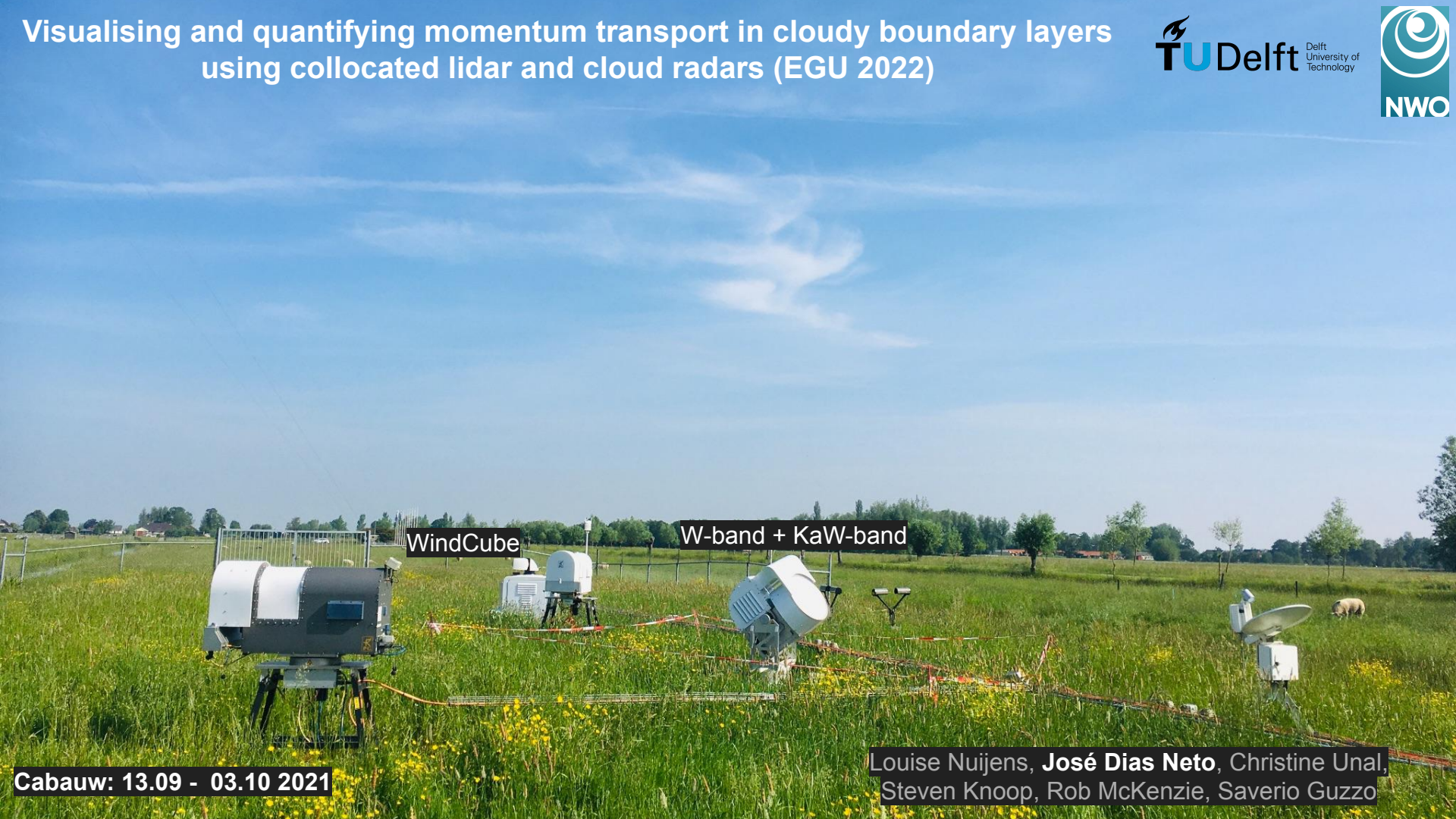
Visualising and quantifying momentum transport in cloudy boundary layers using collocated lidar and cloud radars (EGU 2022)

