Garda Lake Dynamics and Mixing

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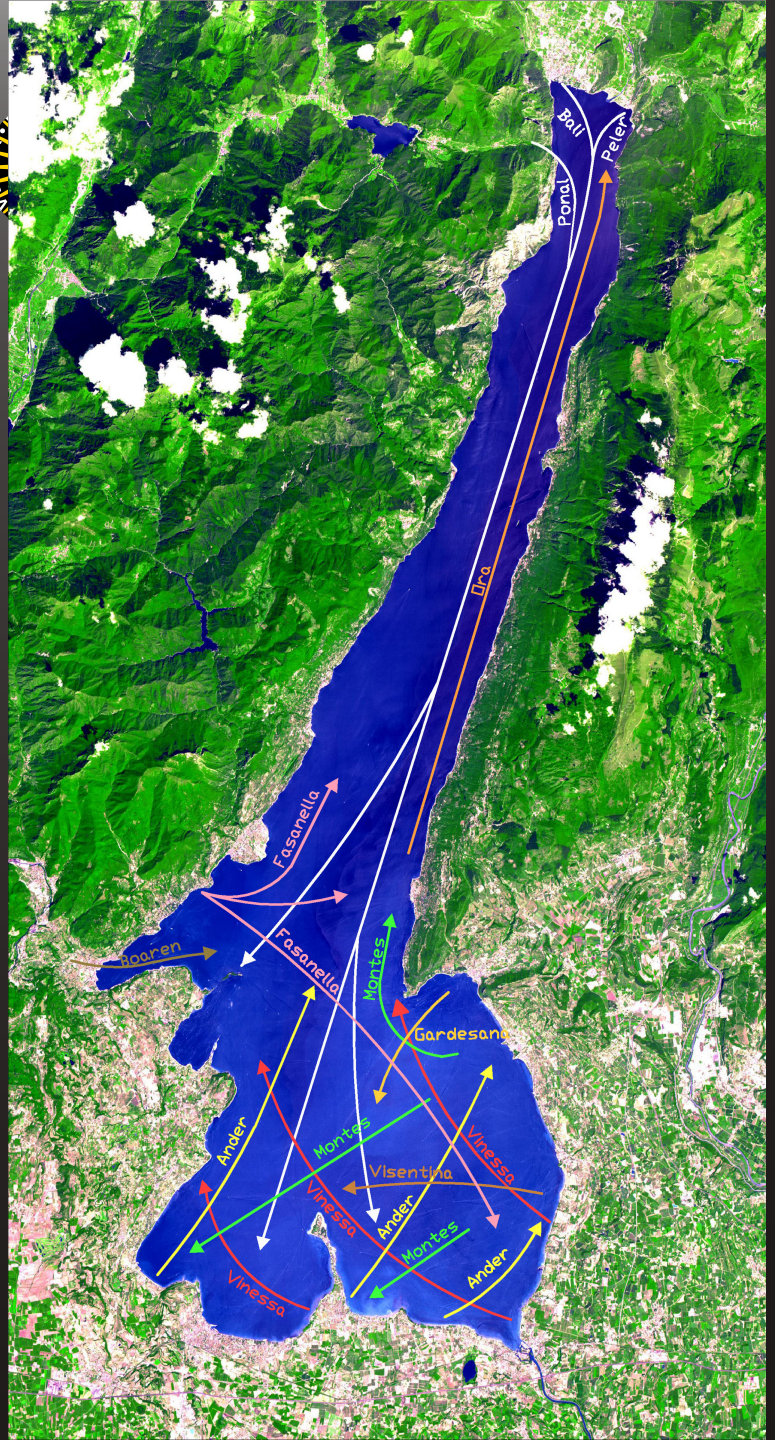
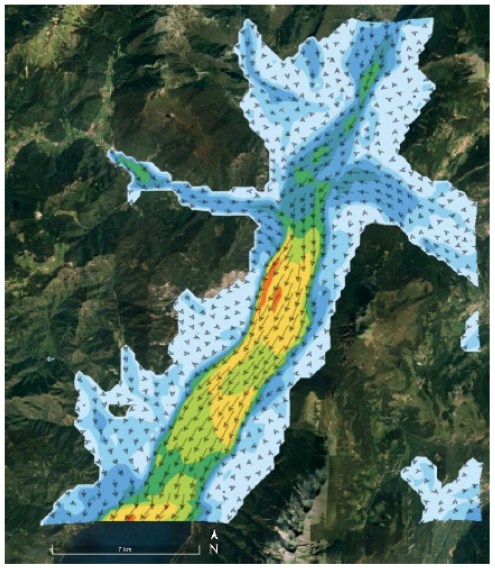
NIOZ, Texel, NL

