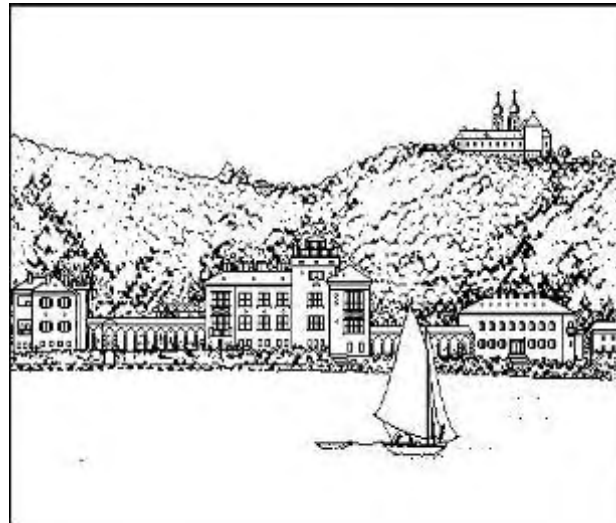


# Satellite and LIDAR based remote sensing of water quality parameters on Lake Balaton

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VIENNA  
UNIVERSITY OF  
TECHNOLOGY  
INSTITUTE OF  
PHOTOGRAMMETRY  
AND REMOTE SENSING