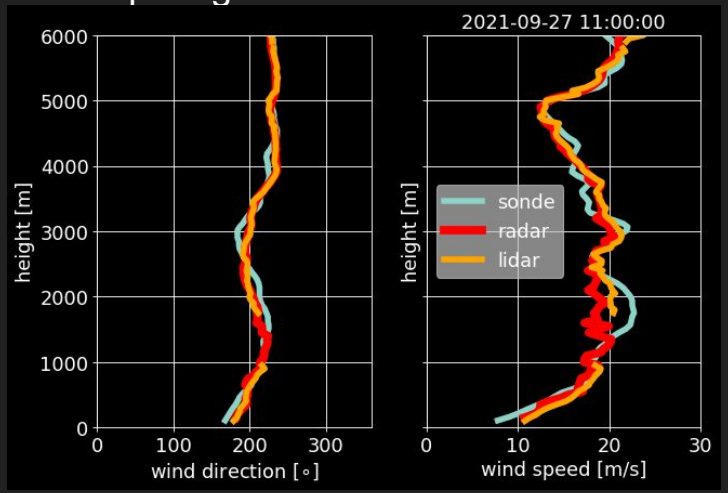


Cabauw: 13.09 - 03.10 2021

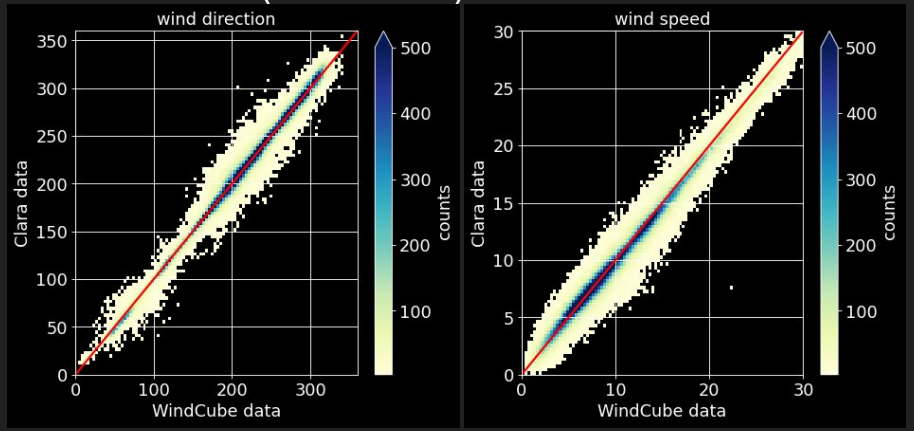
Louise Nuijens, **José Dias Neto**, Christine Unal,
Steven Knoop, Rob McKenzie, Saverio Guzzo

Data evaluation

Comparing to radiosondes



Radar x Lidar (full dataset)



Comparing to 34 radiosondes

	WindCube		Clara	
metrics	wind direction	wind speed	wind direction	wind speed
bias	0.37	0.52	-0.24	-0.34
RMSE	12.62	1.98	14.03	2.35
correlation	0.98	0.92	0.96	0.94

	CLARA x WindCube	
metrics	wind direction	wind speed
bias	0.24	-0.16
RMSE	12.85	0.93
correlation	0.98	0.99

