ANTHROPOGENIC INFLUENCE ON MESOSCALE WEATHER

An example of man-made lake

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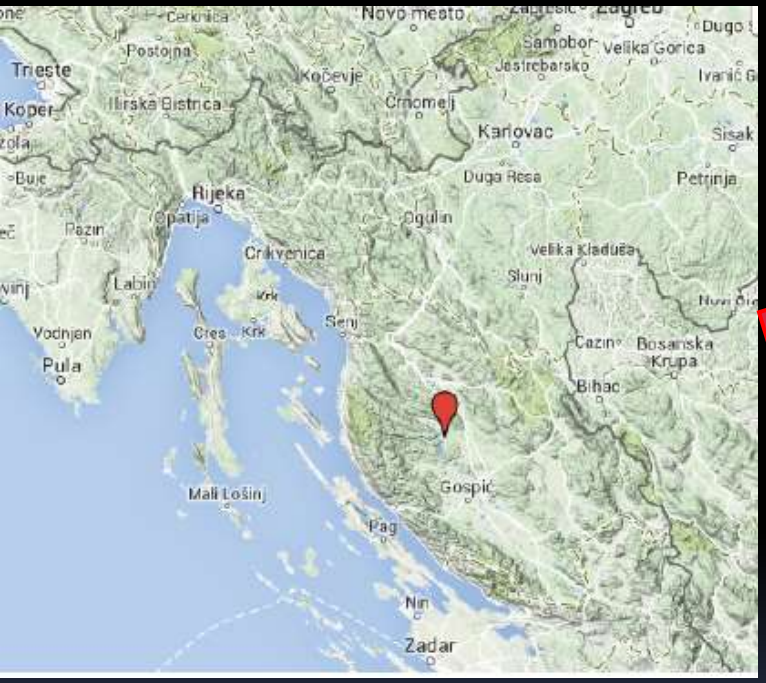
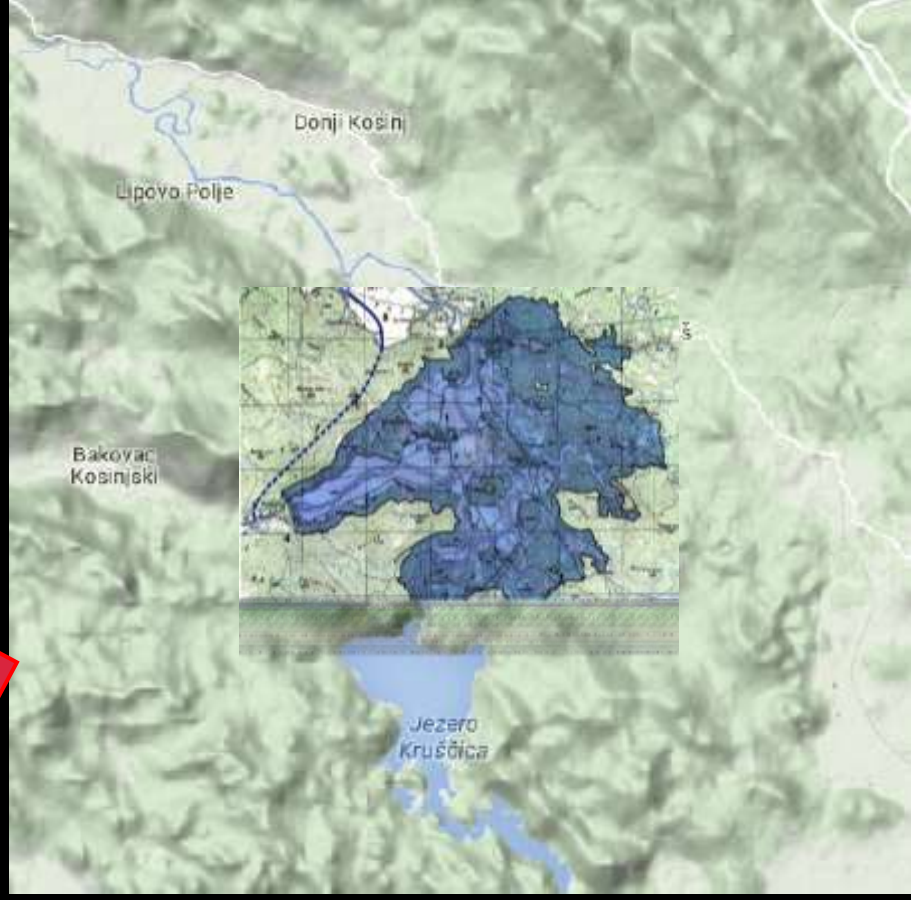
Workshop on Advances in Meso- and Micrometeorology
3 – 4 November 2014, Donja Stubica, Croatia

OVERVIEW

- Introduction
- Model and selected episodes
- Results
- Conclusions

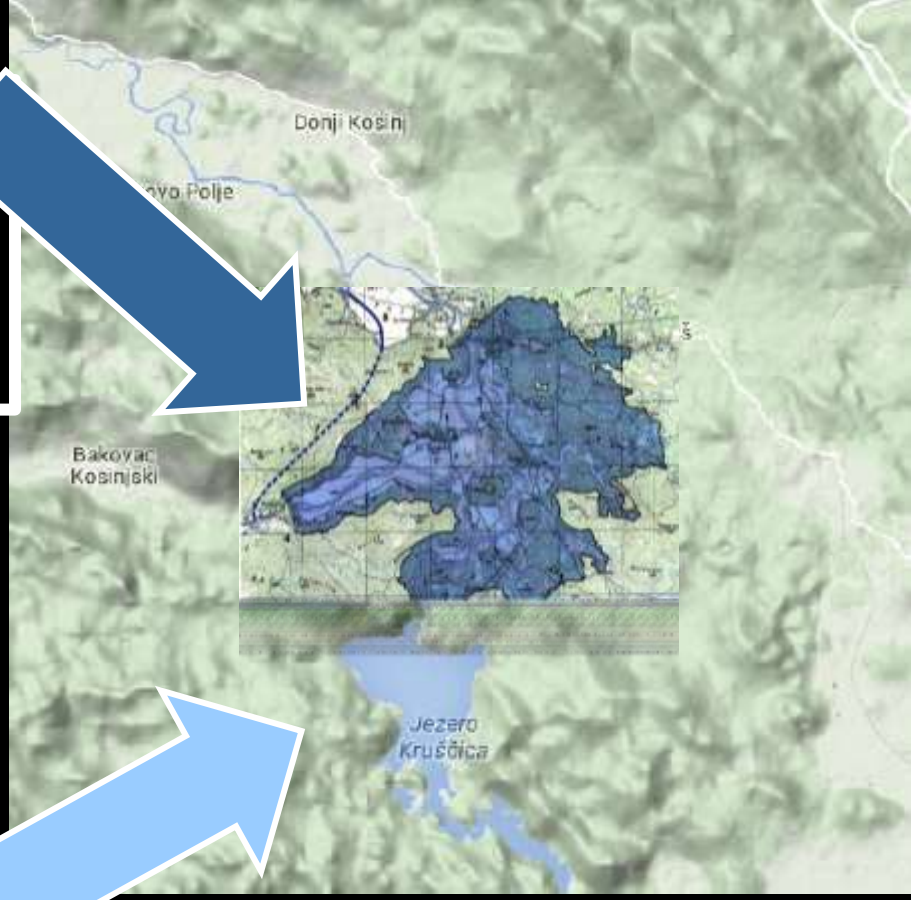
INTRODUCTION





New lake:

