Case study of a bora event at the Dubrovnik airport

[1]Lada Gabela Šeperić, [1]Jadran Jurković, [2]Željko Večenaj, and [2]Branko Grisogono

[1]Croatia Control Ltd [2]University of Zagreb, Faculty of Science, Department of Geophysics

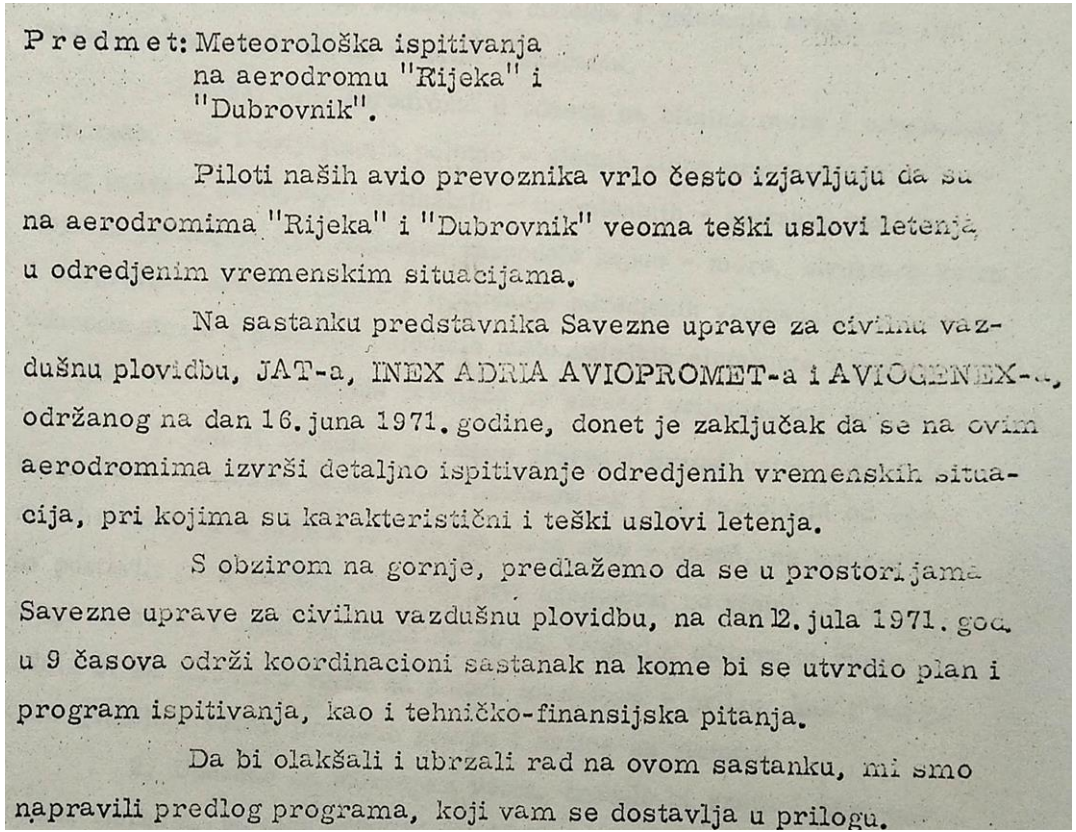
Outlook

Introduction
Anemometer and Lidar setup
Comparison of measurements
Bora event on March 21-22, 2018
Future work

Introduction

- Bora is strong and gusty wind (N-NE)
- crosswind up to 70kt
- significant difficulties in the aircraft taking off and landing procedures at Dubrovnik airport

Introduction



Predmet: Meteorološka ispitivanja
na aerodromu "Rijeka" i
"Dubrovnik".

Piloti naših avio prevoznika vrlo često izjavljuju da su na aerodromima "Rijeka" i "Dubrovnik" veoma teški uslovi letenja u odredjenim vremenskim situacijama.

