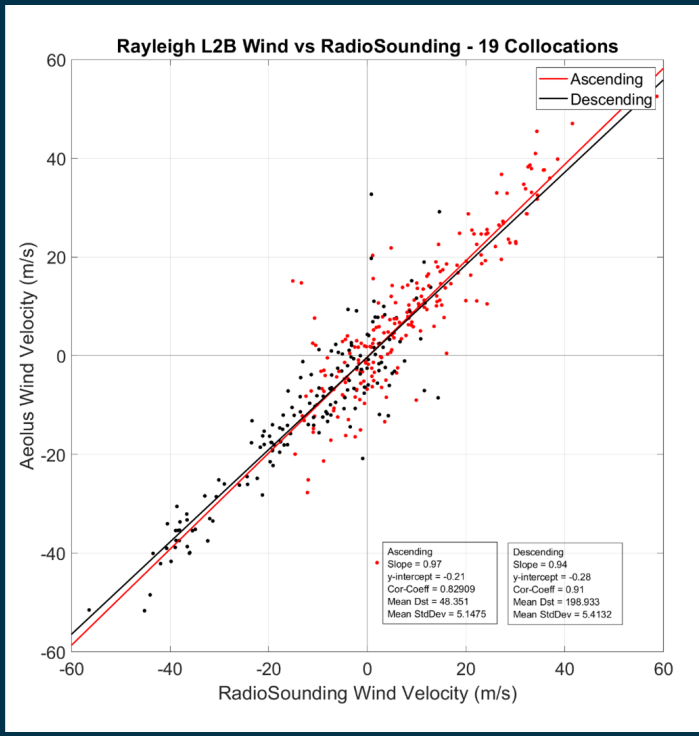


Main results from L2B product quality analysis:

Radiosoundings

		RS		LiWind	
		Asc	Desc	Asc	Desc
All data	Slope	0,96	0,93	0,98	0,95
	Y intercept	0,25	-0,33	-0,67	0,15
	corr coeff	0,84	0,91	0,8	0,89
	Std Dvt	4,8	5,4	5,9	5,5
Altitude Range 5-22km	Slope	0,99	0,98	1,01	1,01
	Y intercept	-0,04	0,79	-1,31	1,69
	corr coeff	0,85	0,93	0,8	0,88
	Std Dvt	4	4	5,1	4,6
Average within 200km	Slope	0,99	0,9	1	0,91
	Y intercept	-0,12	-1,45	-1,09	0,78
	corr coeff	0,89	0,95	0,9	0,8
	Std Dvt	3,6	4,1	3,9	4,9





- Systematic error is higher for Descending orbits (longer distance to collocations)
- Better slope for Ascending orbits
- Increase of random error in the higher bins

Main results from L2B product quality analysis:

LiWind

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		Asc	Desc	Asc	Desc
All data	Slope	0,96	0,93	0,98	0,95
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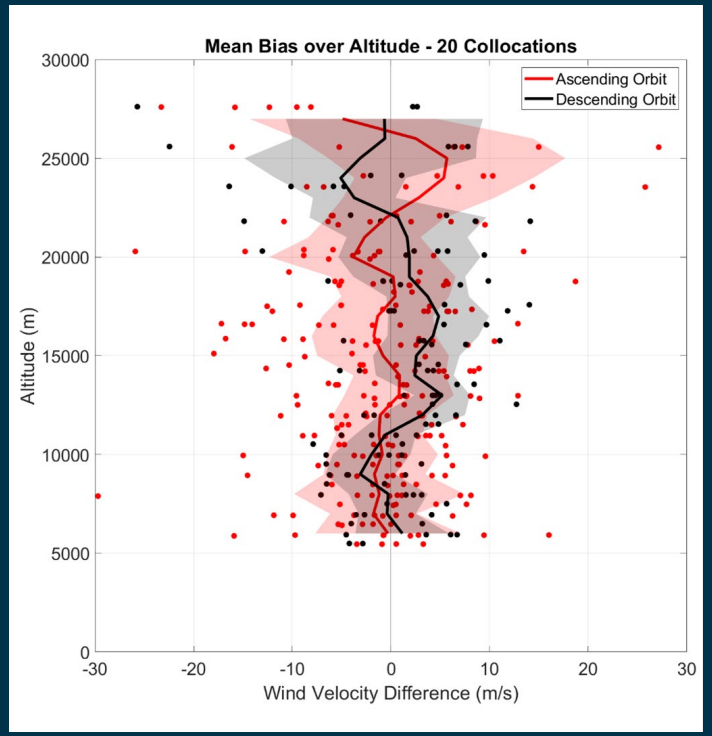

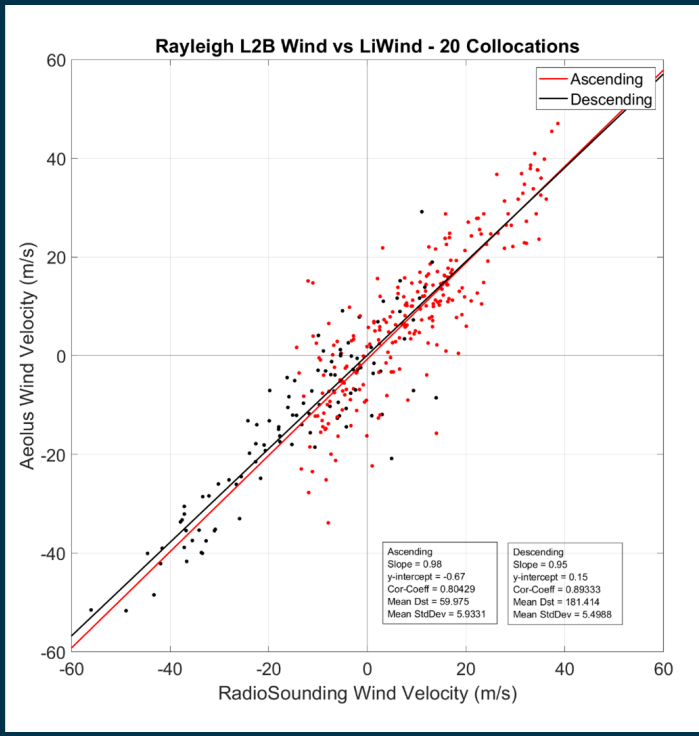

- Better slope for Ascending orbits
- Increase of random error in the higher bins
- Overall consistent LiWind/Radisonde CalVal

Summary and recommendations for Aeolus-2

- AboVE 1 : October 2019 | Mean Systematic Error -0.42 m/s | Mean Random Error 4.63 m/s
- AboVE 2 : June 2021 | Mean Systematic Error 0.8 m/s | Mean Random Error 7.6 m/s

- We recognize evolutions in the L2B data quality throughout the FM-B's lifetime
- We have noticed range-bin and temporal wind dependencies
- The uppermost bins of the Reunion RBS (>22km) show higher than estimated random error
- Averaging several profiles tends to reduce the random error

- Our analysis does not show improvements after the M1 Bias correction
- We observe orbital dependent biases in October : - 1.96 m/s for Asc and 0.5 m/s for Desc

- Spatial representativeness of Aeolus Rayleigh winds :
  Ascending : Mean correlation coefficient 0.82 | Mean Random Error 7 m/s
  Descending : Mean correlation coefficient 0.9 | Mean Random Error 6.3 m/s

- Rayleigh clear flag and validity flag 1 were used, we plan to add the mie clear as an additional flag

Seed questions for Aeolus L2B product quality working meeting 2021

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