- surface area = 11.6 km^2
- volume = $3.3x10^8$ m^3
- max. depth = 30 m



Existing lake:

- surface area = 8.6 km^2
- volume = $1.4x10^8$ m^3
- max. depth = 38 m

? POSSIBLE IMPACTS OF A NEW MAN-MADE LAKE

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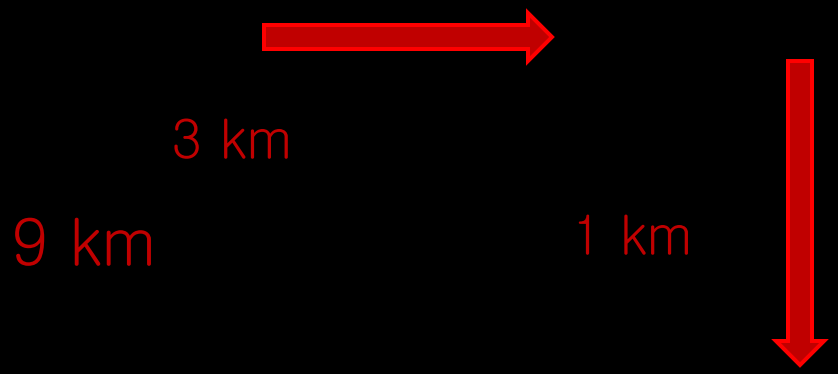
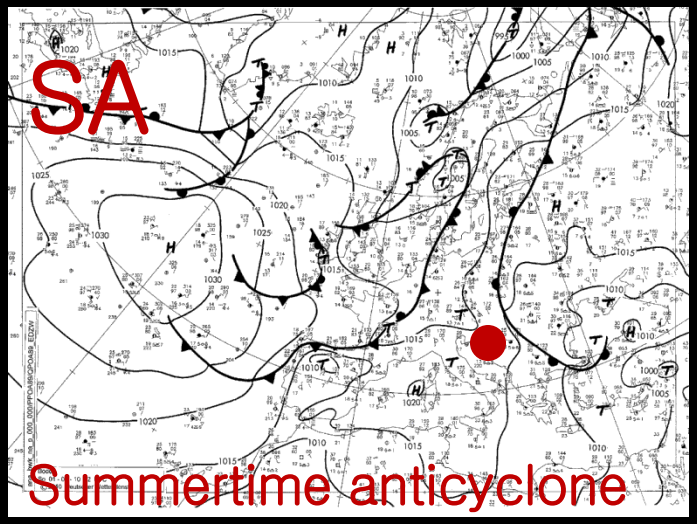
MODEL

WRF (v. 3.3, Skamarock et al., 2008)