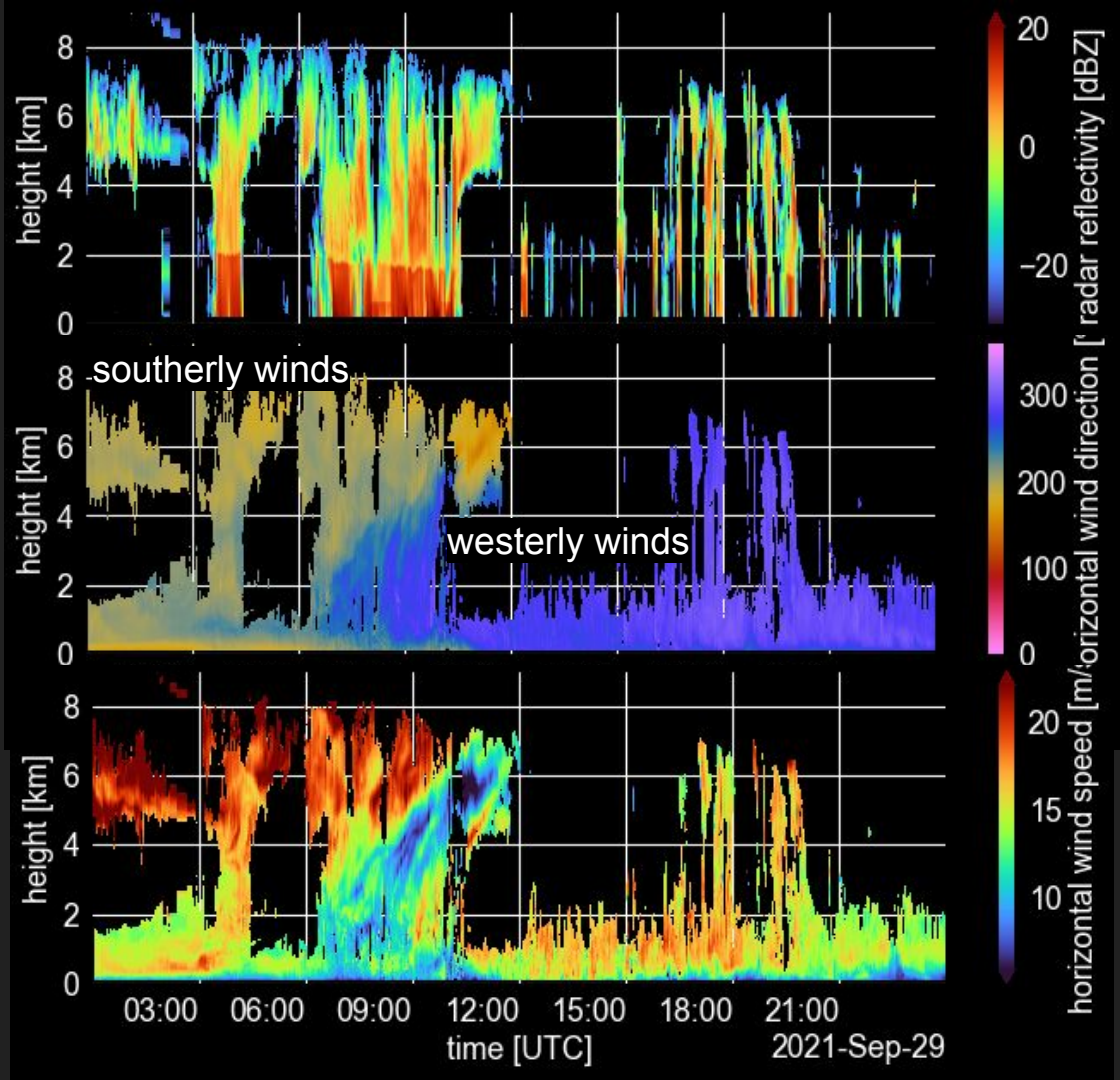
Example case
Continuous profiles

Occluded front passage followed by a convective period

Different air masses meeting

Change in direction
9-12 UTC

Significant reduction in speed
9-12 UTC



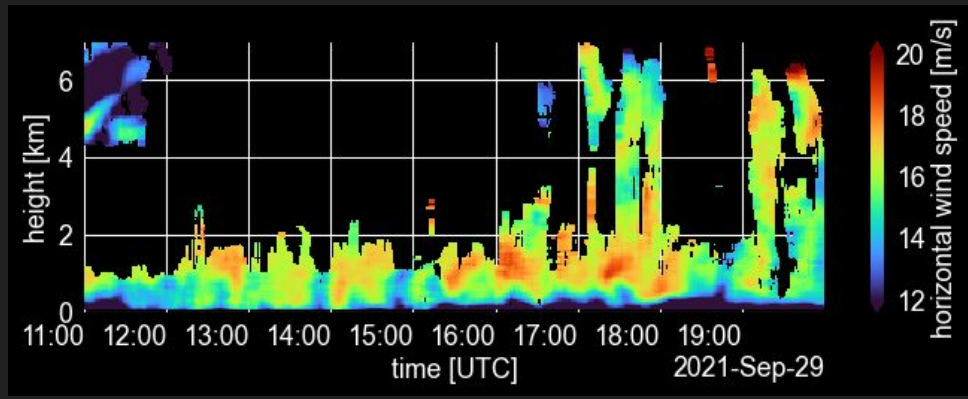
Different scale processes: low pass filter (larger than 10 min)