Bright minds, better future

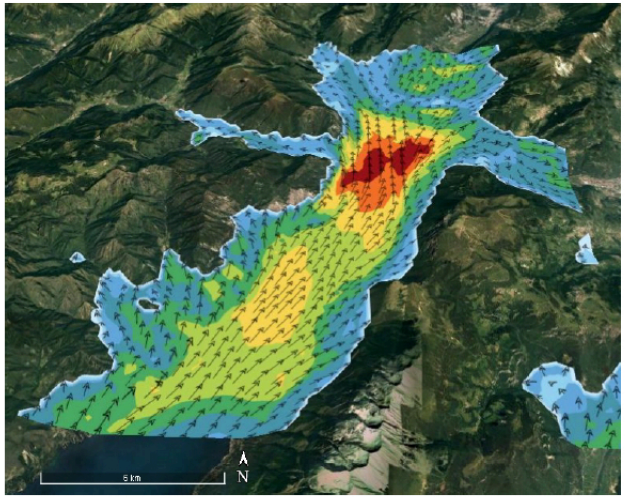
Lake Garda: characteristics



Peler



Ora



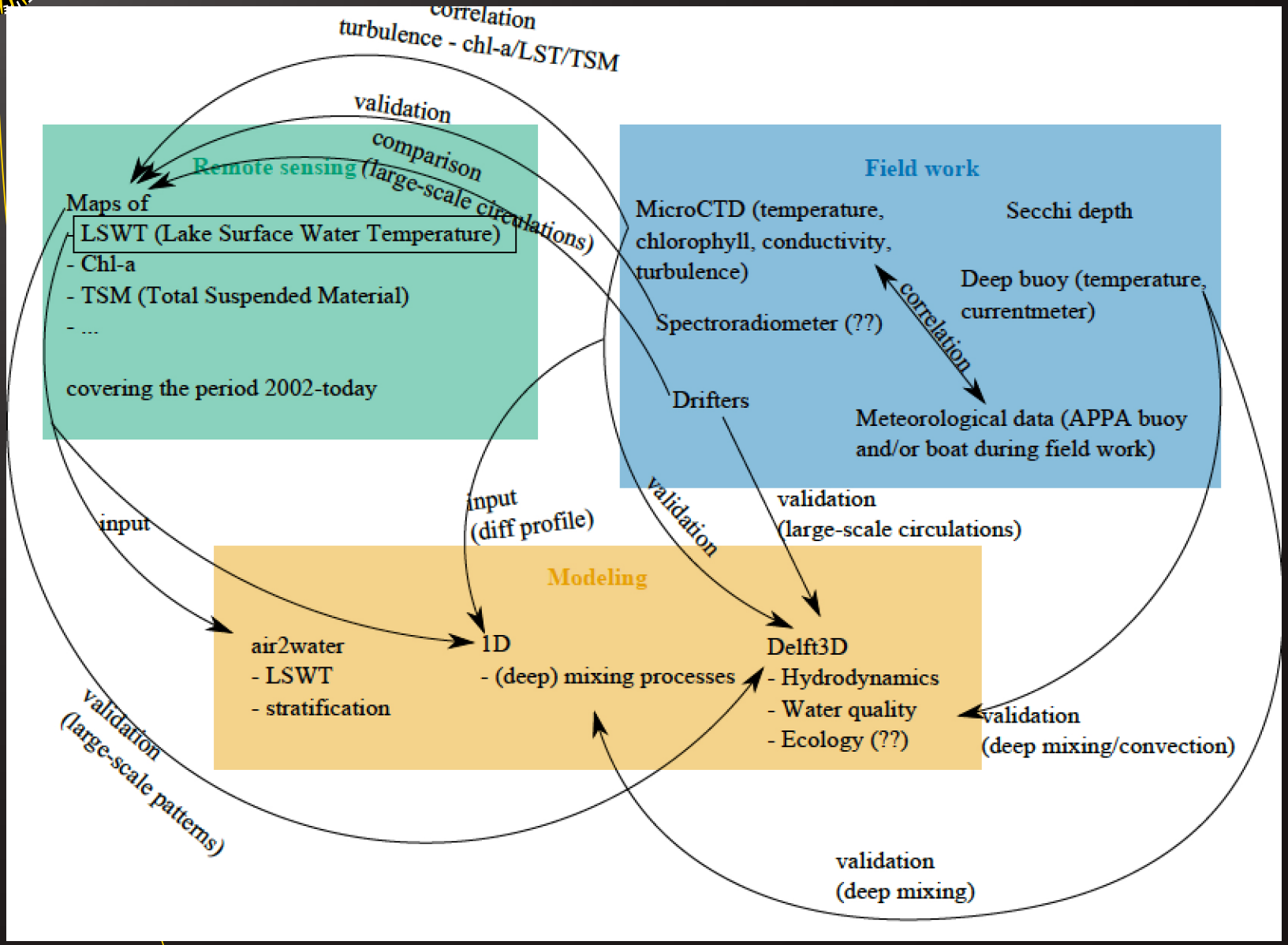
Motivation and Main Questions

Which processes control the ventilation of the deep Lake Garda?

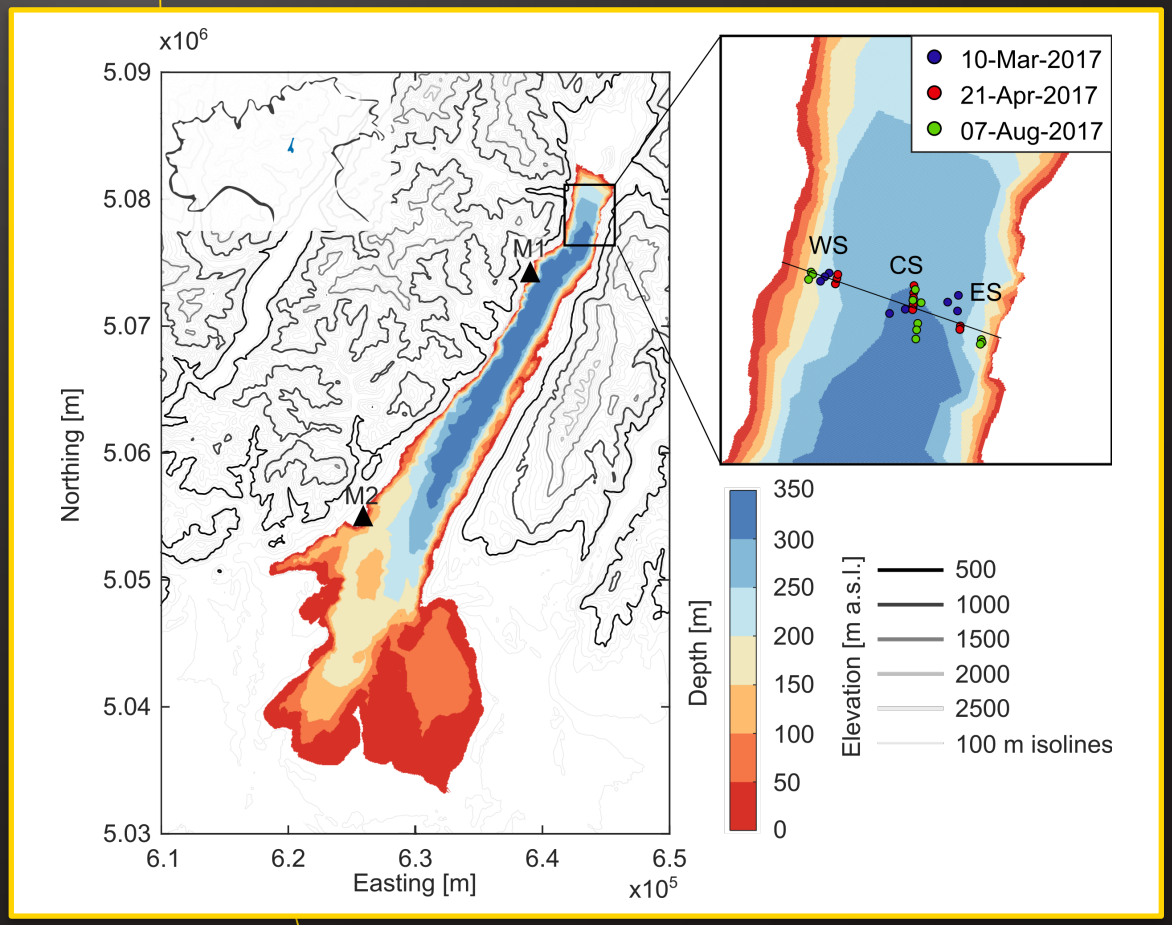
What modes of internal variability exist in Lake Garda?

How resilient is Lake Garda to climate change?

Activities since 02/2017



In situ measurements (3/2017-5/2018)

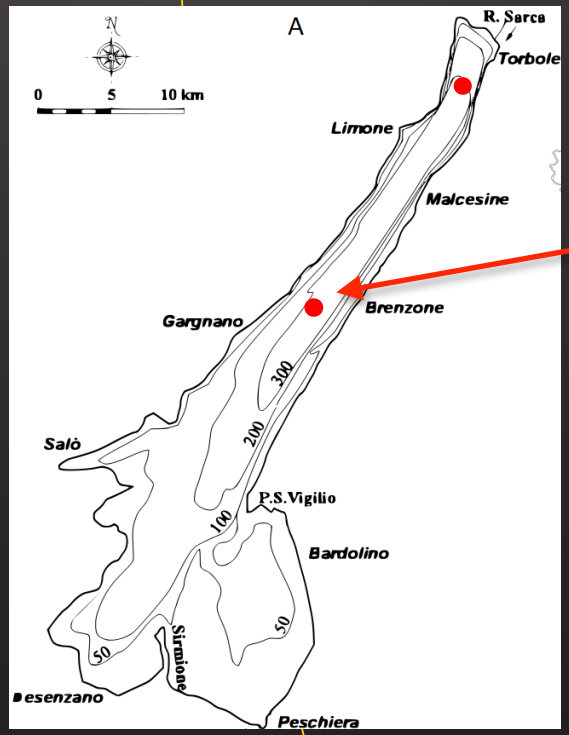


ROCKLAND SCIENTIFIC

MicroCTD profiles (upper 100m)