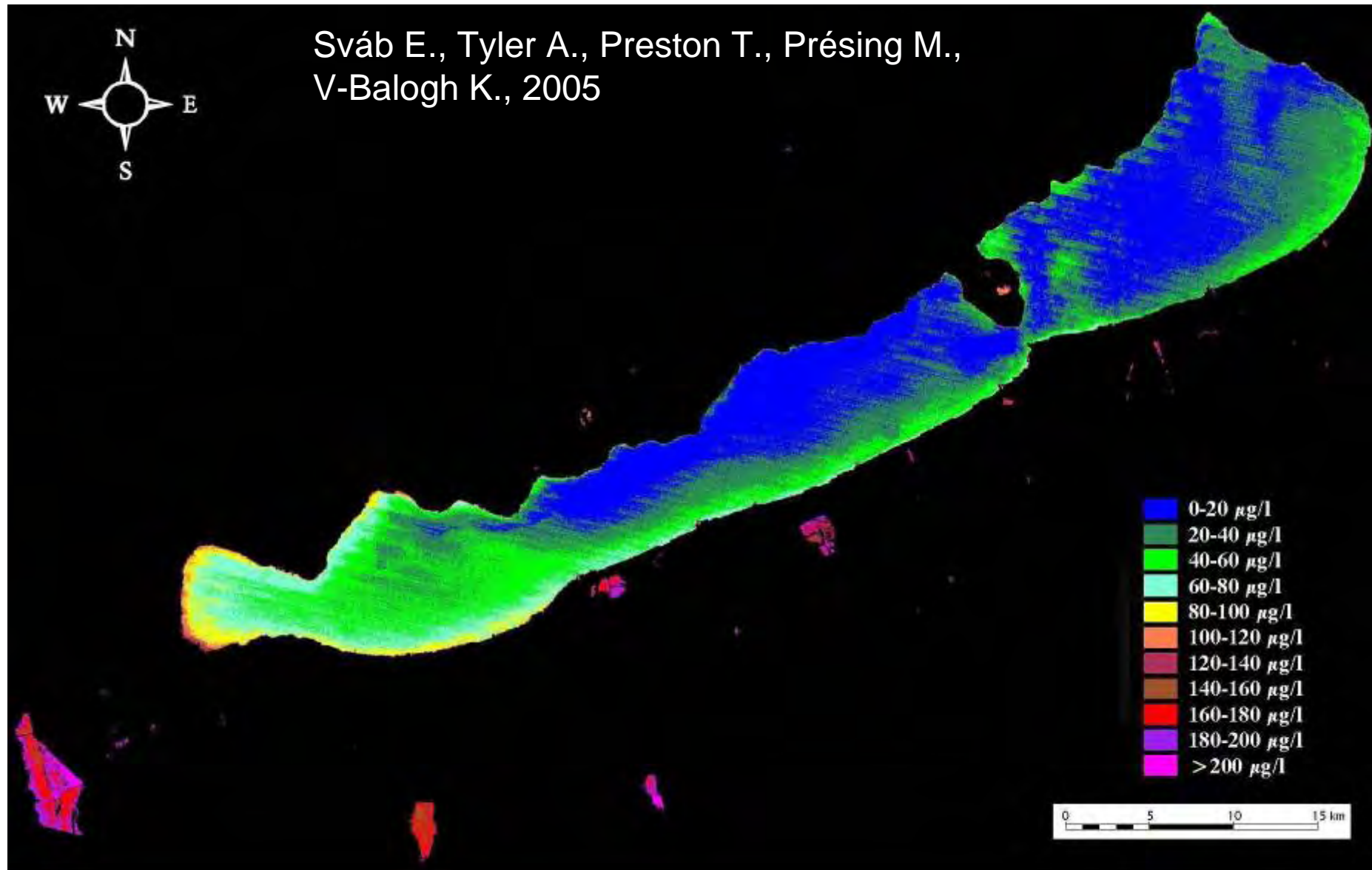
# Study area: Lake Balaton

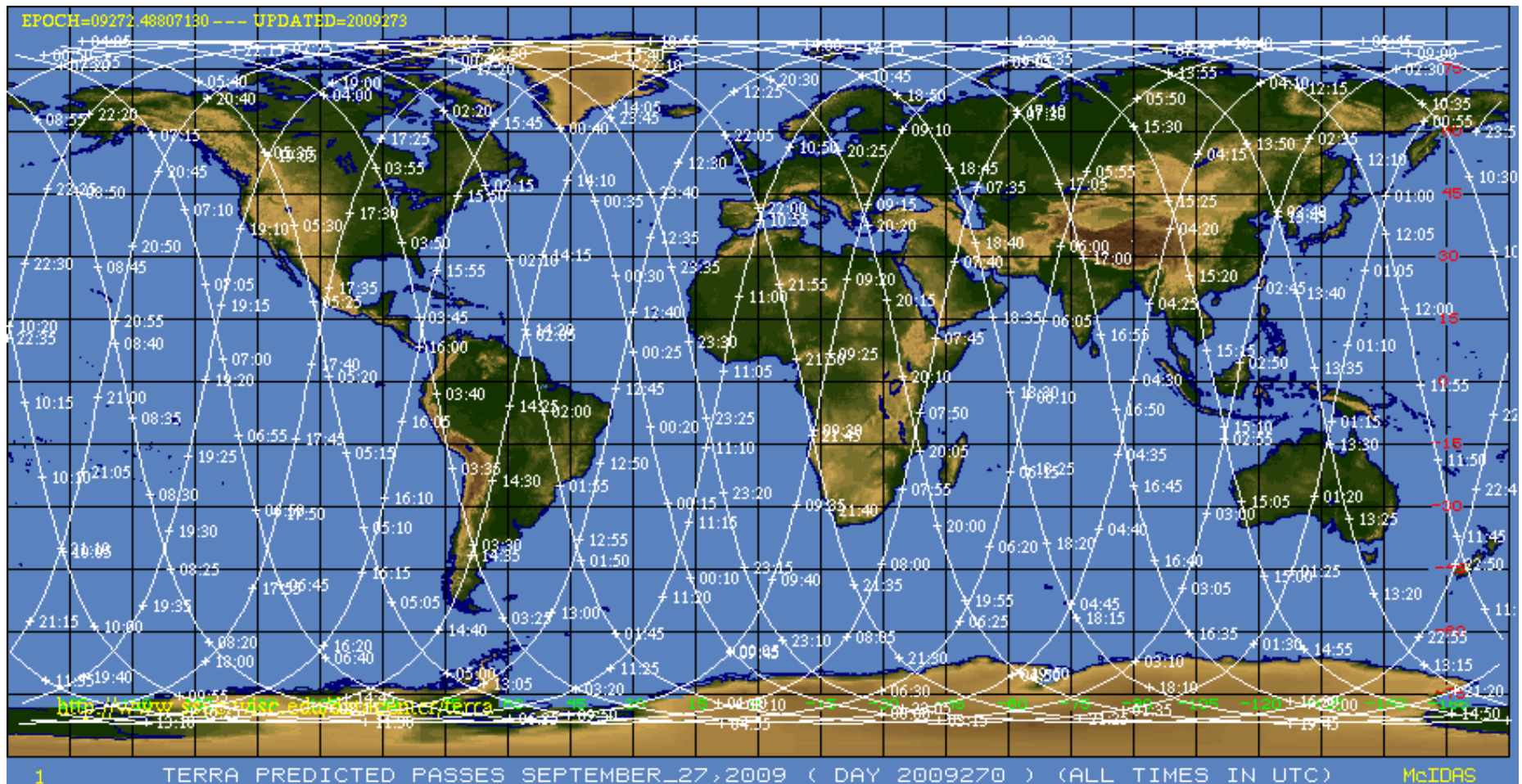
+	-
Large area (597 km <sup>2</sup> ) patterns visible even at low resolution	Shallow water (avg. 3.3 m) and fine sediment causes low transparency
Trophic gradient allows for wide range of measurements	Systems of currents not understood yet
Long history of research, several sources of ground truth available	Elongated shape causes shore infiltration of satellite pixels



