Investigating the impacts of LLJs and OLEs on ABL exchanges and transports using an airborne Doppler wind lidar

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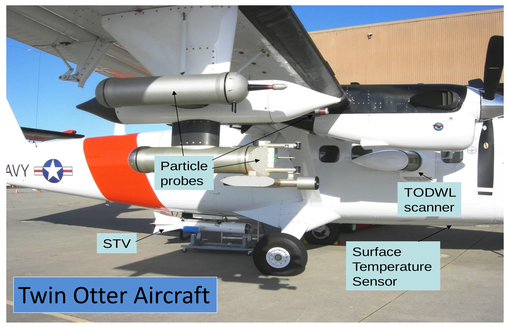
Objectives

- Utilize the Twin Otter Doppler Wind Lidar (TODWL) and Controlled Towed Vehicle (CTV) to take ABL wind and flux measurements over marine and coastal environments
- Extend prior investigations (2001-2008)of LLJs and OLEs in the MBL and PBLs.
- Investigate and characterize the presence of rolls (OLEs) at the boundaries of stratocumulus topped MBLs.
- Study the potential impact on the development and implementation of the EDMF into forecast models.



TODWL Data Description

Attribute	Performance Metric	Comments
LOS resolution (applies to vertical profiles of 3D winds as well)	50 m	Range resolution to hard targets (ground or dense cloud) can be better than 10 meters.
U,V,W resolution	< 10 cm/s	< 5cm/s for stationary ground based operations
Maximum range	6 -30 km	Very dependent upon aerosols
Time to complete full step stare conical scan for wind profiles	~ 20 sec	12 point step stare with .5 -2 second dwells
Sampling frequency	100 Hz	Integration of several shots is typical to improve range performance

Structure Prospecting with TODWL

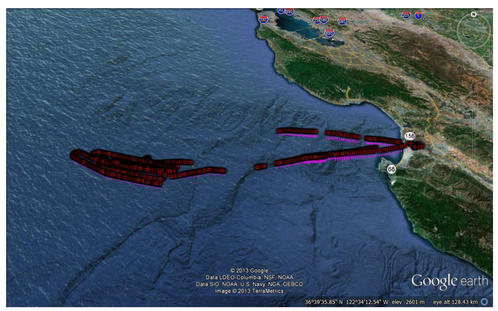
- Feature prospecting uses a very shallow angle below the horizon (~ -1 -3 degrees for a 300m flight altitude).
- Results in ~ 2 m vertical resolution and 50 m horizontal resolution with ~10 meter sliding sample.
- It takes ~ 40 seconds to profile 100 meters below the aircraft.

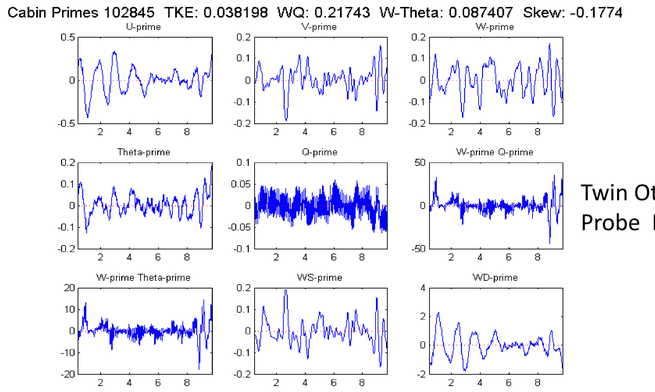
9/30/2012 Case Study

- Processed lidar data in search of organized aerosol/wind structures below the Twin Otter
- Processed Twin Otter instrument and CTV data for time series of u, v, w, q, and Θ.
- Match up times and their features from the TODWL and CABIN data sets near flight level and CTV at CTV cruise levels.

