Atmosphere and Climate

PT1: Climate and hydrological cycle

Convection Studies with the Doppler-Lidar "WindTracer"

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CLR Photonics WindTracer 2 µm Doppler-Lidar specifications

Laser:

• Wavelength	2.0225 µm (eye save)
• Pulse energy	2 mJ
• Pulse width	425 ns
• Pulse repetition frequency	500 Hz

Receiver:

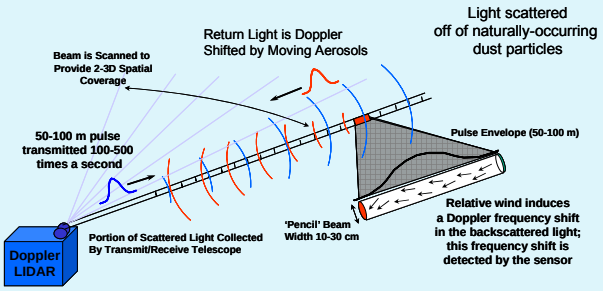
• Bandwidth	50 / 100 MHz
• Sampling frequency	100 MHz

Scanner:

• Beam diameter	8 cm
• Azimuth (range, step, speed)	360°, 0.01°, 25° s^{-1}
• Elevation (range, step, speed)	190°, 0.01°, 25° s^{-1}

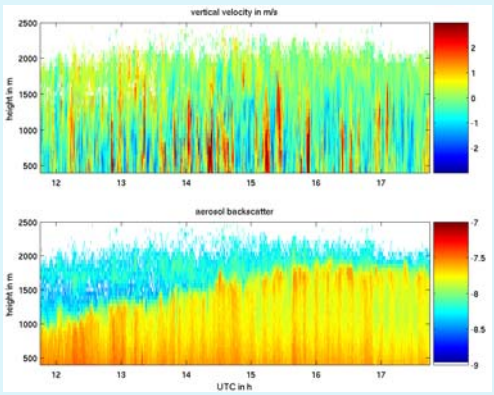
Output:

• Range gates	120 / 60
• Range (min, max)	372 m, 10 km
• Range resolution	72 – 96 / 192 m
• Velocity range:	±20 / ±40 m s^{-1}
• Velocity resolution	0.6 m s^{-1}
• Update frequency (LOS)	10 Hz

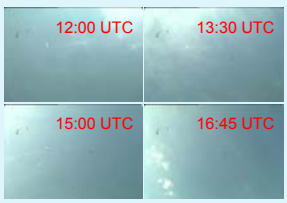


Doppler-Lidar functional principle

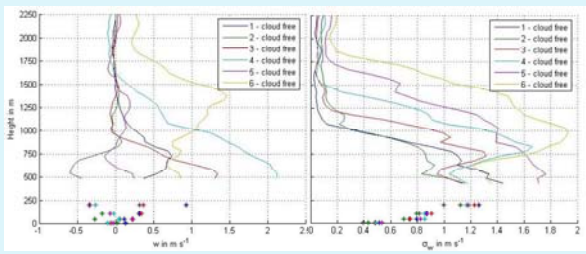
View inside the Lidar shelter: electronics rack with operator GUI (left) and laser unit (right)



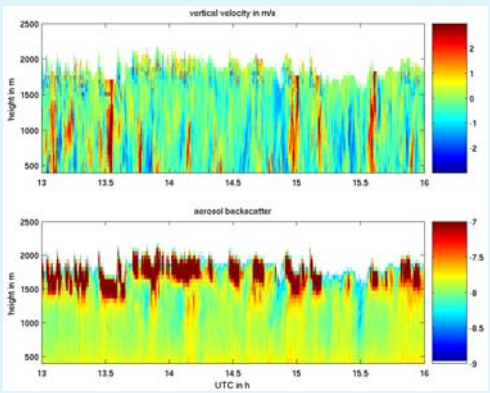
Blue Convection



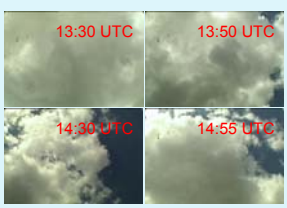
Vertical wind velocity (upper left) and aerosol backscatter signal (lower left) from measurements with vertically pointing beam and photos from cloud camera during a nearly cloud free period. The aerosol backscatter signal shows the growing of the mixing layer. CSIP measurement campaign, Chilbolton, UK, June 10, 2005



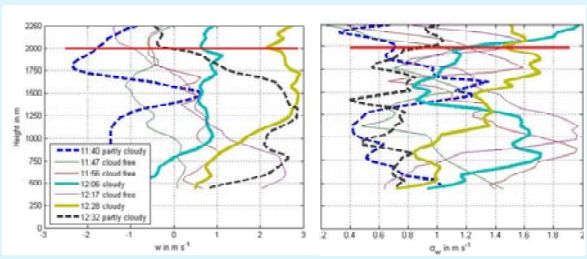
Profiles of vertical wind velocity and σ_w in a in a growing mixing layer under cloud free conditions at Forschungszentrum Karlsruhe, August 2, 2004.



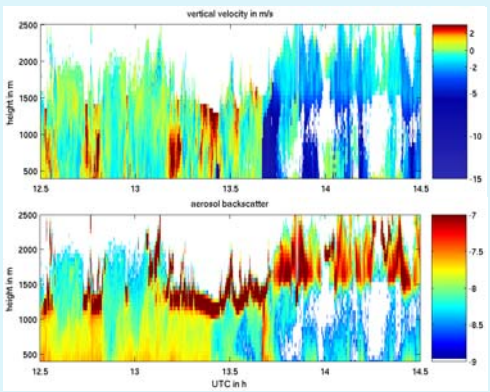
Cumulus Convection



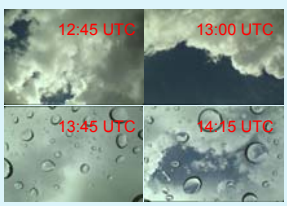
Vertical wind velocity (upper left) and aerosol backscatter signal (lower left) from measurements with vertically pointing beam and photos from cloud camera during a period with active and passive cumulus clouds. CSIP measurement campaign, Chilbolton, UK, June 11, 2005



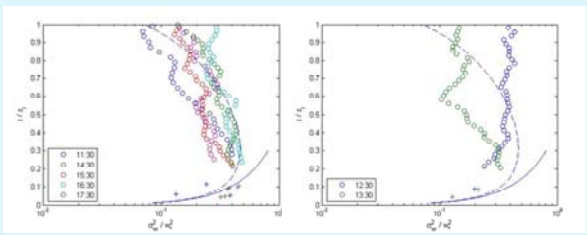
Profiles of vertical wind velocity and σ_w in a fully developed mixing layer with cloudy periods at Forschungszentrum Karlsruhe, August 2, 2004. The cloud base is indicated as red solid line.



Thunderstorm Event



Vertical wind velocity (upper left) and aerosol backscatter signal (lower left) from measurements with vertically pointing beam and photos from cloud camera during a thunderstorm event with heavy rain and hail (13:45 UTC). CSIP measurement campaign, Chilbolton, UK, June 4, 2005



Normalized profiles of σ_w^2 / w_*^2 in fully developed mixing layer under cloud free (left) and cloudy (right) conditions from Lidar (o) and Tower data (+) at Forschungszentrum Karlsruhe, August 2, 2004. Solid line is free convection prediction, dashed is according to Willis & Deardorff (1974).