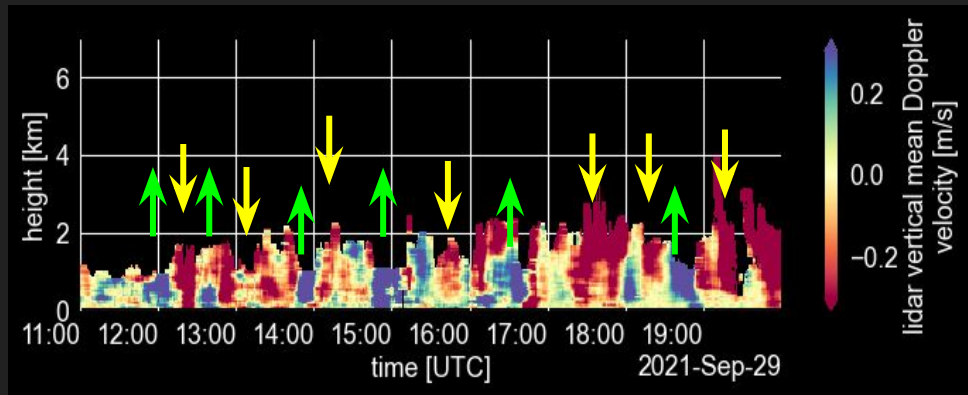
Looking at the convective period

Periodic slowdown and speedup of horizontal winds

Periodic upward and downward motion

Observations suggest a correlation between slow wind and upward motion



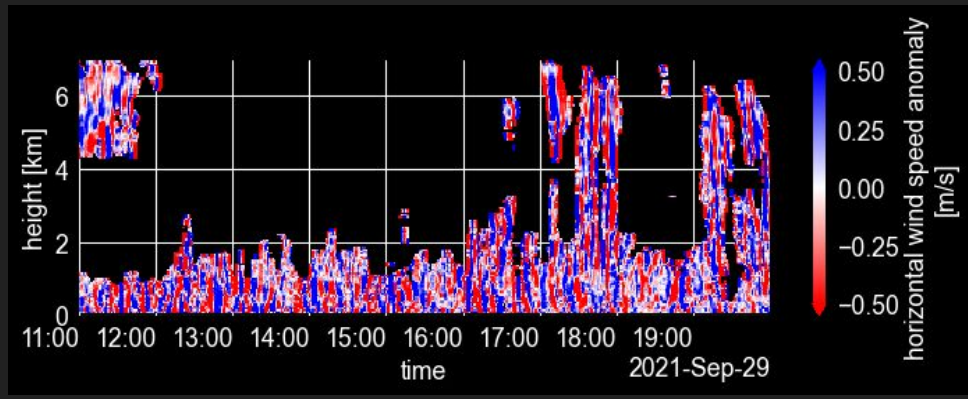


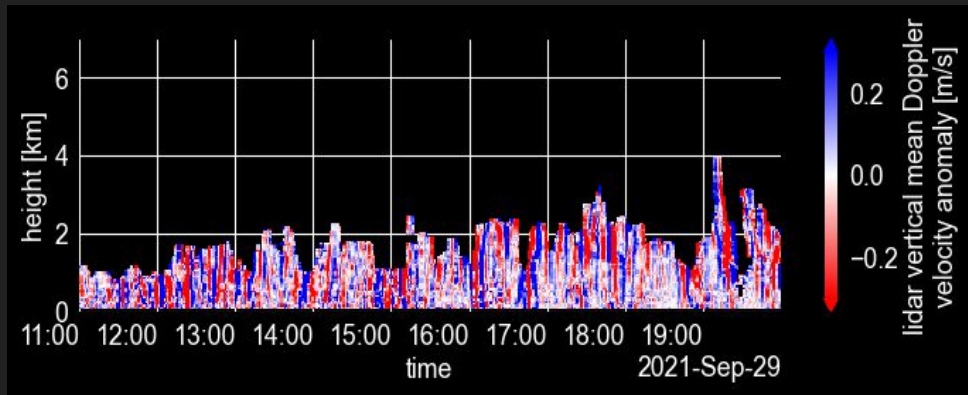
Different scale processes: high pass filter (smaller than 10 min)