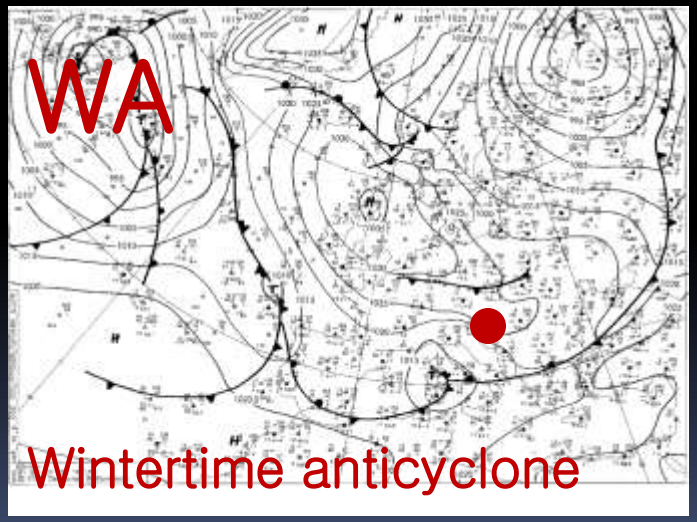


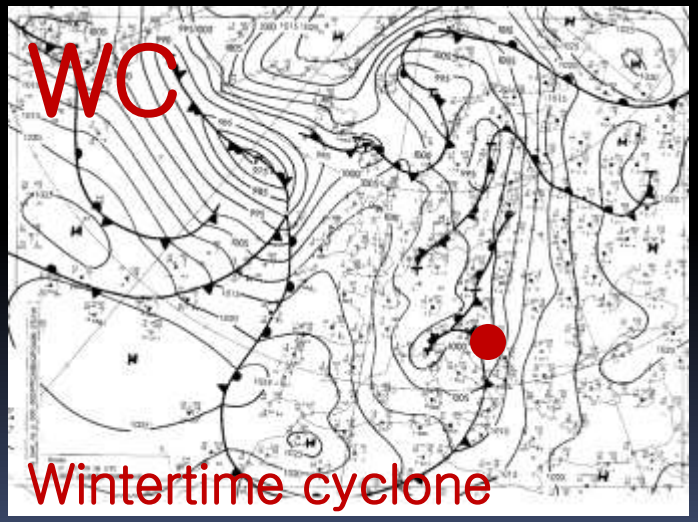
SELECTED EPISODES



SC

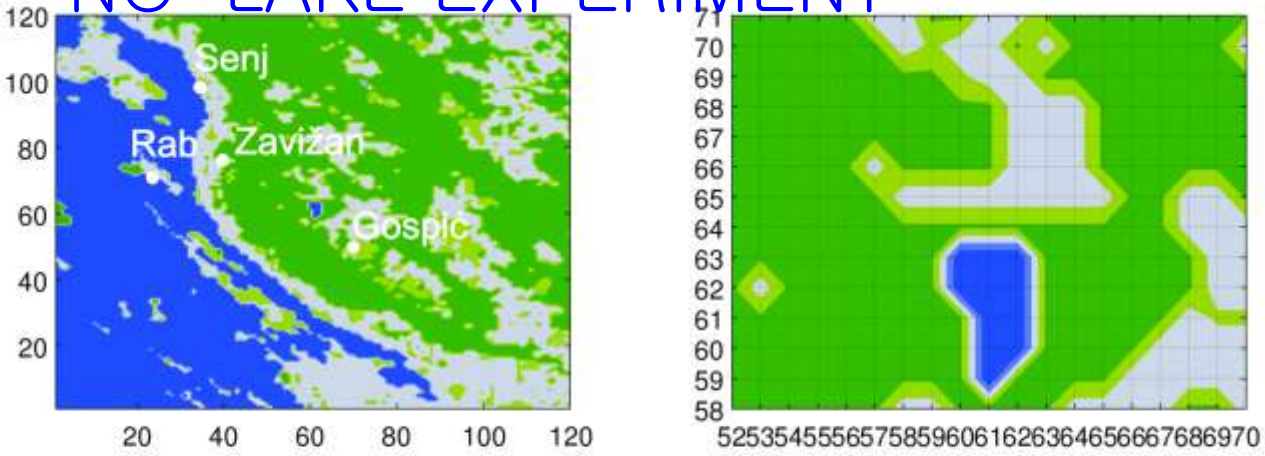
Summertime cyclone



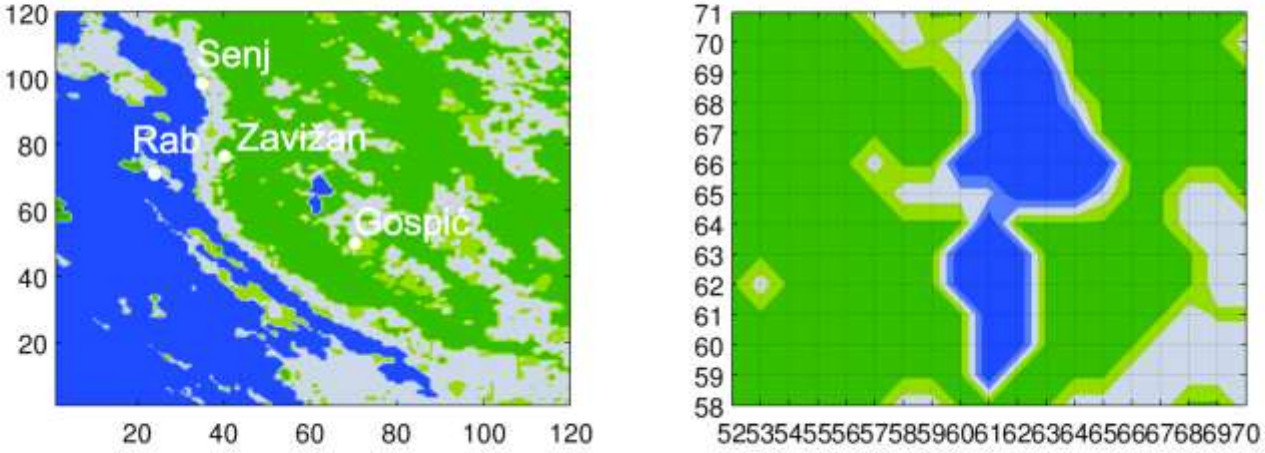


Each simulation: pre-run (12h) + 36 simulated hours

NO-LAKE EXPERIMENT

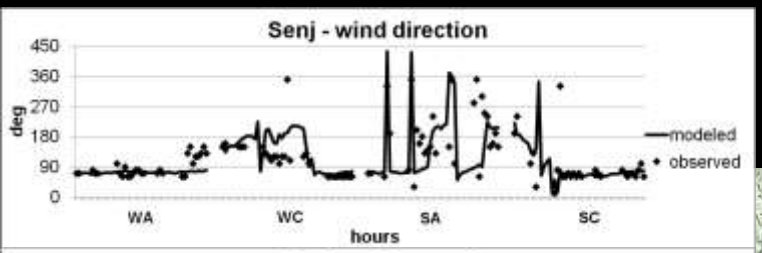


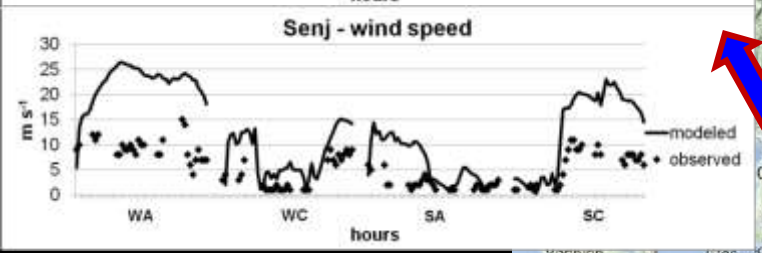
LAKE EXPERIMENT

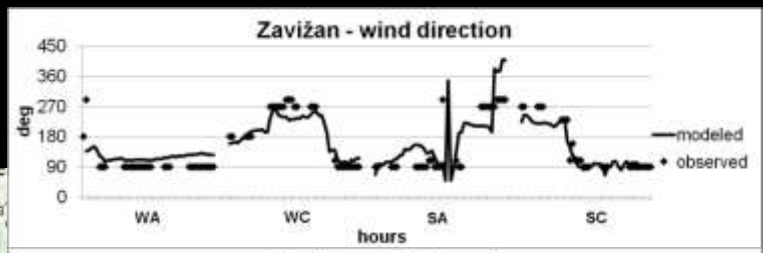


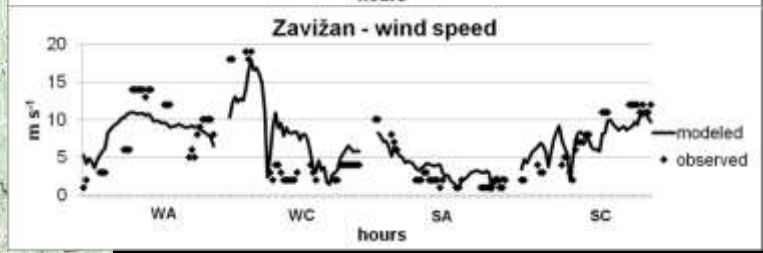
RESULTS

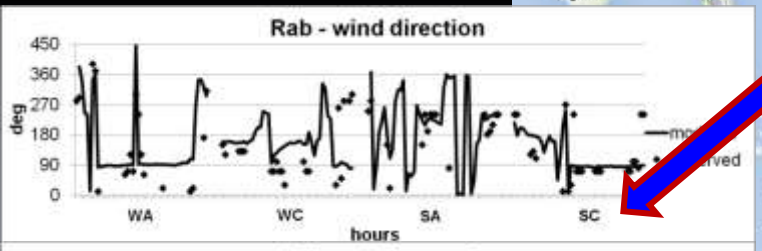