- full seasonal cycle
- full diurnal cycle

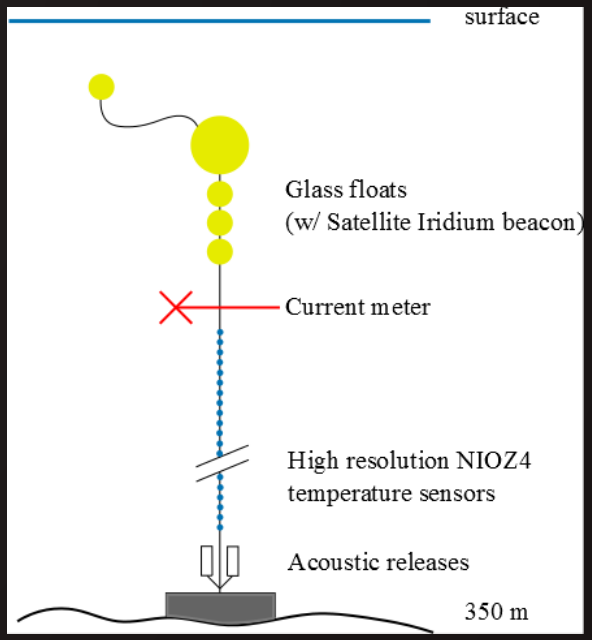
In situ measurements (5/2017-5/2018)



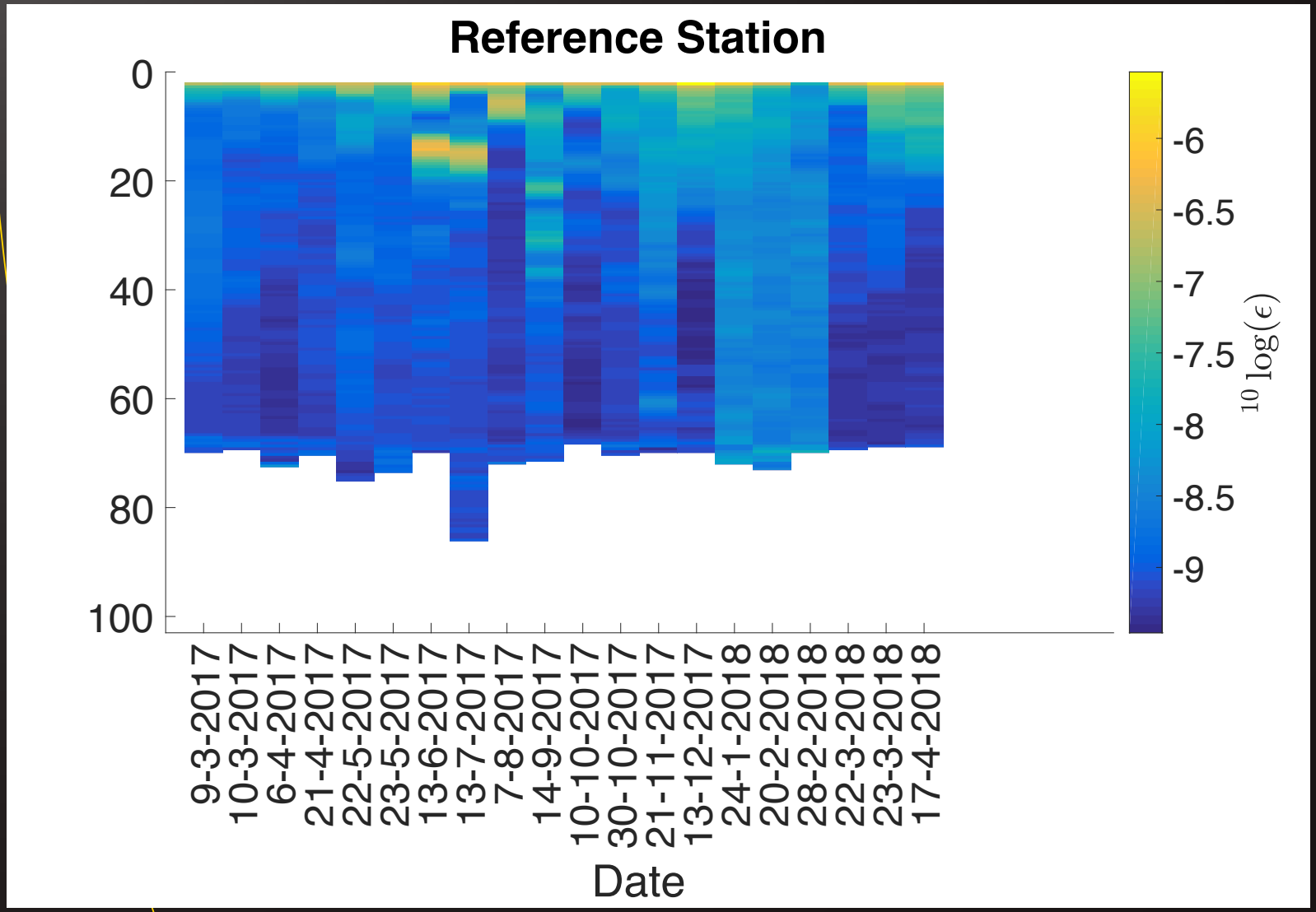
Thermistor String

full seasonal cycle

(May 2017- May2018)



Main results MicroCTD
(with Francesco Cassano, Bryan Brouwer, UU)



