# ANALYSIS OF NAVIGATION PATTERN IN THE SPORT OF ROWING

A. Pezzoli, A. BaldaccI, A. Cama, M. Faina, D. Dalla Vedova, M. Besi, G. Vercelli, A. Boscolo, M. Dalessandro, E. Cristofori

GOAL: Evaluation of the wind-wave interaction in enclosed basin and analysis of the impact of the environmental conditions on the sport of rowing

MATERIALS AND METHODS: analysis of meteorological data for the site of Poznan (PL) and "Timing Analysis" of the M4x regatta (data analysis of "speed/stroke rate" assessed every 50m)

- Evaluation of the wind speed and direction recorded data and elaboration of wind roses trough the Windrose PRO (Enviroware) software

- Evaluation of the wave through a computer code developed in MATLAB using the "parametric equation"

- Development of a "Timing & Performance Analysis" of the semi-final and final races with the aid of "tracking's" techniques for data analysis

WHY POZNAN?: in the Malta's basin in Poznan, you can do the analysis of the race with a favorable wind ("tailwind") and with the wind against it ("headwind")
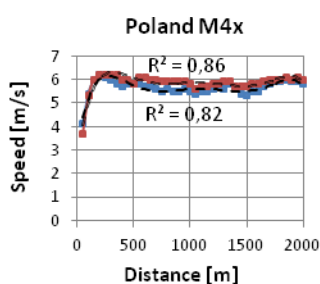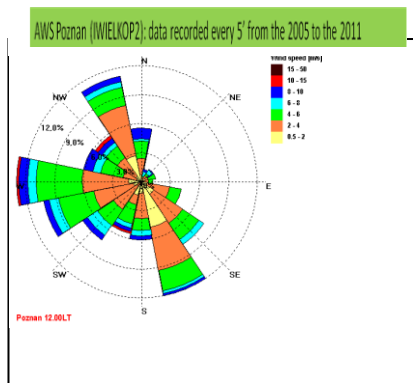
Polynomial function (order 6) regression coefficient R ^ 2
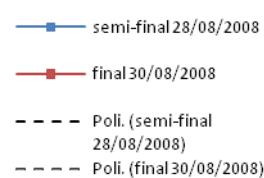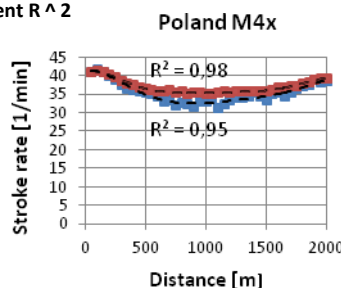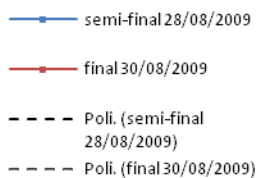
Detailed "Timing & Performance Analysis" of the teams that achieved the 1st, 3th and 6th position

	Final Rank	Average Stroke/Rate Semif.	Average Stroke/Rate Final	Average Meters/Stroke Semif.	Average Meters/Stroke Final	Total Strokes Semifinal	Total Strokes Final	Time Semifinal	Time Final
Poland	1°	35,4	37	9,58	9,50	210	209	05.56,4	05.38,3
Germany	3°	36,1	38	9,43	9,50	215	216	05.57,5	05.39,9
Italy	6°	37,4	38,1	9,09	9,26	223	220	05.59,0	05.45,8

AWS Poznan (IWIELKOP2): data recorded every 5' from the 2005 to the 2011

Poznan 12.00LT

N	5.524%
NNE	1.240%
NE	1.466%
ENE	1.466%
E	1.127%
ESE	4.171%
SE	7.666%
SSE	11.950%
S	5.975%
SSW	5.412%
SW	7.215%
WSW	10.259%
W	12.852%
WNW	6.088%
NW	5.750%
NNW	11.048%
Calm	0.790%

Wind Speed [m/s]	Percent
Calm	0.790
]0.5;2.0]	16.911
]2.0;4.0]	38.557
]4.0;6.0]	28.298
]6.0;8.0]	8.005
]8.0;10.0]	6.652
]10.0;15.0]	0.789
> 15.0	0.000