MODEL VERIFICATION (NO-LAKE) → WINDS

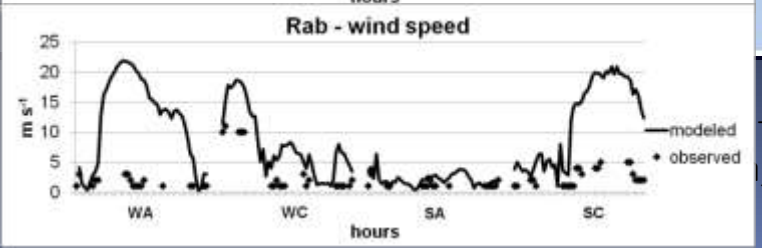


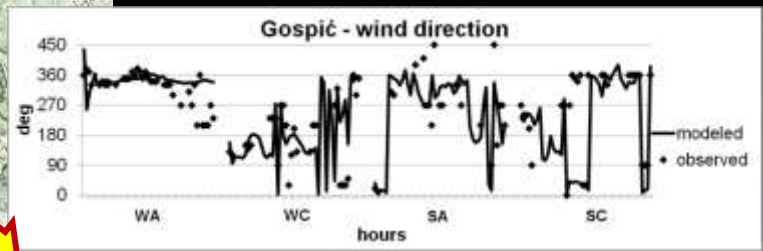


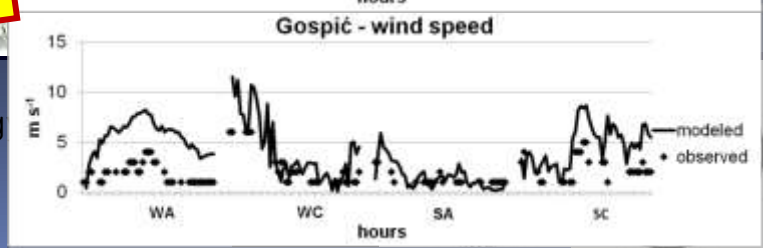


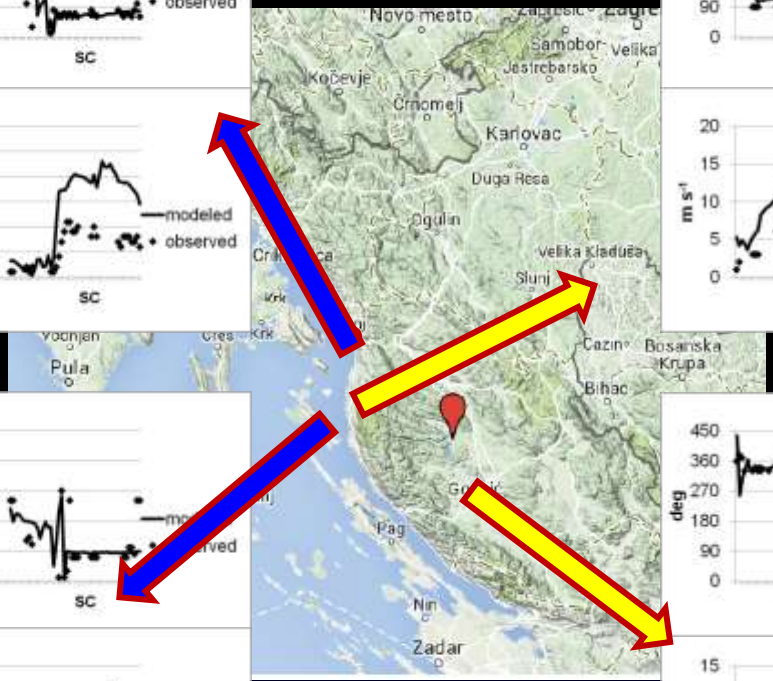












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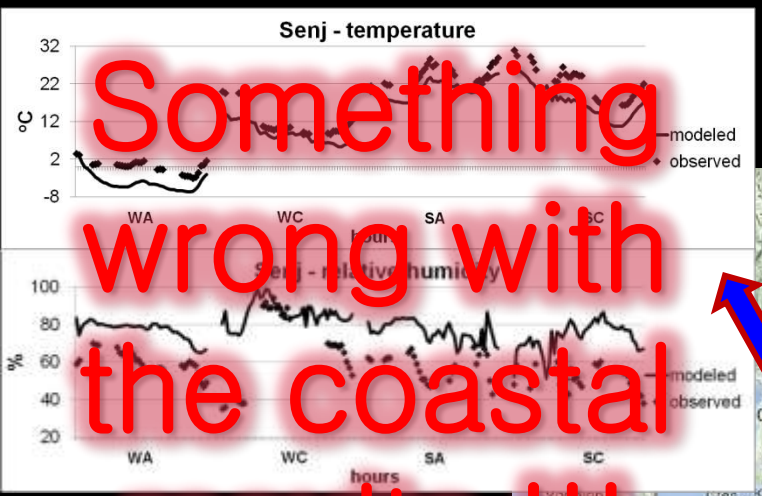
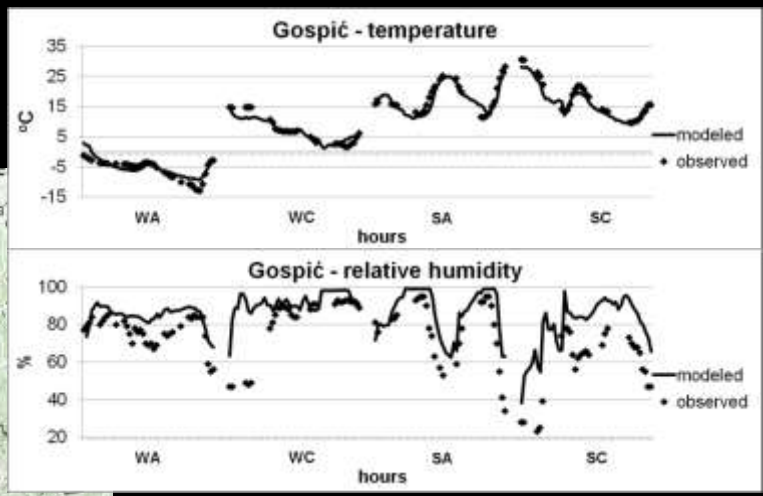
RESULTS

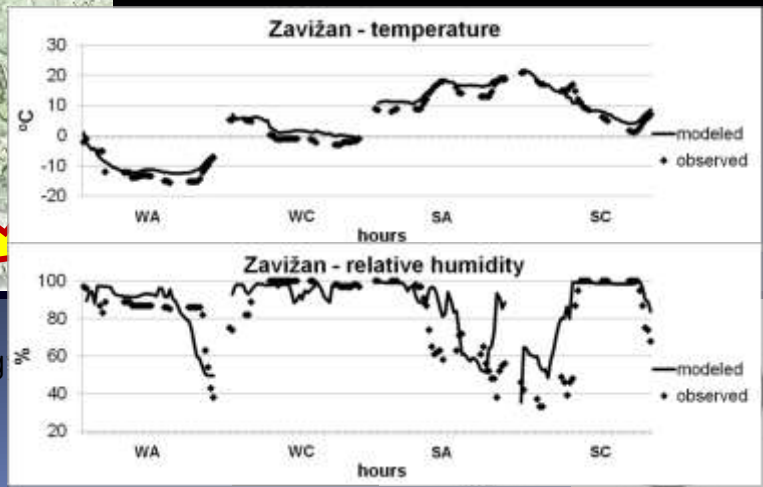
MODEL VERIFICATION → TEMP & HUMIDITY



Something wrong with the coastal results !!!

WHY?