Main results MicroCTD

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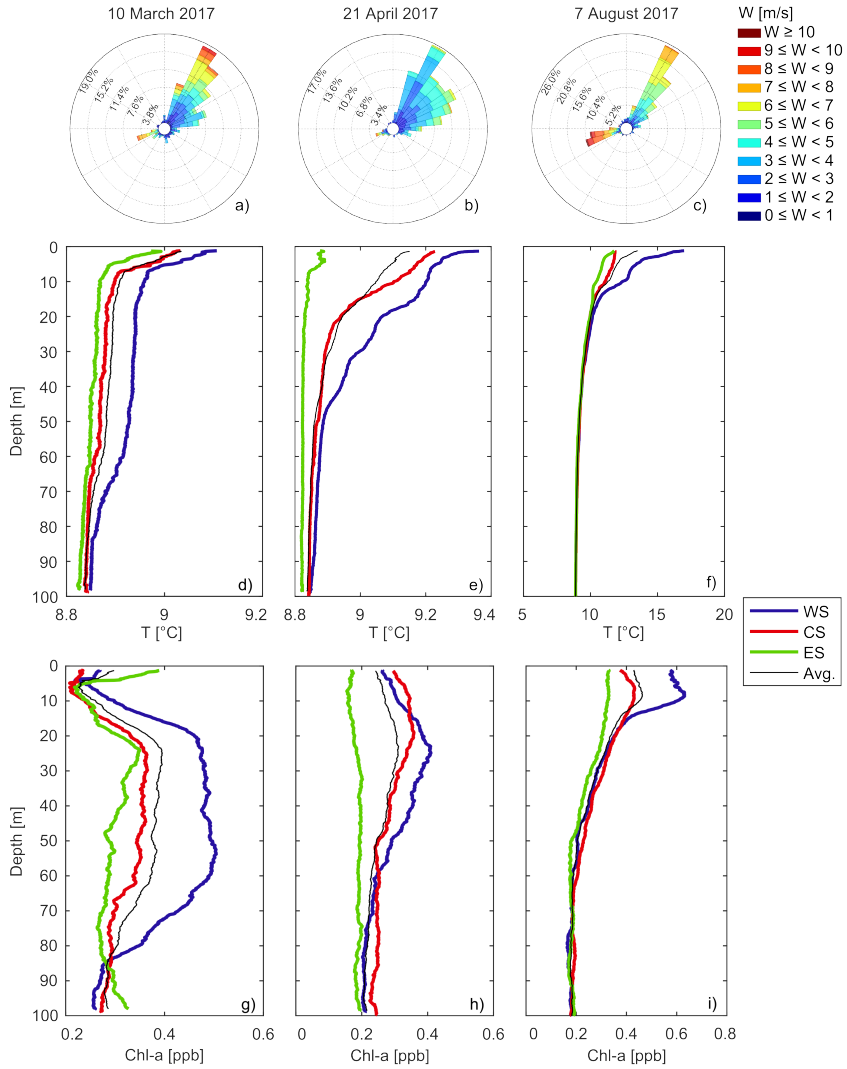
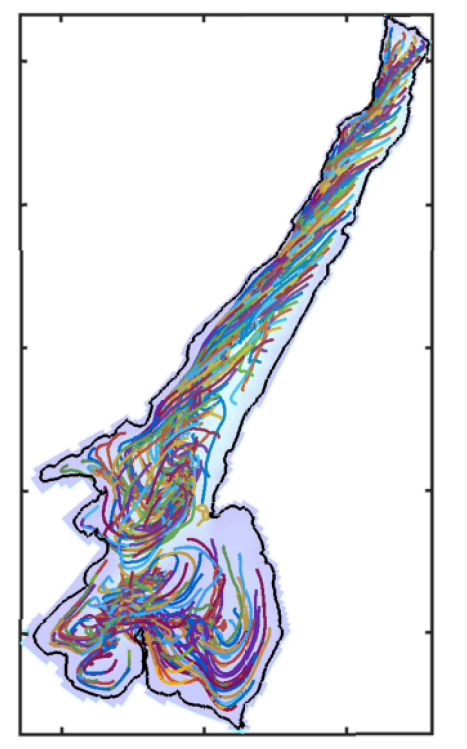


Talk Sebastiano Piccolroaz!

Simulations: Delft 3D



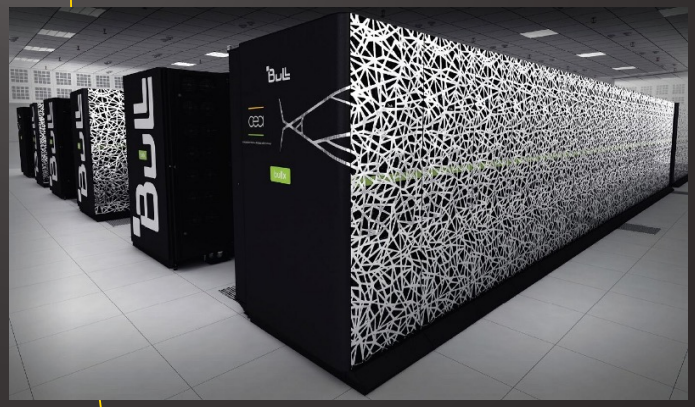
spatial resolution:
low: 64 x 224 x 100 (~200m)
high: 128 x 448 x 100 (~100 m)
ultra-high: 1280 x 4480 (~ 10 m)

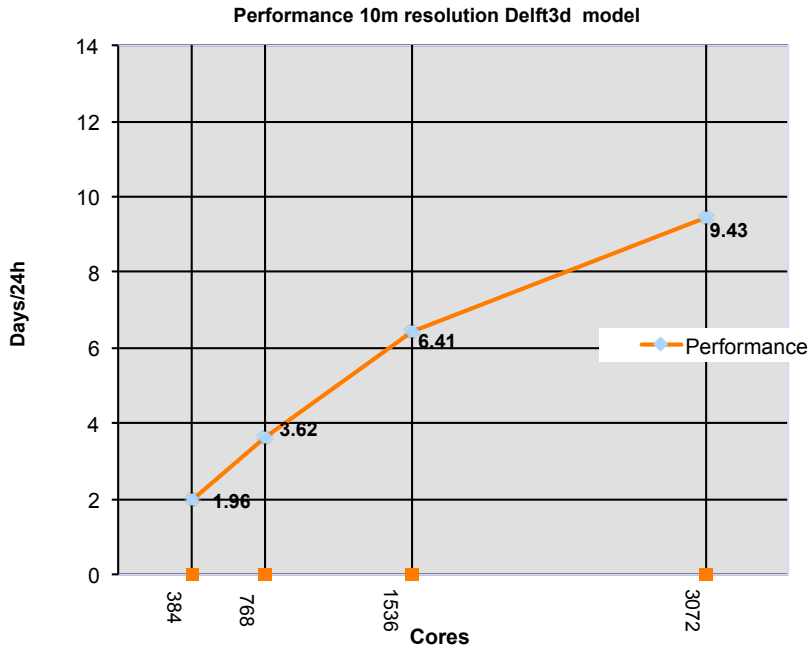
forcing: WRF (2004-2014)
(with Lorenzo Giovanini & Dino Zardi)

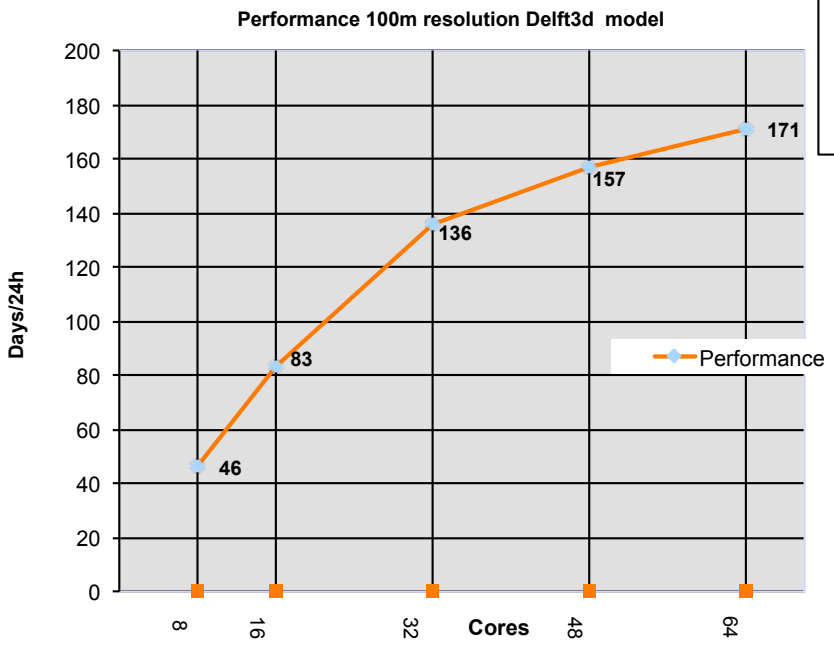
- Event based (PhD thesis Marina Amadori, 2016)

- Long term

Performance: Delft 3D







47,776 cores + 132 GPUs: 1.843 Pflop/s (theoretical peak performance)