Na sastanku predstavnika Savezne uprave za civilnu vazdušnu plovidbu, JAT-a, INEX ADRIA AVIOPROMET-a i AVIOGENEX-a, održanog na dan 16. juna 1971. godine, donet je zaključak da se na ovim aerodromima izvrši detaljno ispitivanje odredjenih vremenskih situacija, pri kojima su karakteristični i teški uslovi letenja.

S obzirom na gornje, predlažemo da se u prostorijama Savezne uprave za civilnu vazdušnu plovidbu, na dan 12. jula 1971. god. u 9 časova održi koordinacioni sastanak na kome bi se utvrdio plan i program ispitivanja, kao i tehničko-finansijska pitanja.

Da bi olakšali i ubrzali rad na ovom sastanku, mi smo napravili predlog programa, koji vam se dostavlja u prilogu.

- **1966 Proposal for the research of bora at LDDU**
- **In 1971, NHMI calls a meeting with partner Airports, ATS, NHMI, and Airlines**

Introduction

- the influence of the crosswind and wind shear on air traffic is examined within **SESAR 2020** programme, according to solution PJ.04 Total Airport Management and PJ.18 Trajectory Management

- WINDCUBE400S-AT LIDAR and 3D Windmaster Pro ultrasonic anemometer were installed

- Measurements span from 14 December 2017 to 14 April 2018

Poster presentation: First LIDAR measurements in Croatia

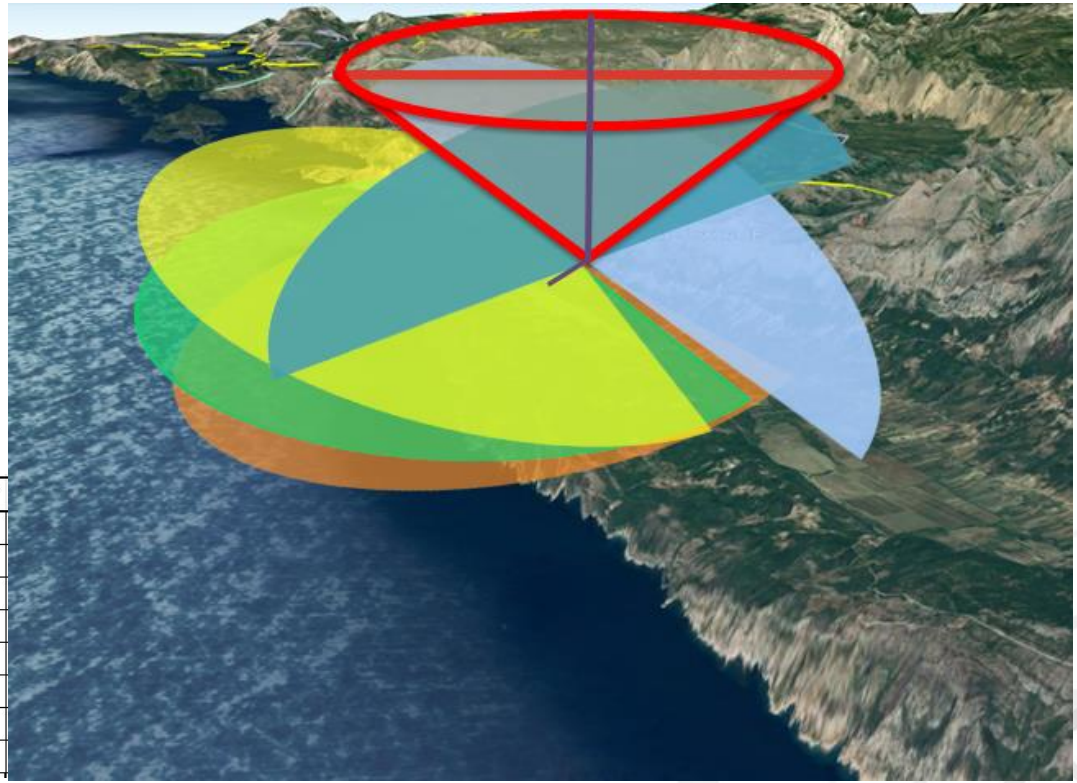
Anemometer and Lidar setup

Anemometer and Lidar setup

- 3D WindMaster Pro ultrasonic anemometer (Gill Instruments)
- 3 m and 10 m height measurements
- Wind speed up to 65m/s
- Sampling Frequency 10 Hz
- Fourier spectral analysis, estimation of TKE and its dissipation rate