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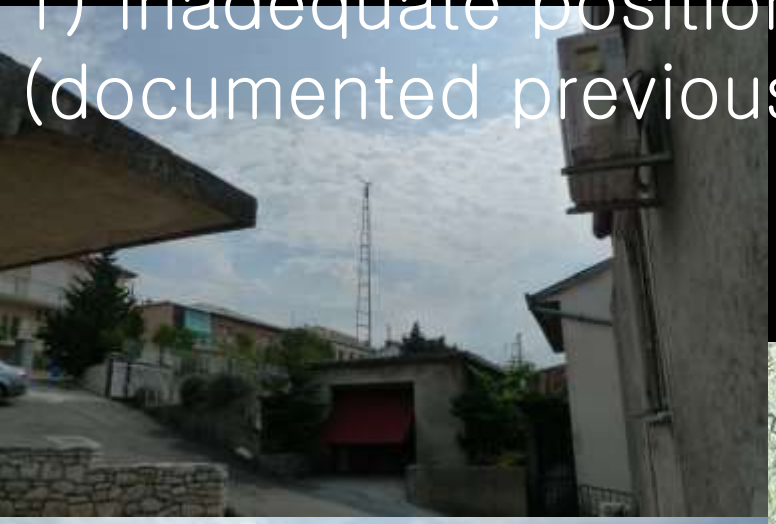
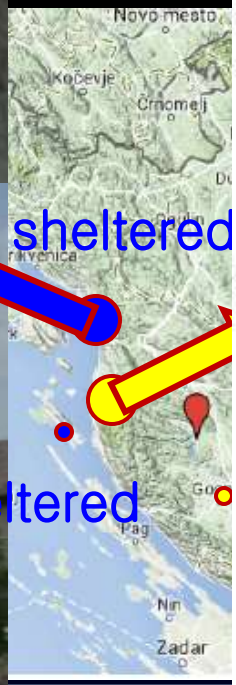
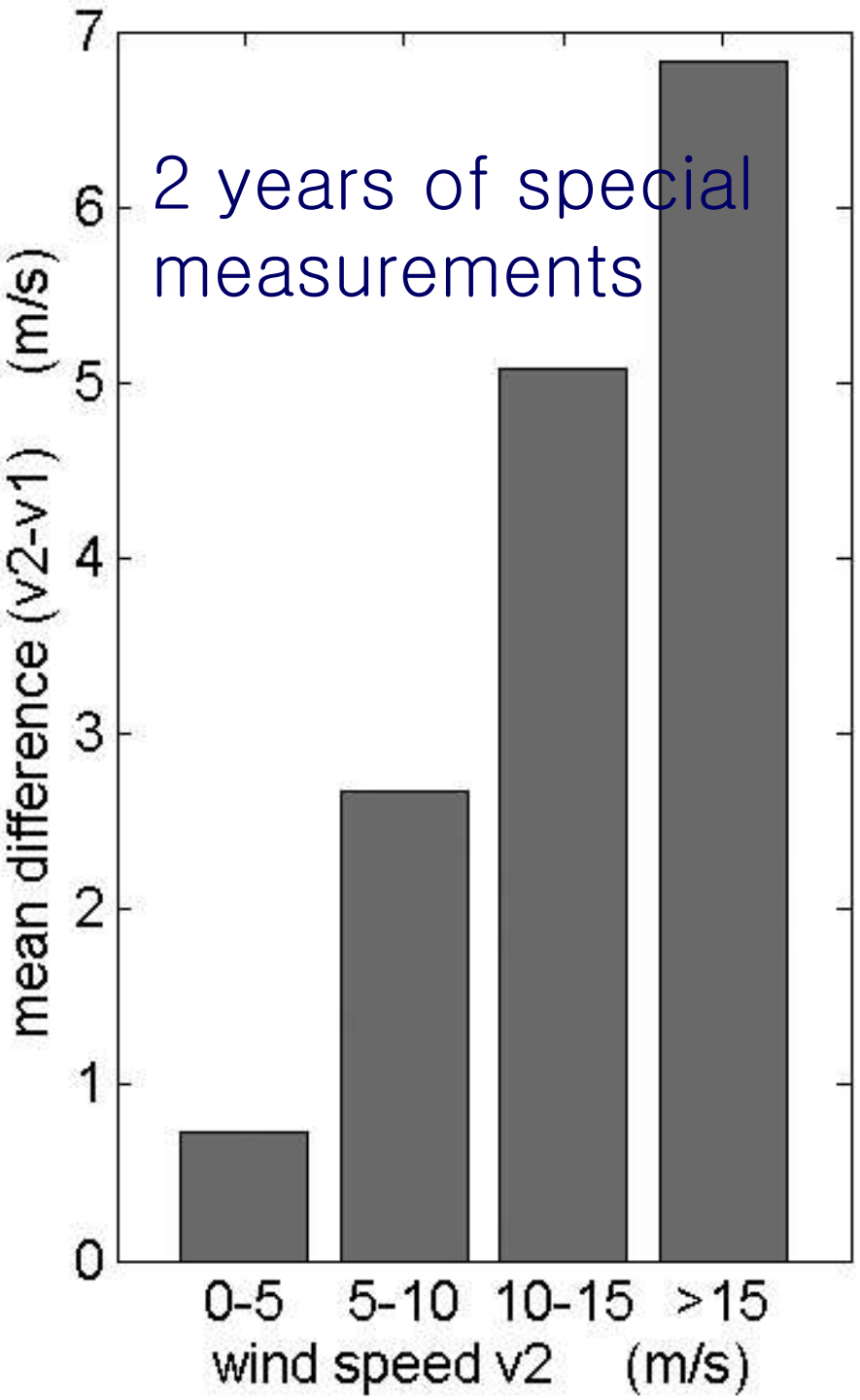
BECAUSE OF:

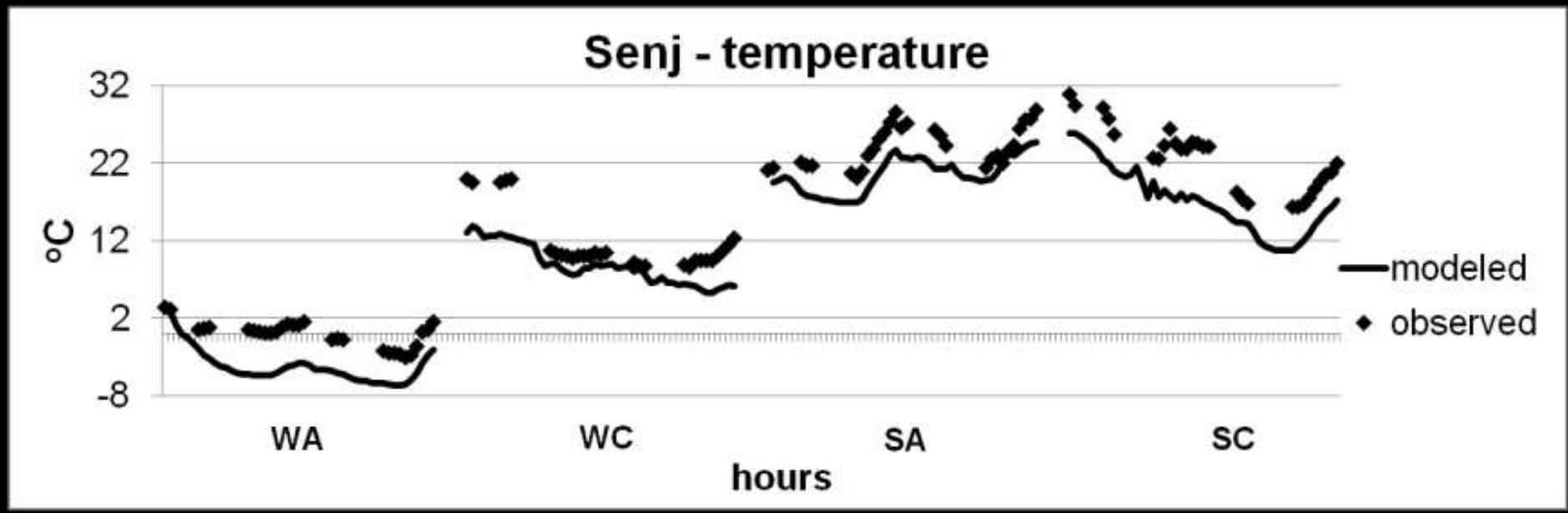
1) Inadequate position of m
(documented previously)