Cartesius (SURFsara, NL)

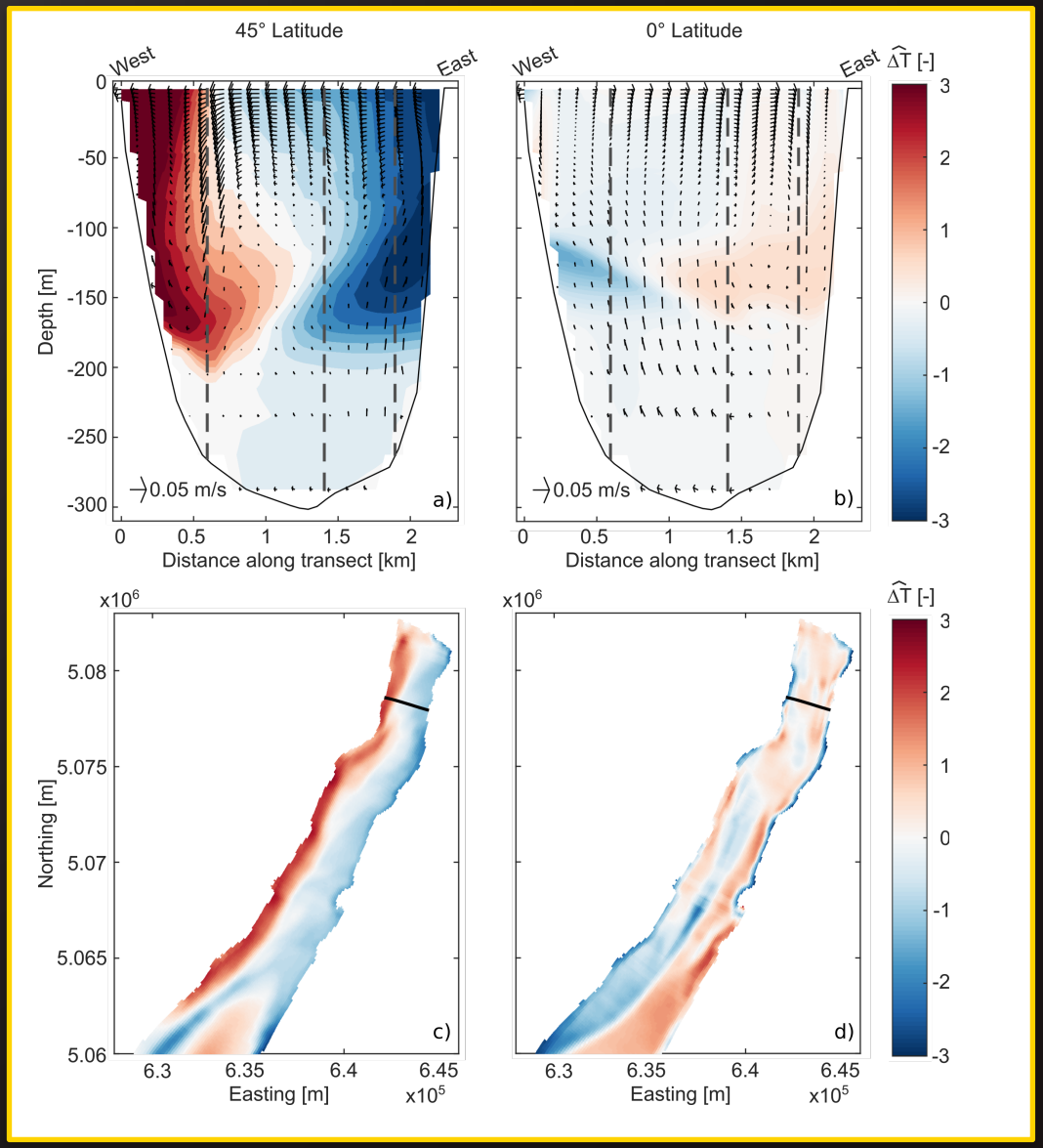
Event-based (high-res) simulations

Effects of planetary rotation on E-W temperature gradient

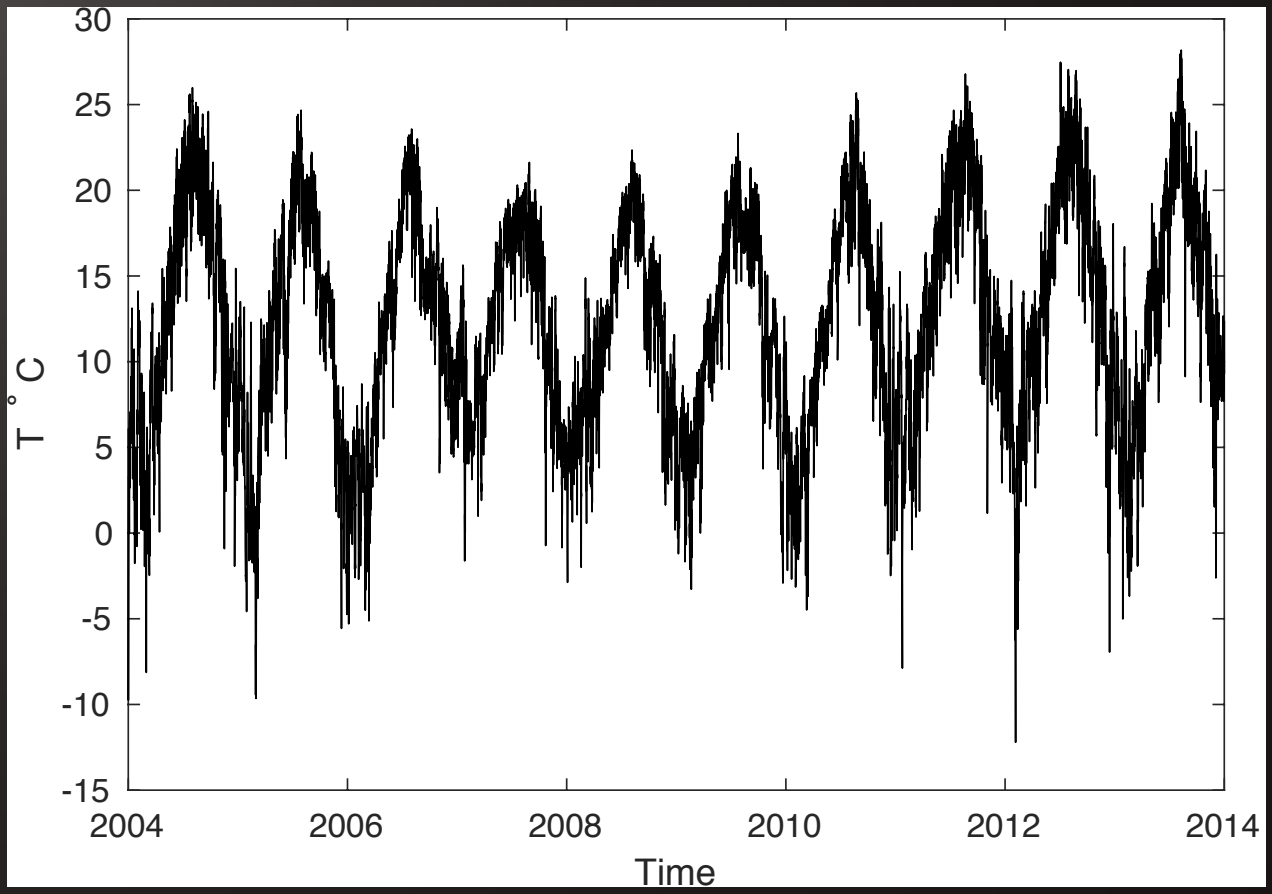
Theory:
New Ekman type solution

Talk Marina Amadori !