Anemometer and Lidar setup

Scan Index	Scanning scenarios	ID Scan	Display resolution	Duration (min)
#1	PPI Median Approach	89	120	1.11
#2	PPI Initial Approach	74	120	1.00
#3	PPI Touchdown	76	120	0.50
#5	LOS Vertical	112	50	1.50
#6	PPI wind mode	97	50	0.50
#7	LOS Met Mast	134	50	1.50
#8	1 RHI mountain	111	50	0.26
#8	1 RHI RWY12	111	50	0.26



More detail on Poster presentation: First LIDAR measurements in Croatia

Objectives of the study

3D distribution of turbulence:

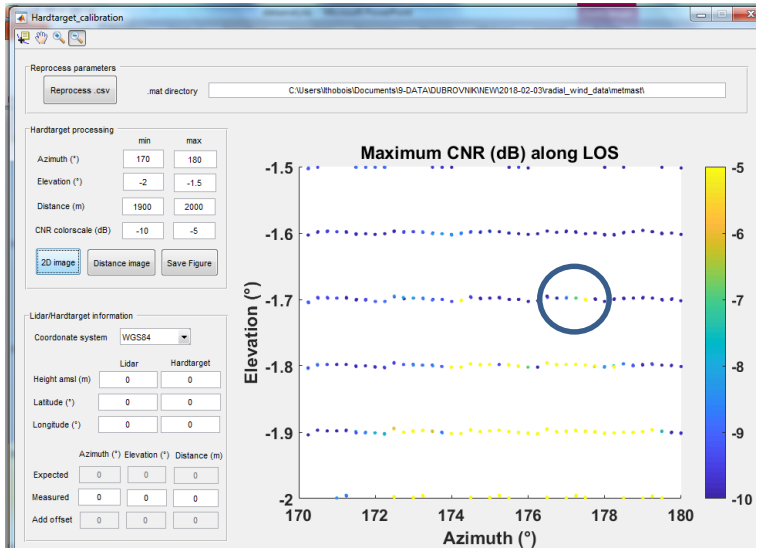
- Retrieve turbulence information from Lidar measurements;
- Compare measurements performed by the LIDAR and the anemometer of mean wind speed and its standard deviation;
- Calibrate values obtained from Lidar to the values obtained from the anemometer

More detail on Poster presentation: First LIDAR measurements in Croatia

Determination of azimuth and elevation angles and distances

- Horizontal distance = 1,91 km
- Vertical difference = 86 m
- Check the pointing of the line of sight with multiple PPI scans

	WGS84		Easting	Northing		
Instrument	Lat DD.dddd	Long DD.ddd	UTM (m)		Elevation Height (ft)	Terrain Elevation Height (m)
Scanning Lidar	42.581762	18.25131	274437.79	4718035.88	775.92	236.5
Met mast	42.5644139	18.25356111	274560.00	4716103.36	547.90	167
			166021.55	0.00	0.00	
			166021.55	0.00	0.00	



- Multiple PPI scans have been configured to sweep
- 2 Max CNR obtained
- Choice of the second one at 177.5°, -1.7° and a distance of 1931 m