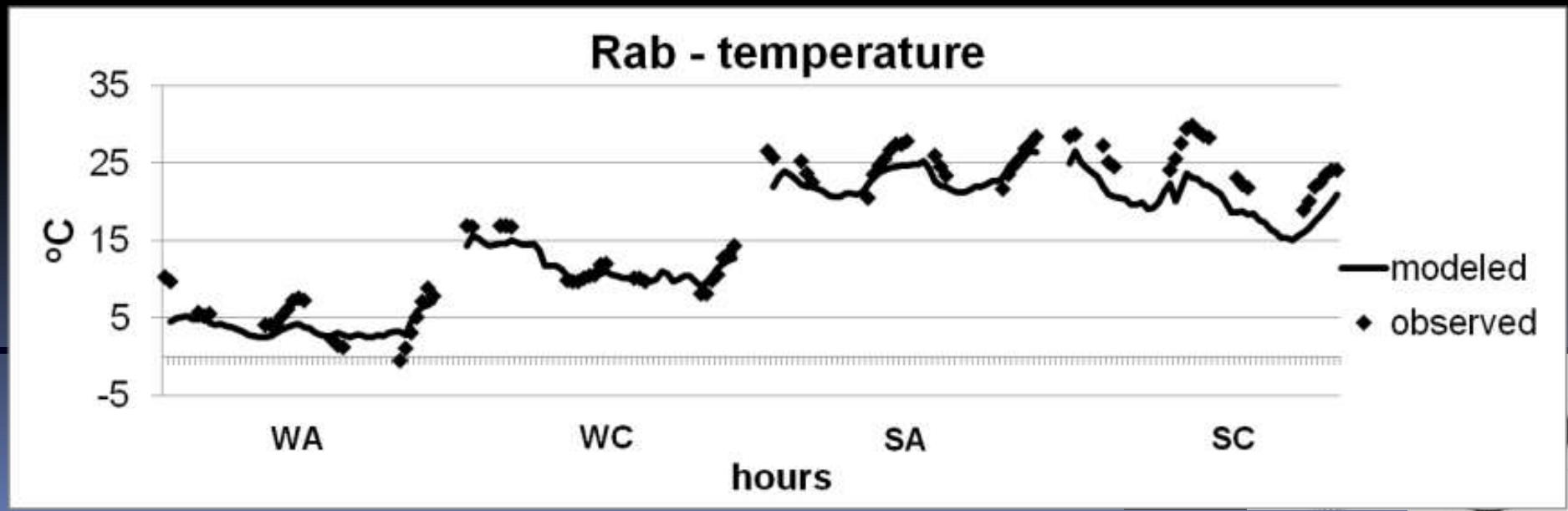






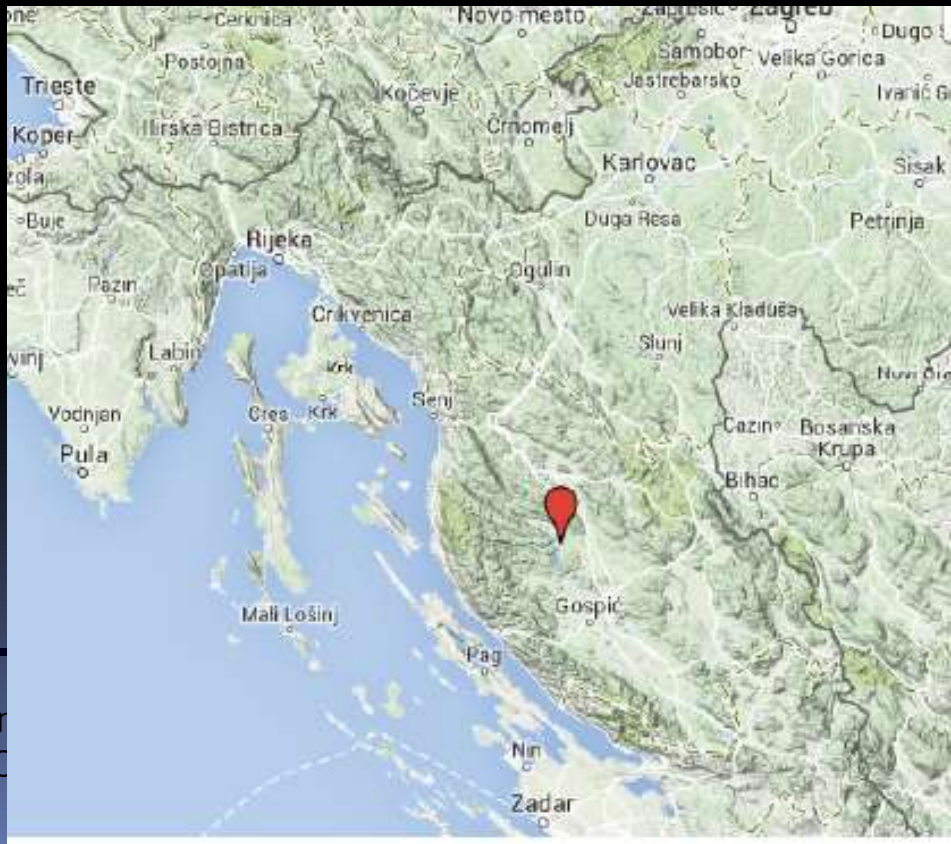
2) Unappropriate resolution (1 km) → e.g., model ‘sees’ the sea instead of the land (or vice versa)





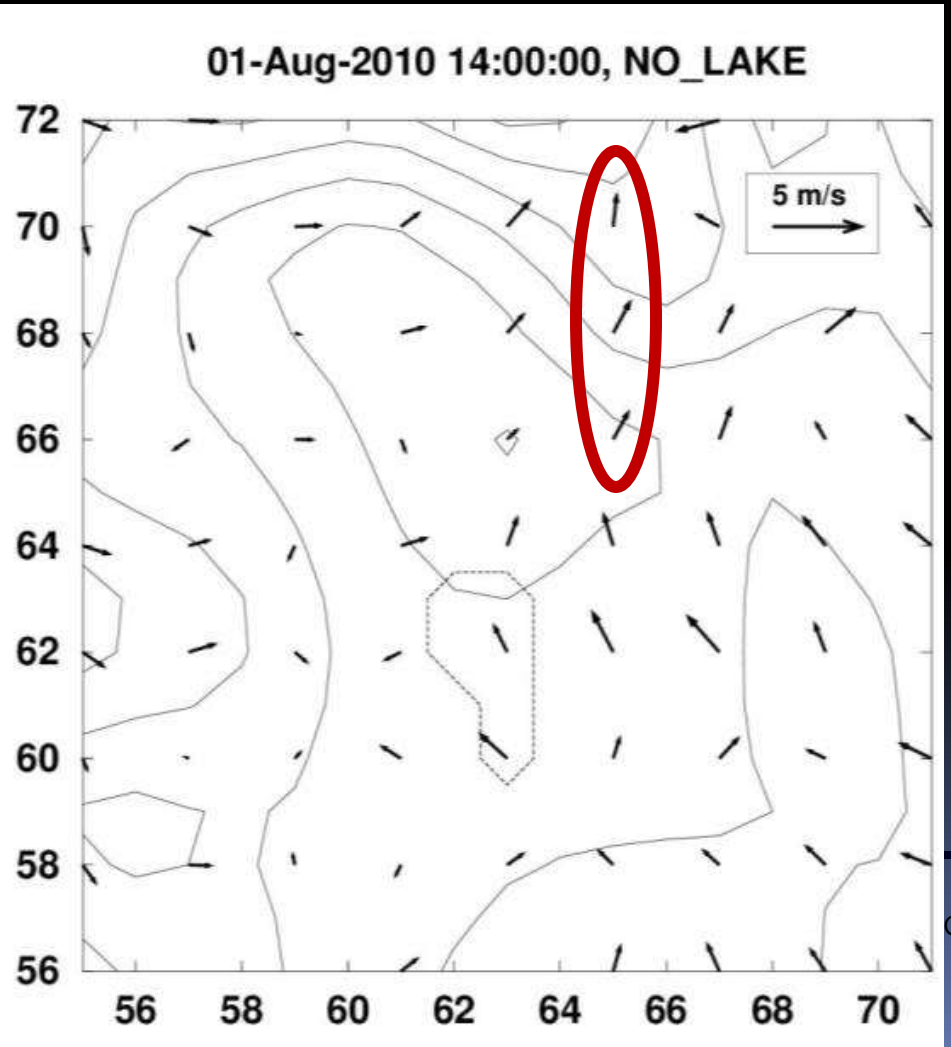
3) Inadequate representation of air–sea interactions in the model