# Mapping chlorophyll concentrations on Lake Balaton based on Landsat TM images

Sváb E., Tyler A., Preston T., Présing M.,  
V-Balogh K., 2005





**MODIS provides data regularly: 1-2 overpasses per day, 2 satellites, direct broadcasting, freely available data**

**High signal-to-noise ratio allows for sensitive measurements**

**Has been used in a wide range of ocean applications**

**Algorithms for lakes and estuaries are being developed**



# Chlorophyll and Suspended Sediment ground truth datasets

## UFL-8 UV Fluorescent LIDAR

- Optical measurements based on laser-induced fluorescence and scattering
- Measurement possible from moving boat with frequency up to 2 Hz (~5 meters)
- Data points geo-tagged by GPS → Map
- 3-day measurement campaign in September 2008



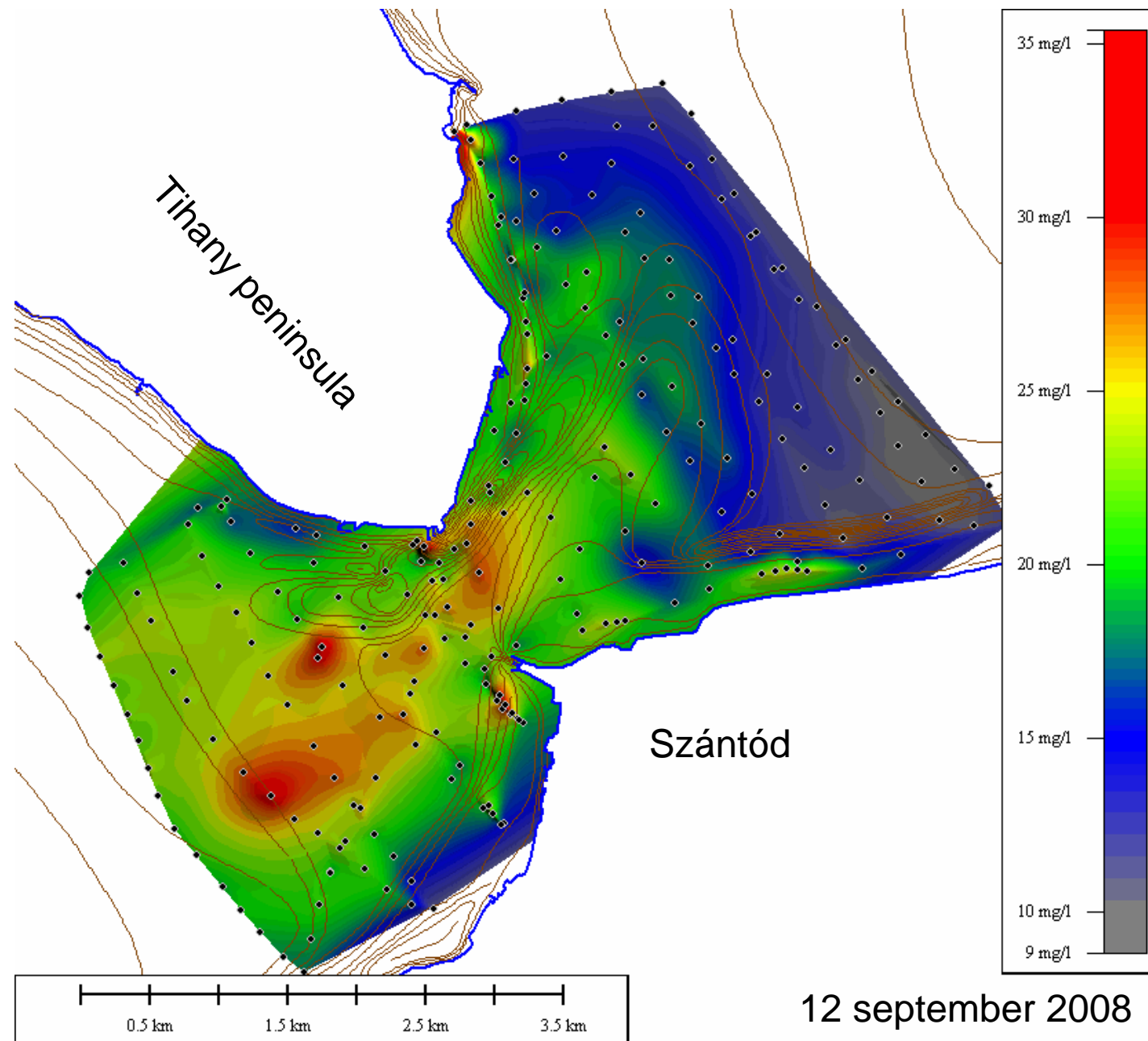
azlinszky@gmail.com

## National Water Authority regular monitoring

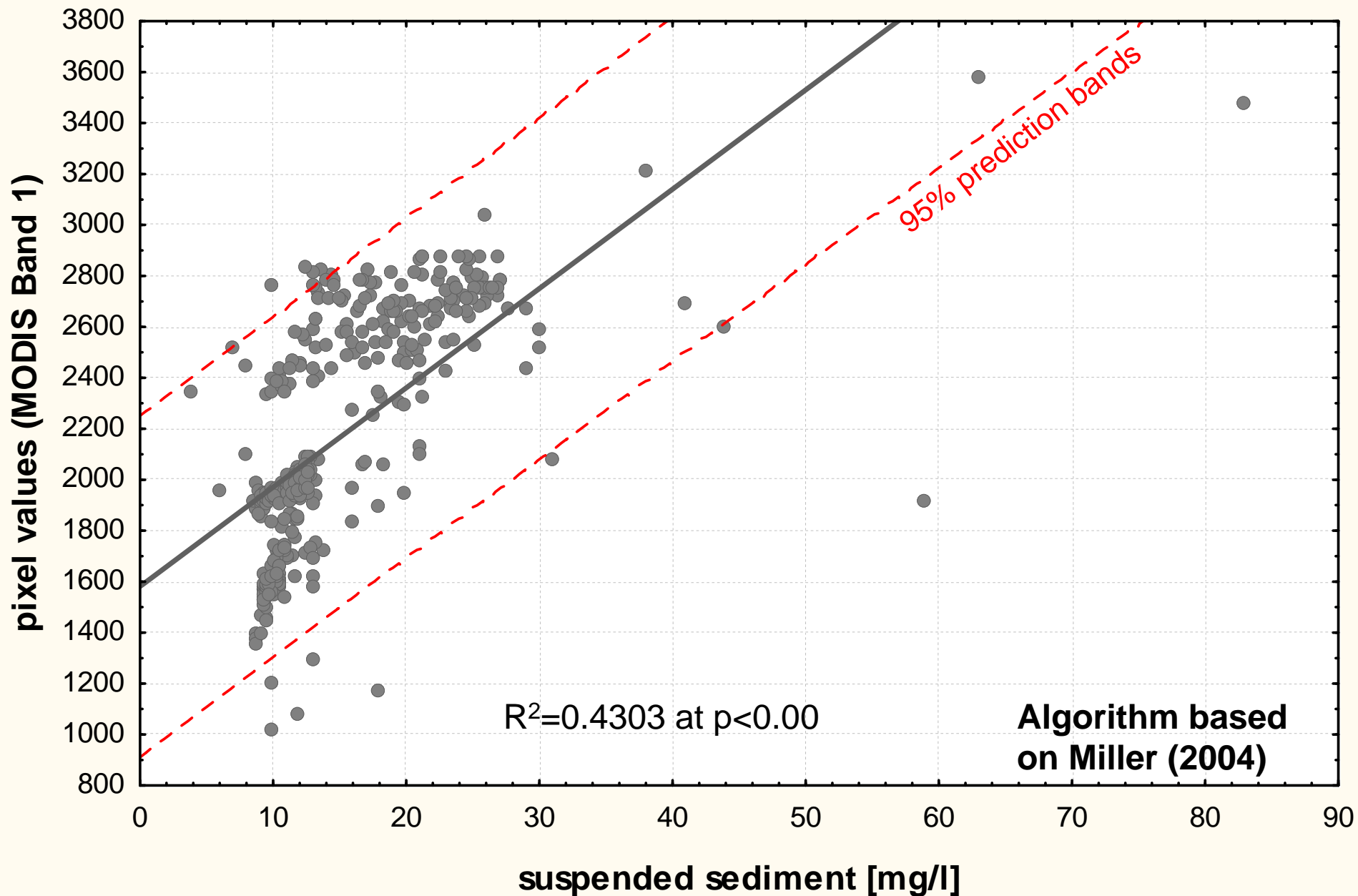
- Analytical measurements based on water samples
- 5 measurement points in main basins of the Lake and the Zala river mouth
- Once per month, twice in summer
- Consistent dataset for several decades