Data also contains information from smaller scales

Turbulence

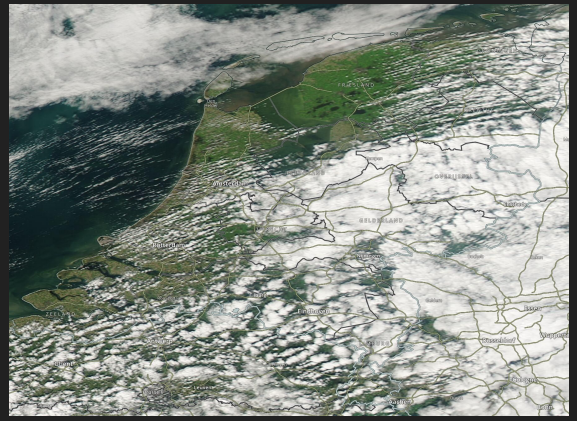
Derivation of momentum flux profiles



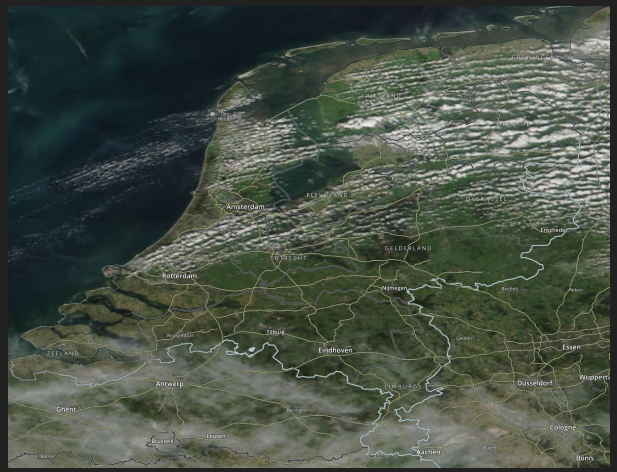


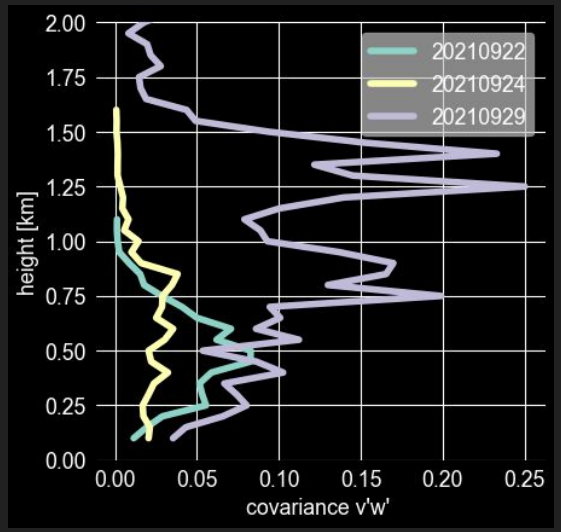
Momentum flux profiles

24.09.2021- shallow convection

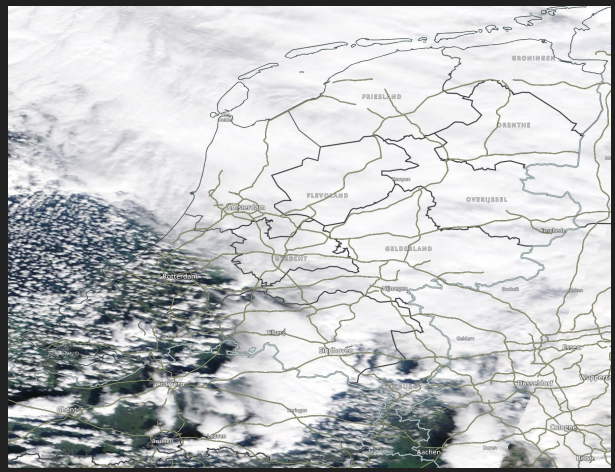


22.09.2021- clear sky





29.09.2021- cold front passage



Conclusions