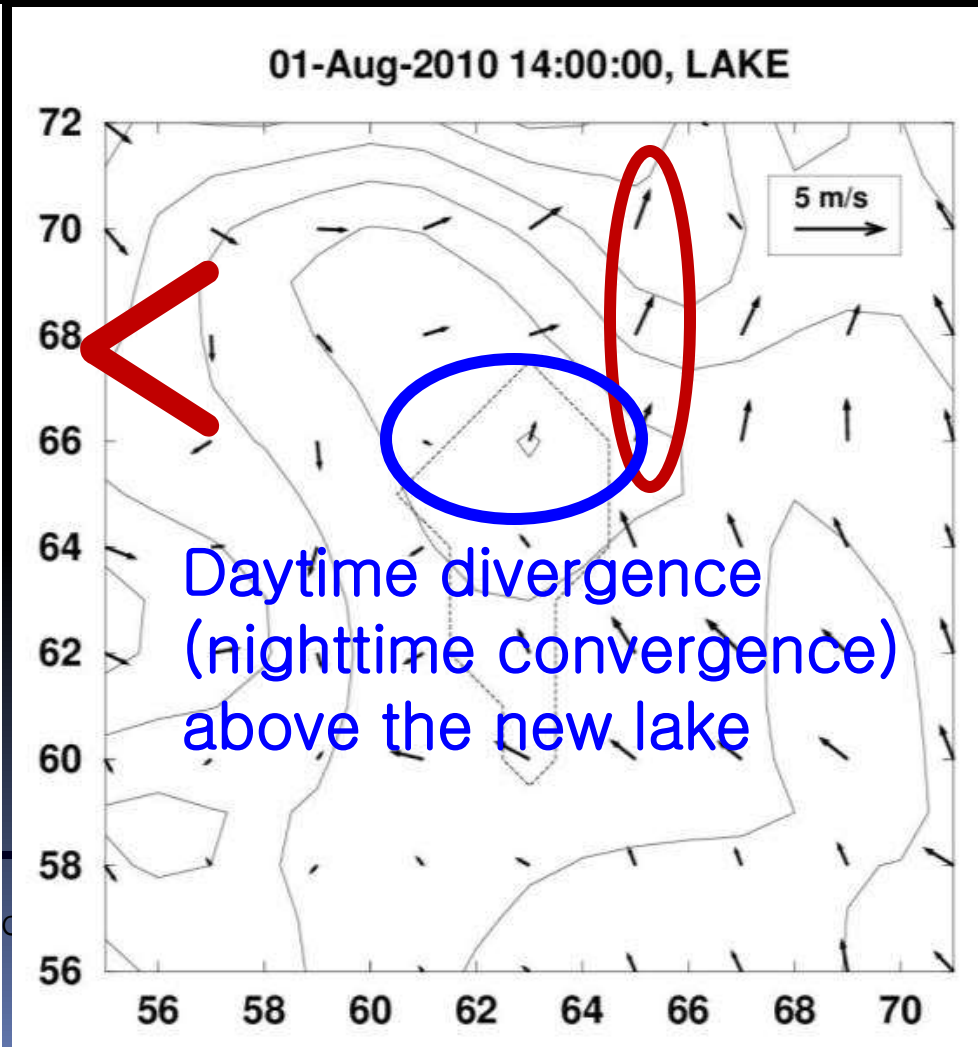
Inland lake



RESULTS:

⇒ Lake breezes & intensification of up-slope winds (SA)