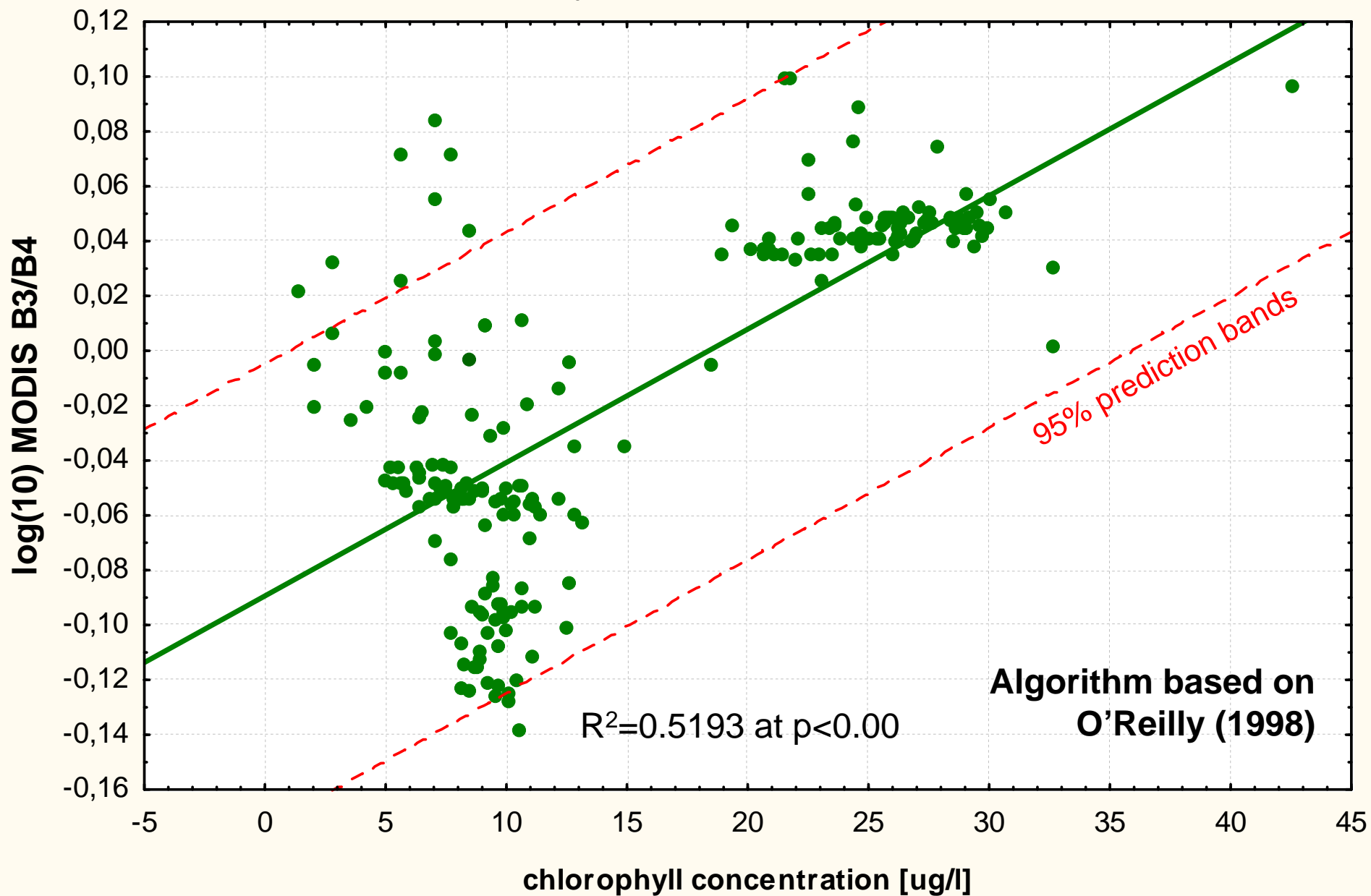
# Suspended sediment map of the Tihany straits based on UFL-8 Lidar