April 21, 2017

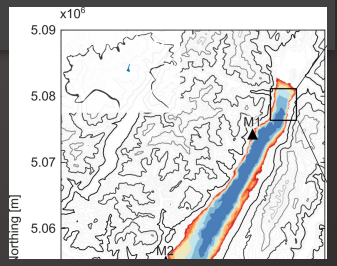


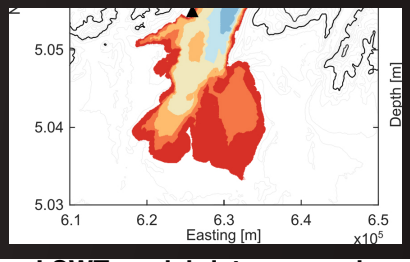
Long Term Simulations (2004-2014): (low-res Delft3D)

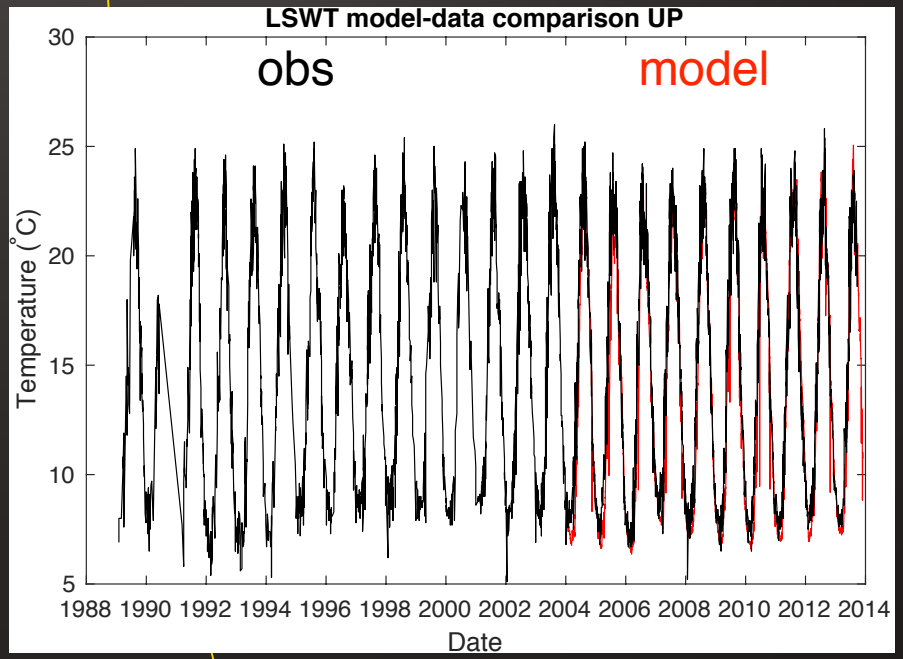


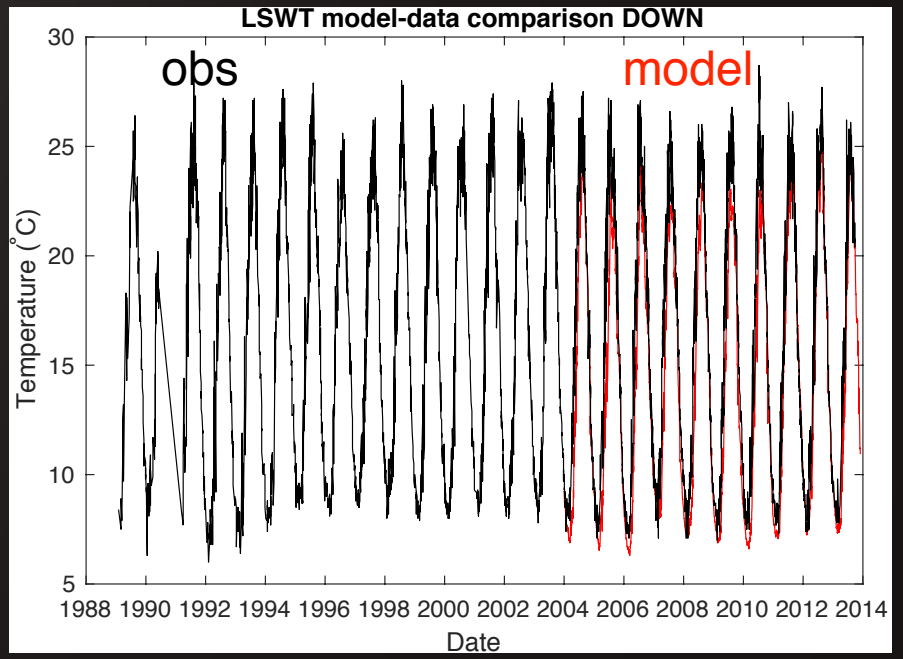
forcing (WRF): Atmospheric temperature

Model validation: LSWT







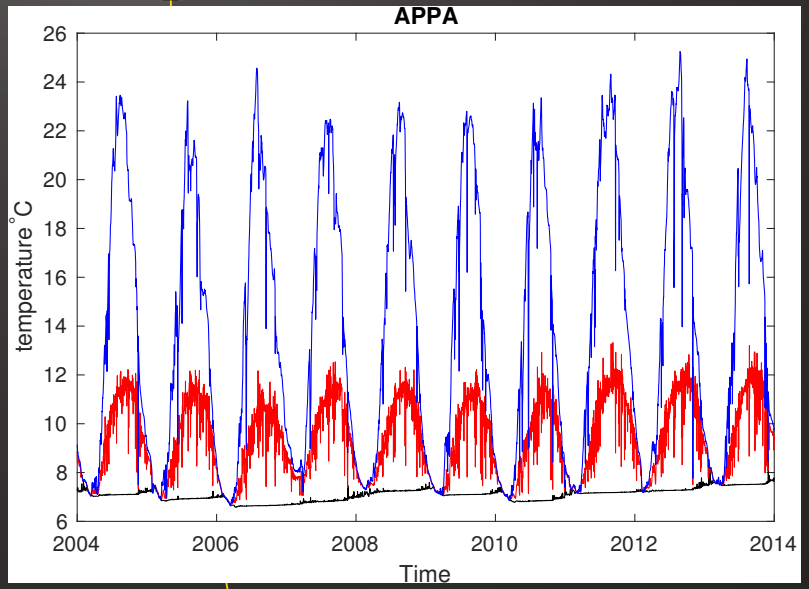


Lake surface water temperatures of European Alpine lakes (1989–2013) based on the Advanced Very High Resolution Radiometer (AVHRR) 1 km data set