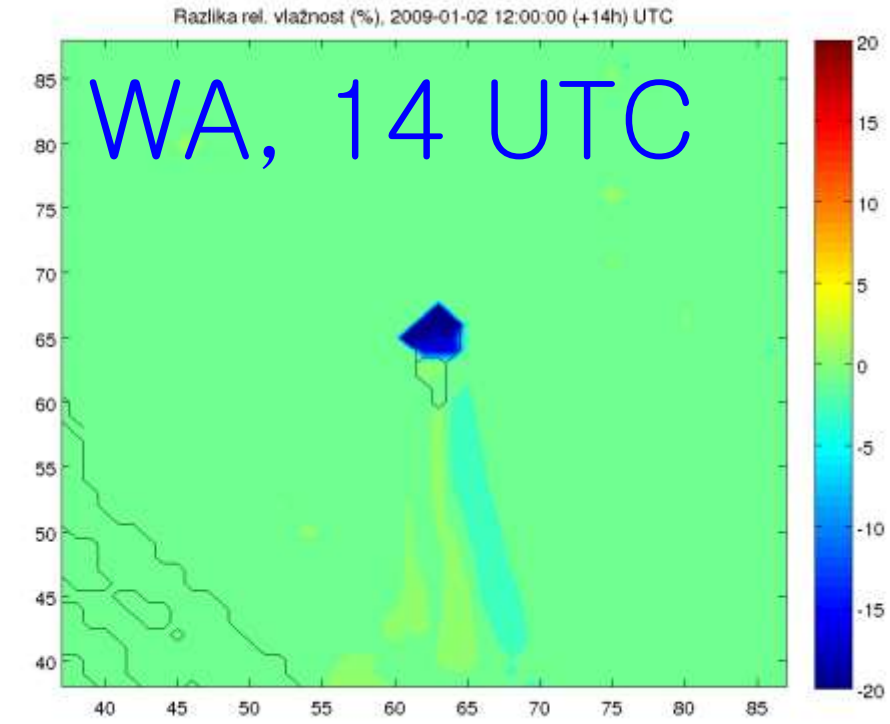


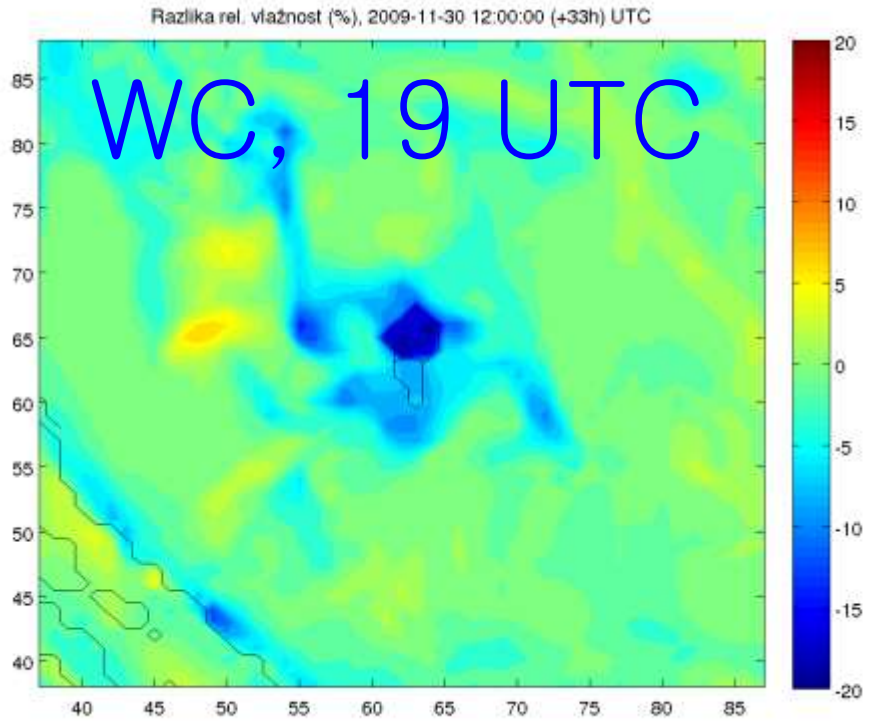


RESULTS:

⇒Differences betwen the LAKE and NO-LAKE
50 km x 50 km (≈ 4L – 6L)

RH differences (%)

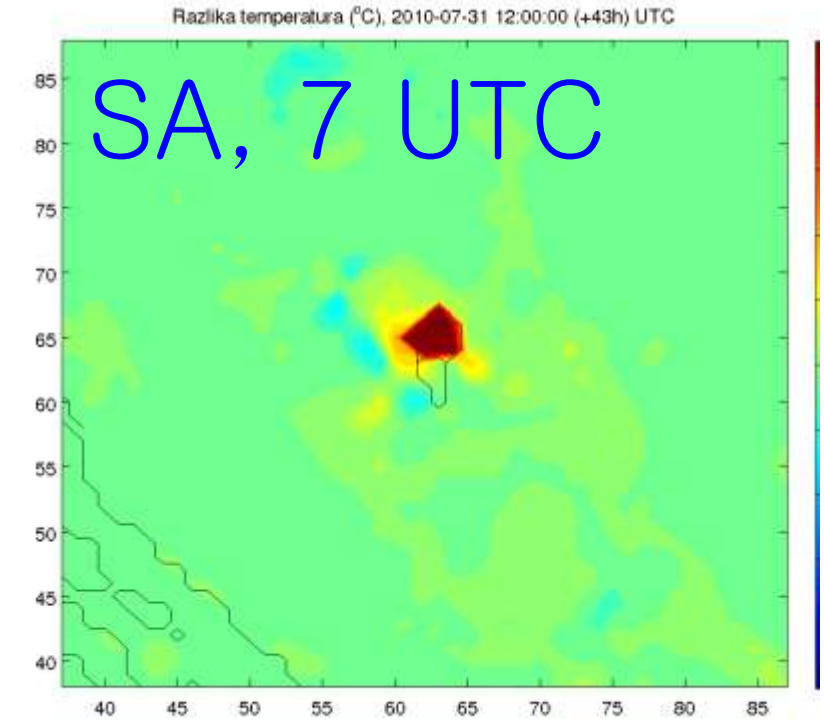


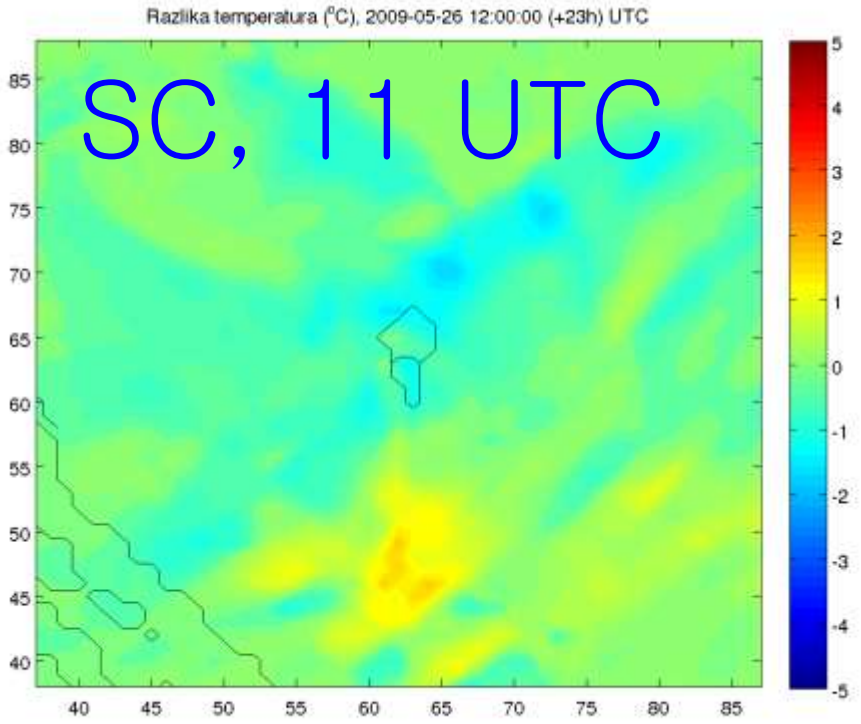


RESULTS:

⇒ Differences betwen the LAKE and NO-LAKE

Temp differences (°C)





RESULTS:

⇒ Significant 36-h mean differences only above the new lake, and only for v, t and RH

Synoptic setup	v (m/s)	t (°C)	RH (%)
WA	0.57	4.04	−48.5
SA	0.22	2.03	−6.4
WC	0.27	1.87	−11.5
SC	0.52	2.05	−7.8

CONCLUSIONS

→ Significant 36-h mean changes are found only above the new lake and only for v, t, and RH (and not for total precipitation, air pressure and CMR)

→ Above remaining 50 km x 50 km area 36-h mean changes were below the order of magnitude of accuracy of operational instruments

CONCLUSIONS

→ For WA, WC and SC temperature above the new lake increased (on the average between +1.9 and +4.0°C)

→ For SA, the average temperature change depended on the time of the day (daytime decrease & nighttime increase)

CONCLUSIONS

→ The RH above the new lake generally decreased for all 4 synoptic setups

→ A small increase of the wind speed is seen above the new lake for all 4 synoptic setups

CONCLUSIONS

→ New lake would affect thermally induced cirulations (LB & slope winds)

? Lake-effect precipitation → further investigations needed

? Long-term effects of a new lake (accumulation of slightly biased differences) → further (climatological) investigations needed

CONCLUSIONS

? Quality of operationally observed meteorological data

? Proper incorporation of air–sea interactions


THANK
YOU
HVALA