L. Thobois, Leosphere

Case study

#	Date	Time (UTC)	MAX WSPD	MAX GUST	GUSTS	Comment	EPISODE name	Bora type
1	17/18.12.2017.	1100-1400 & 1700-0830	25	34	rare			Gap flow
2	18/19.12.2017.	1700-0830	24	31	occasinally			st BORA
3	19/20.12.2017	2130-0130	21	31	rare			Gap flow
4	20/22.12.2017	2000-0000	29	40	frequent			gap flow => Bora ? => N?
5	29.12.2017	1230-2330	23	32	some	light precipitation -RA		not recognized (gap)
6	02-03.01.2018.	1930-0400	28	41	frequent			st BORA
7	21-22.1.2018.	1900-1800	37	60	frequent	light precipitation -RA	STRONGEST	st BORA => deep
8	23-24.1.2018.	1100-0800	29	49	frequent			st BORA
9	10/11.2.2018.	1430-0600	31	42	frequent			st BORA
10	15.2.2018.	0030-0830	29	37	occasinally			st BORA
11	15/16.2.2018.	1730-0830	22		without			Gap flow
12	23/24.2.2018.	0130-0700	23		without			Gap flow
13a	24/25.2.2018.	1800-0800	25	36	rare		LONG epispode 24-	Gap flow
13b	25/26.2.2018.	0800-0900	30	41	frequent	light precipitation -RA		Gap flow
14	21/22.3.2018.	1400-1800	36	52	frequent	light precipitation -RA		st BORA

CROATIA CONTROL

Bora event on March 21-22, 2018

2018-03-21 13:34:35.201

System ID: WLS400s-113

Latitude:

Longitude:

Accumulation time: 250 ms

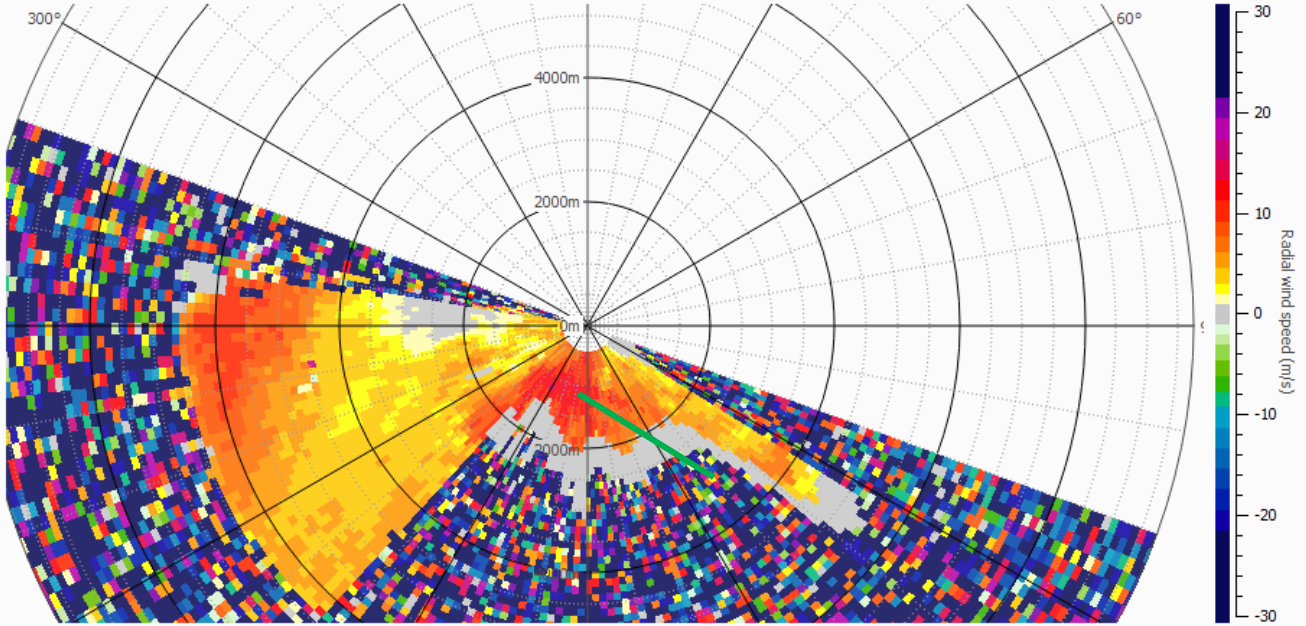
Range gate length: 200 m

Rotation speed: 6 °/s

Elevation: -2.000 °

Scan ID: 76

Resolution ID: 7



CROATIA CONTROL

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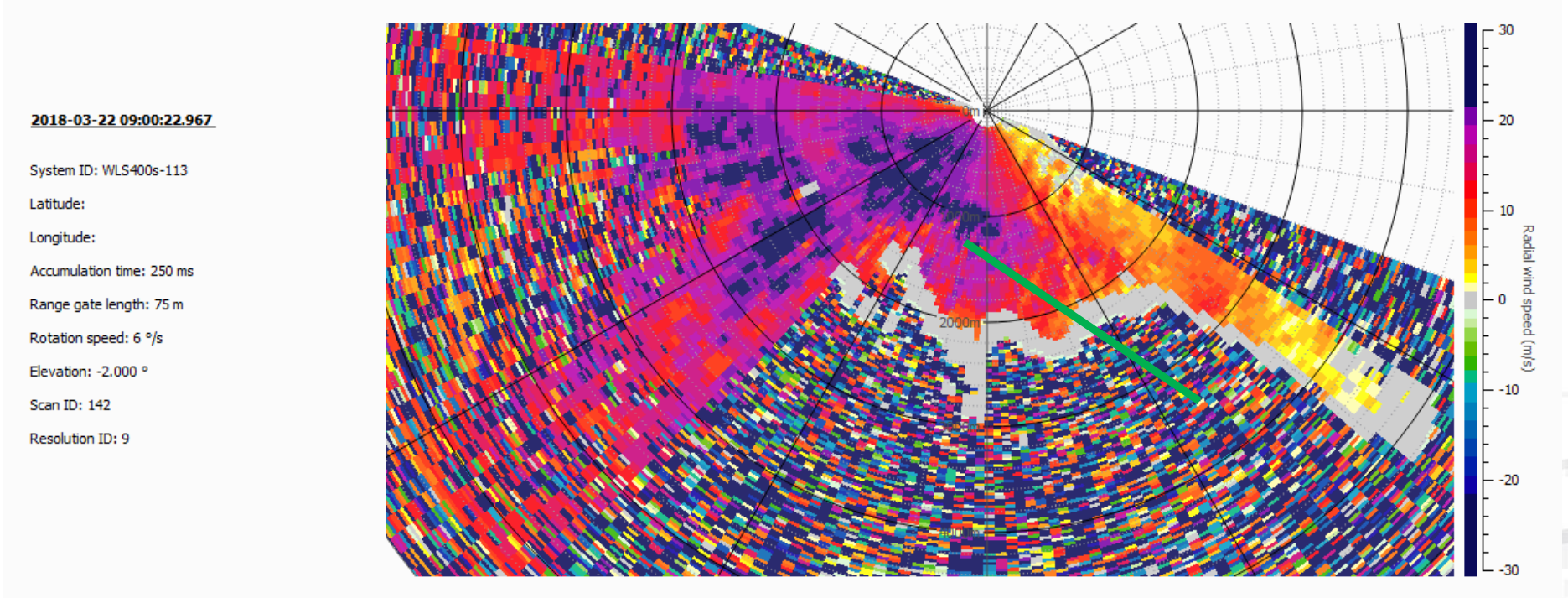
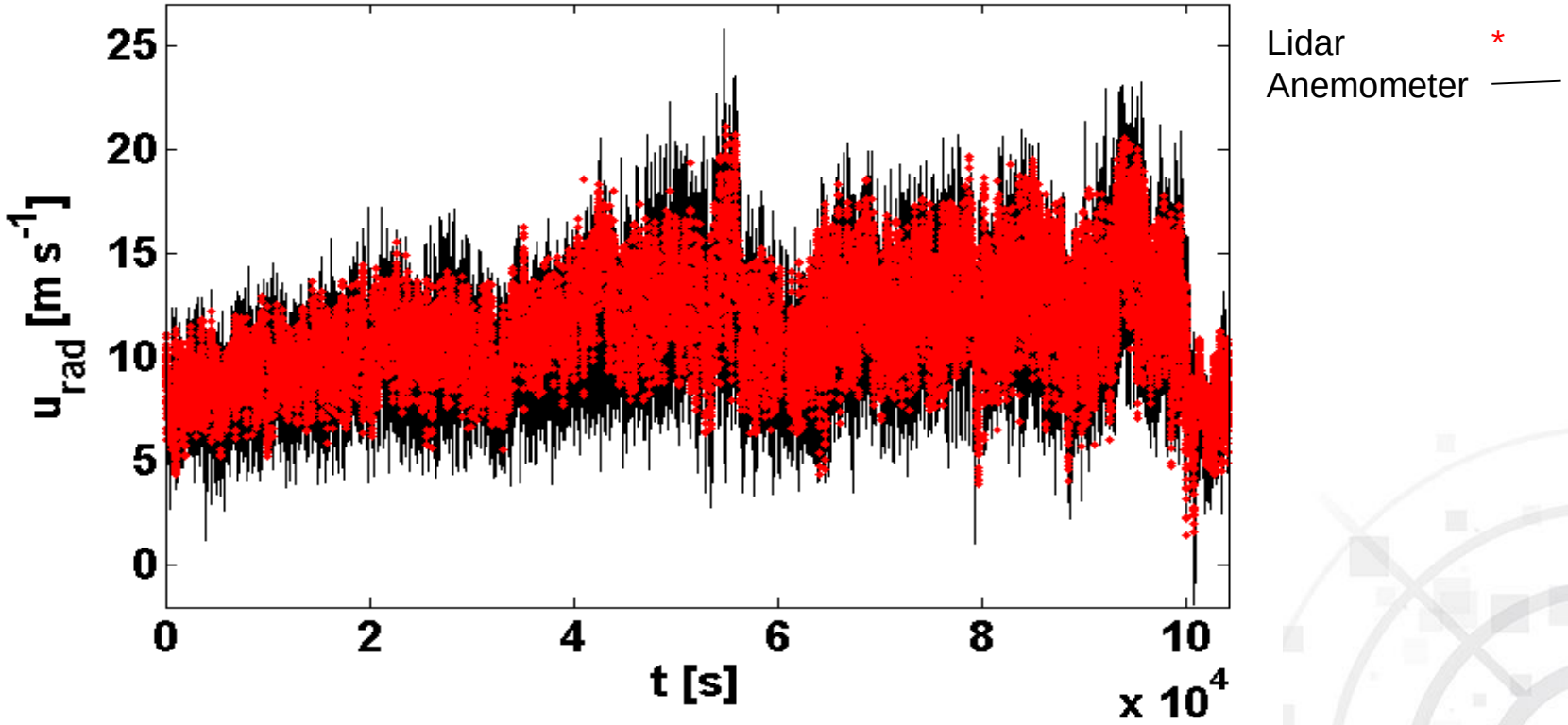


For more interesting bora scans => Jadran Jurković „Small mesoscale features during bora at Dubrovnik airport" 17h

Bora event on March 21-22, 2018



Future work

- Explore possible link between the standard deviation of Lidar and anemometer data;

- By establishing the connection we will be able to relate st. dev. from Lidar data with TKE and its dissipation from anemometer;

Thank you for your attention!

Q/A