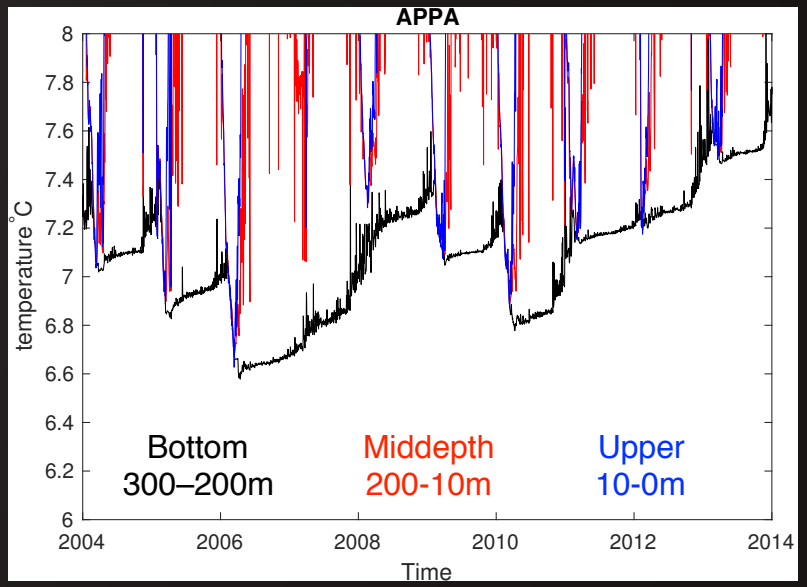
M. Riffler[1,2], G. Lieberherr[1,2], and S. Wunderle[1,2]

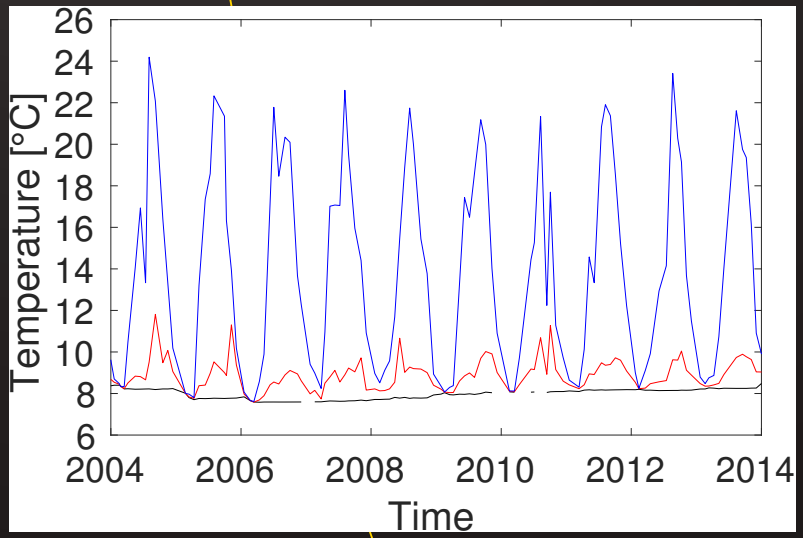
Earth Syst. Sci. Data, 7, 1–17, 2015
www.earth-syst-sci-data.net/7/1/2015/
doi:10.5194/essd-7-1-2015