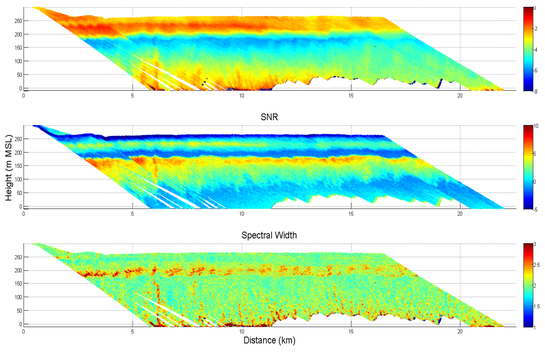
CIRPAS Twin Otter with CTV below

9/30/2012 Flight Path

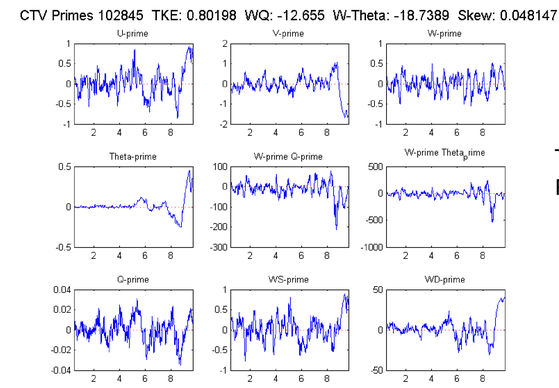




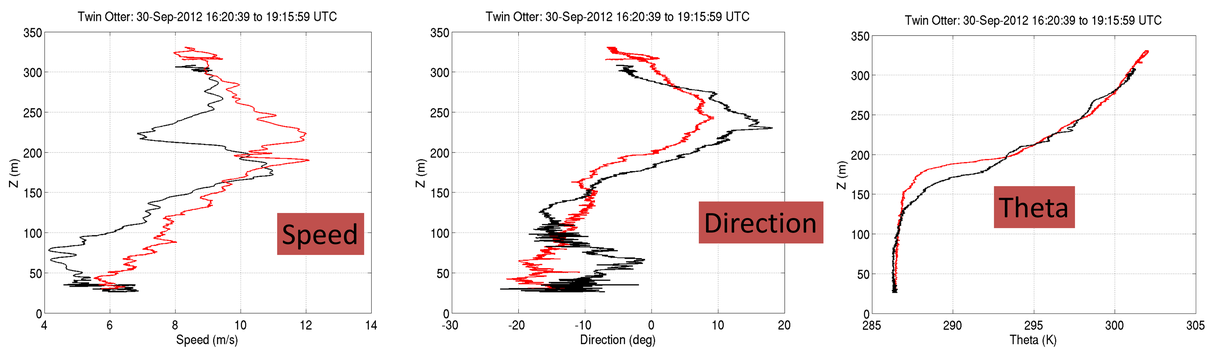
Twin Otter Probe Data



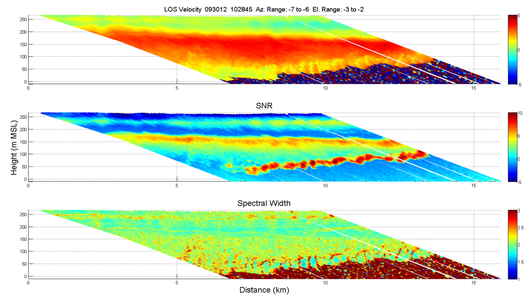
TODWL Time/height Cross sections



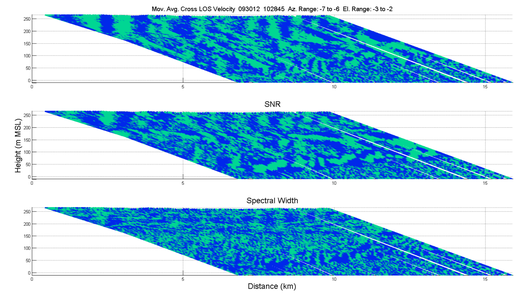
Towed Vehicle Flux Data



TODWL LOS, SNR and Spectral Width



TODWL Rad. Velocity, SNR and Spec. Width (Two Color Processing)



Summary of Segment Statistics

Flight Segment	TODWL Altitude	CTV Altitude	Heading	TKE	Sensible Heat (W)	Latent Heat (W)	Skewness
1007	284	60	94	.19	8.55	3.43	-.40
				1.92	-1.28	15.15	.90
1028	292	25	98	.04	.22	.09	-.18
				.80	-12.6	-18.7	.05
1106	286	75	294	.05	3.02	1.21	-.51
				1.1	-3.36	-1.19	-.17
1111	290	75	293	.24	1.98	.80	-.37
				.29	-.74	.55	.22
1121	288	climbing	98	.14	-1.11	-.44	.90

Summary

- The combination of an airborne Doppler Wind Lidar and a Controlled Towed Platform holds promise of a transformation of how we investigate air/sea exchanges and construct flux parameterizations for use in numerical weather models.
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