Radar and Lidar data have a good agreement.

Continuous wind profiles from the surface up to the cloud top

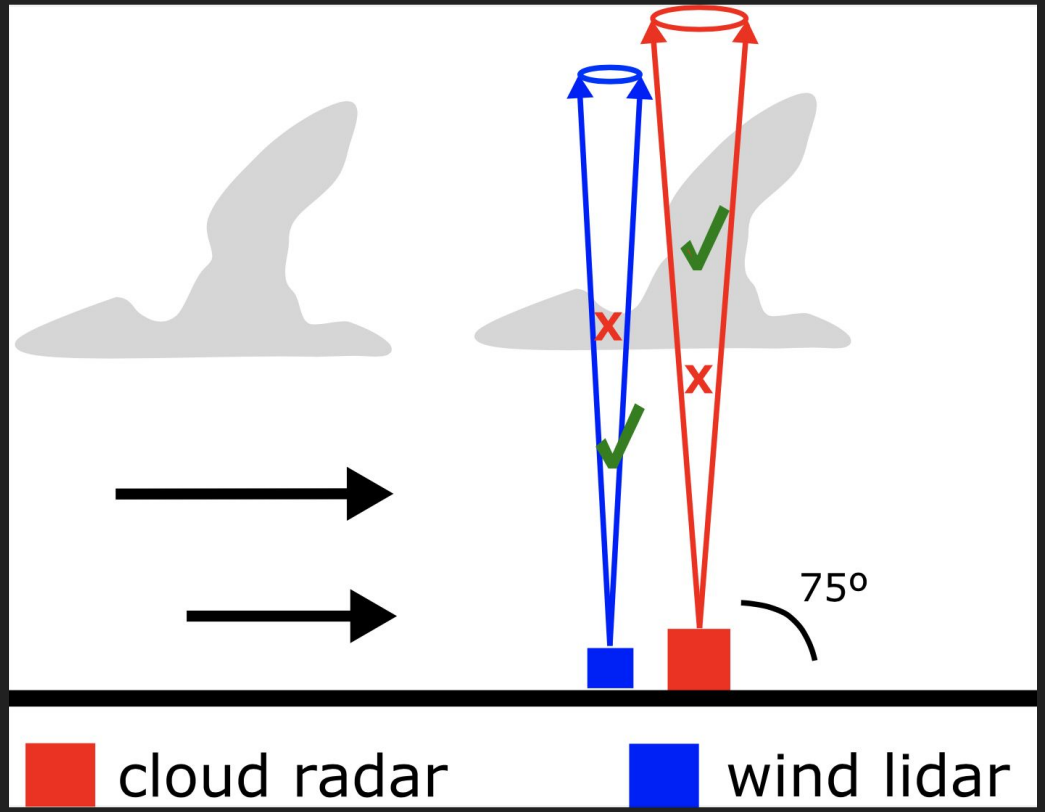
Observations contain information from different scales

(including turbulence)

Derive continuous momentum fluxes profiles

additional slides

Concept



Data processing

Two level processing

Level 1: removal of artifacts and derivation of wind properties

Level 2: volume correction and resample