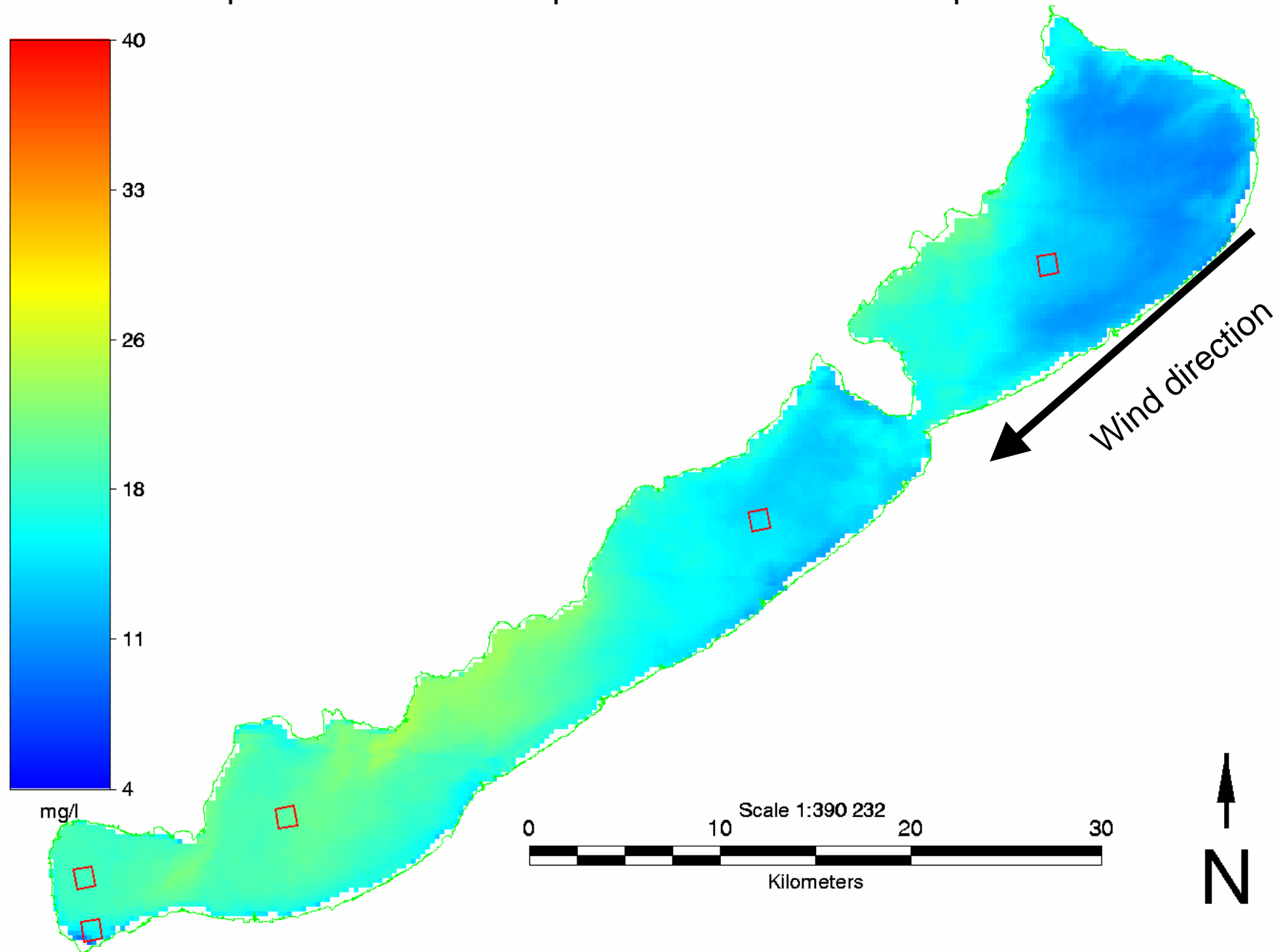
# Calibration dataset for conversion of MODIS pixel values to suspended sediment concentrations