Model validation: APPA

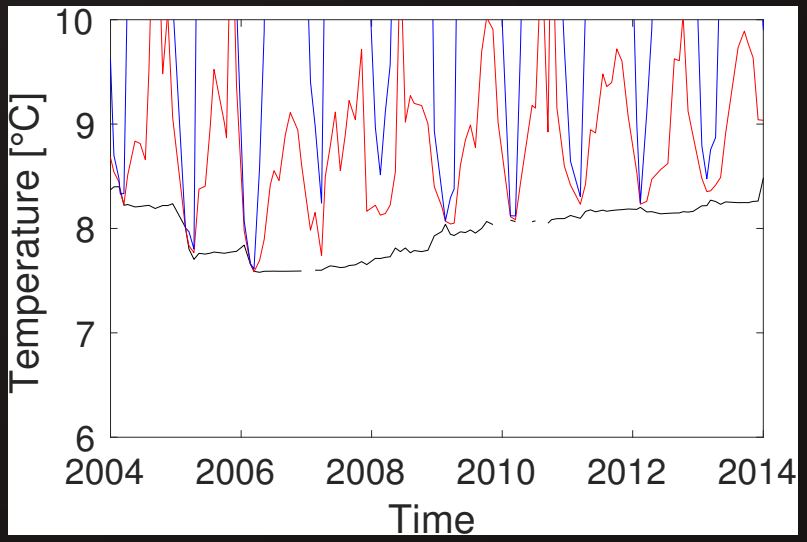


Delft3D

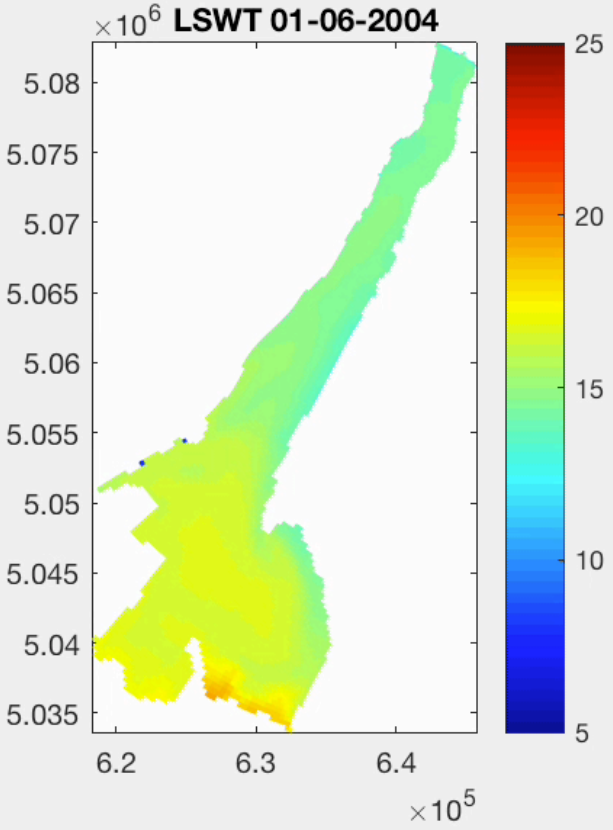


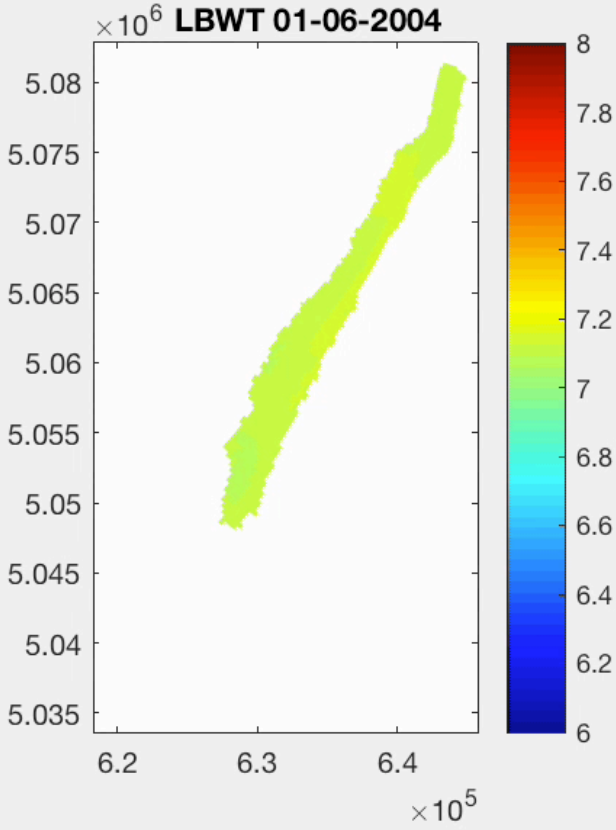


Observations



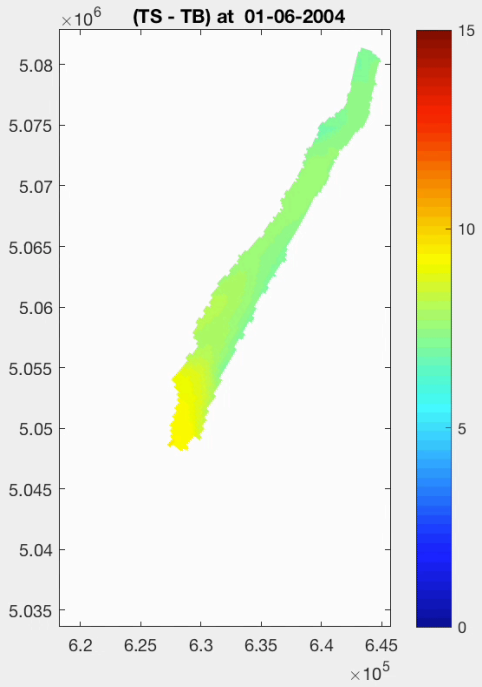
Transient development 1/6/2004 - 1/6/2008



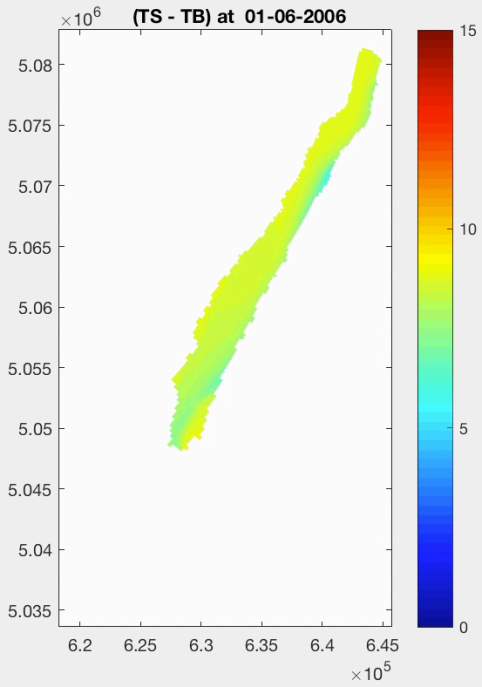


Vertical temperature difference

2004-2005



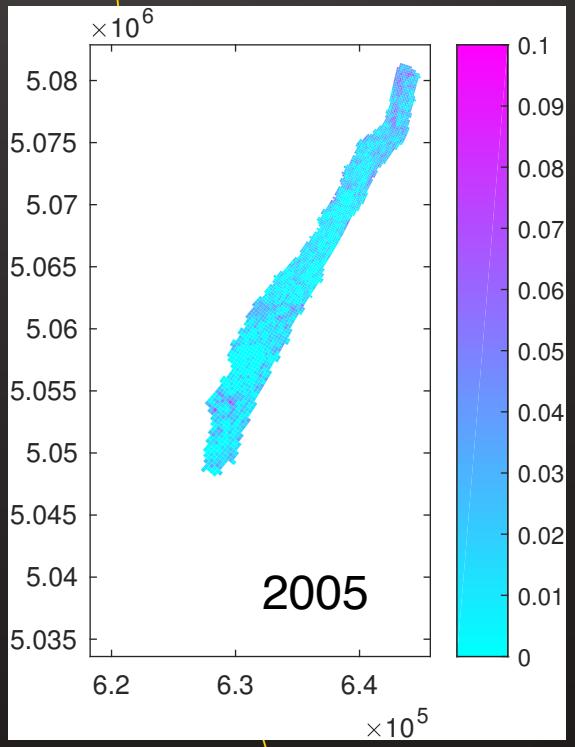
2006-2007

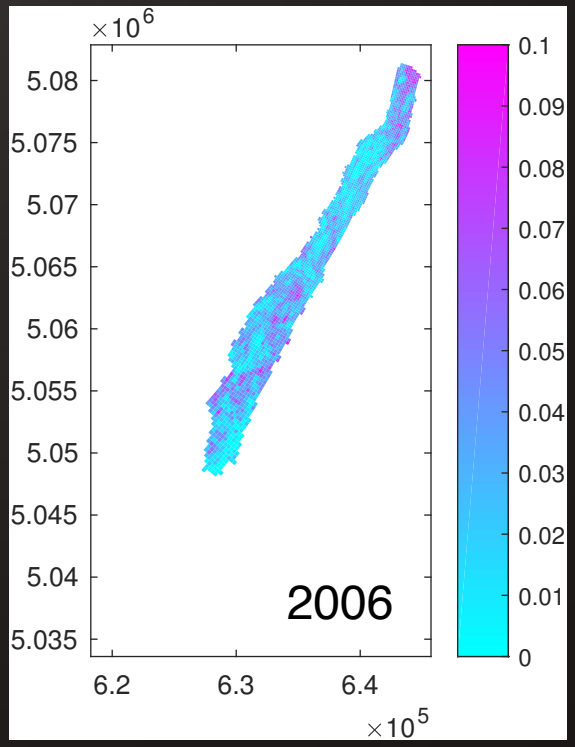


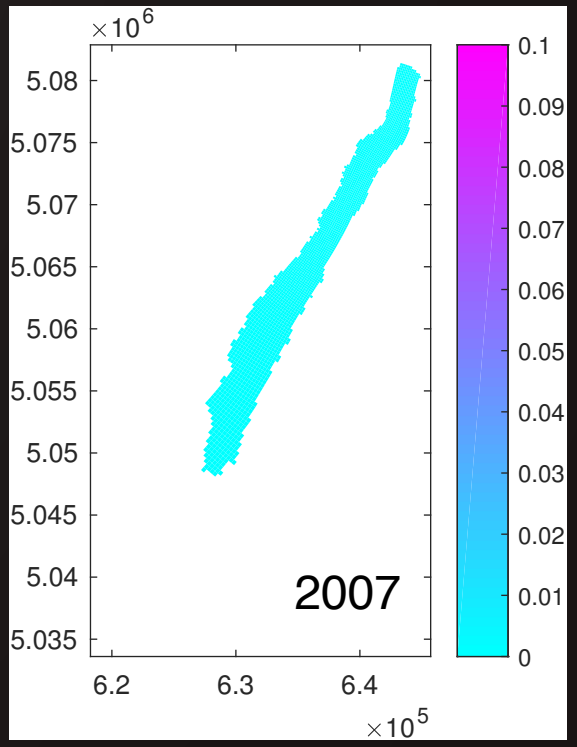
Patterns of Deep Mixing Events

January - March

$$|T_S - T_B| < \epsilon$$ # events/90 days $$\epsilon = 0.005$$







Further analysis is underway …

Summary & Conclusions

A substantial observational effort has provided data of vertical mixing and Chl-a at a zonal section near the APPA point (diurnal cycle and seasonal cycle) over the period March 2017 - May 2018

Delft3D is quite capable of simulating broad scale aspects of Lake Garda dynamics, including deep mixing events

This dynamics is substantially affected by planetary rotation through secondary (Ekman) flows