Wind speed range: **[2 ; 7] m/s**

Average wind speed: **4-5m/s**

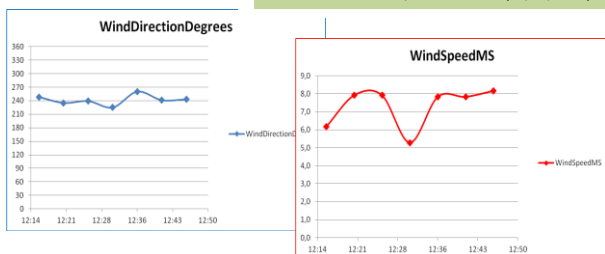| «Headwind» [NW-NNW; SE]		«Tailwind» [WSW-WNW]		
H_s[m]	0.08 ÷ 0.12	500 m	0.10 ÷ 0.12	
		1000 m	0.15 ÷ 0.17	
		1500 m	0.19 ÷ 0.21	
		2000 m	0.22 ÷ 0.25	H_s[m]
T_p[s]	1.5 ÷ 2.0	500 m	1.6 ÷ 2.0	
		1000 m	2.0 ÷ 2.5	
		1500 m	2.2 ÷ 2.8	
		2000 m	2.5 ÷ 3.2	T_p[s]
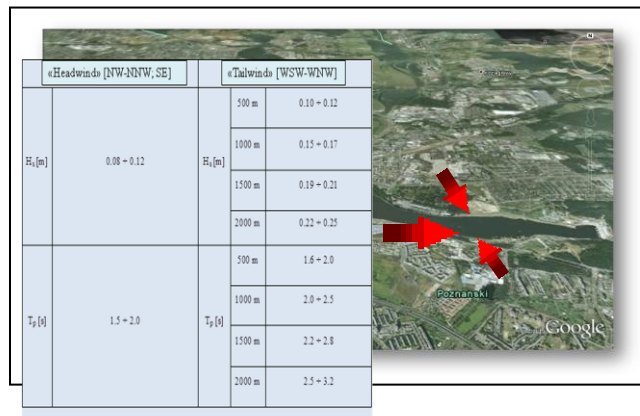
Wind Direction and Wind Speed Data in Semifinal (28/08/2009)
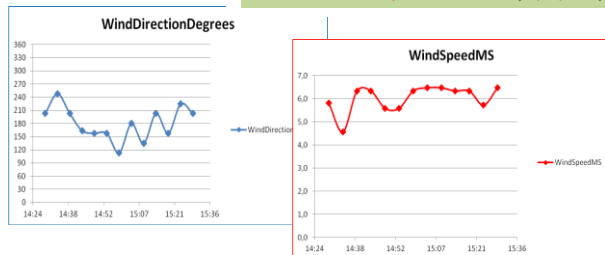
Wind Direction and Wind Speed Data in Final (30/08/2009)

CONCLUSION 1: Our results confirmed the research of Muhlbauer et al. (2010). The graphs of "*speed*" and "*stroke rate*" show that, irrespective of the race type, boat rank or boat type, the navigation's "*pattern*" has always the same typology. In fact we had a faster start in the first quarter (500m) followed by a decreasing of the boat speed in the second and/or third quarter (s) and, finally, a new increasing of the boat speed in the last quarter (2000m)

CONCLUSION 2: The R^2 coefficient was always higher in the final race than in the semi-final. This analysis shows how the curves of "*speed*" and "*stroke rate*" are more regular in the final compared to the semifinal by making us to suppose that the navigation's "pattern" is more regular in tailwind conditions than in headwind conditions

CONCLUSION 3: Between the semifinal and final:
- the **Poland** did 8cm for stroke in less with a decreasing of 1 stroke
- the **Germany** did 7cm for stroke in more with an increasing of 1 stroke
- the **Italy** did 17cm for stroke in more with a decreasing of 3 strokes

CONCLUSION 4: regarding the *environmental* changes between the semifinal and the final and in consideration of the "*Timing & Performance Analysis*", we can said that:
- the **Poland has <u>adapted better</u>** to the new conditions, perhaps aided by a better understanding of the *home's* field and sparing himself in the semi-final
- the **Germany** is in a "***middle way***" regarding the adaptation
- the **Italy <u>has not adapted</u> to the new conditions**