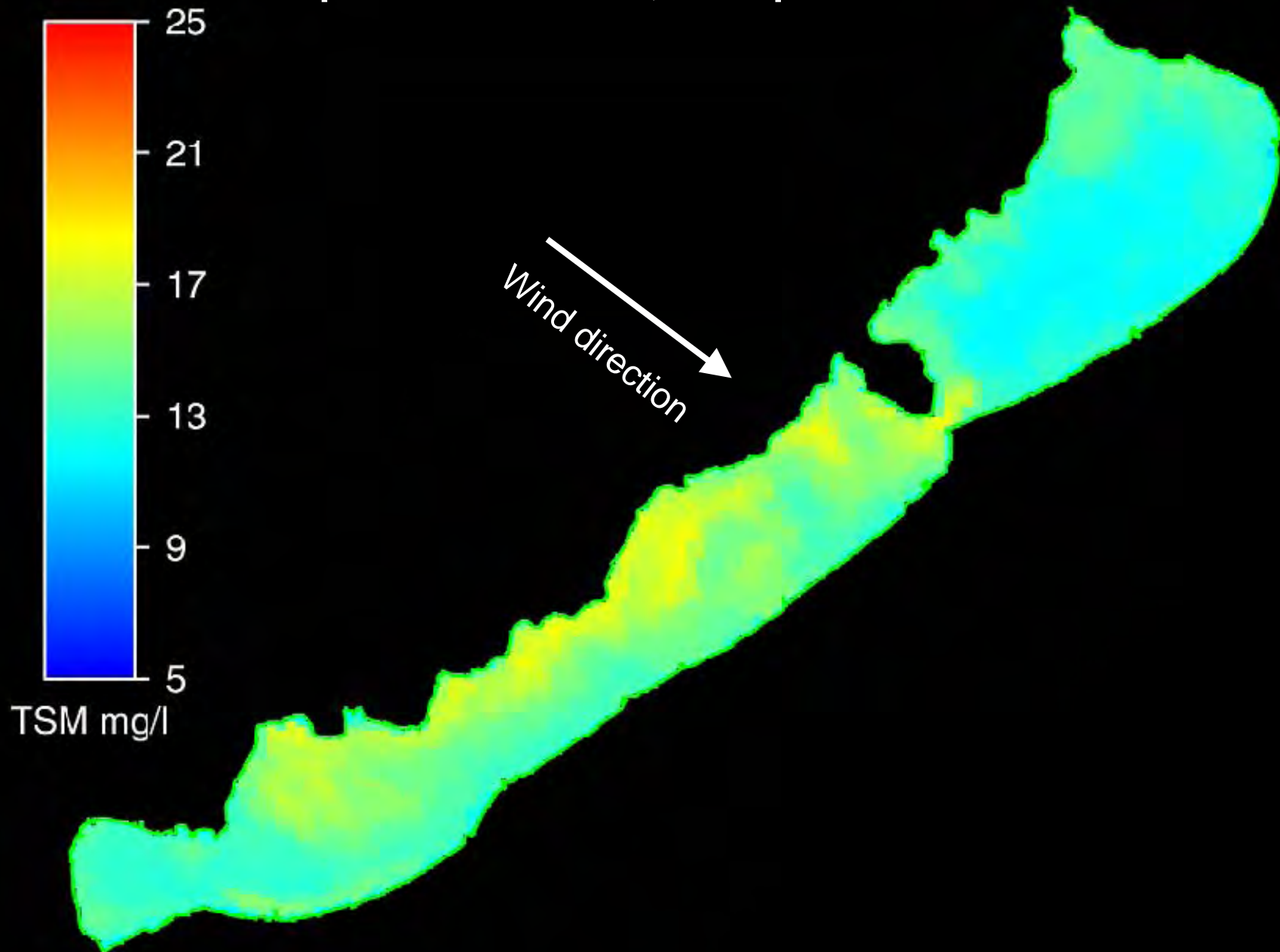
# Calibration dataset for converting MODIS pixel values to chlorophyll-a concentrations



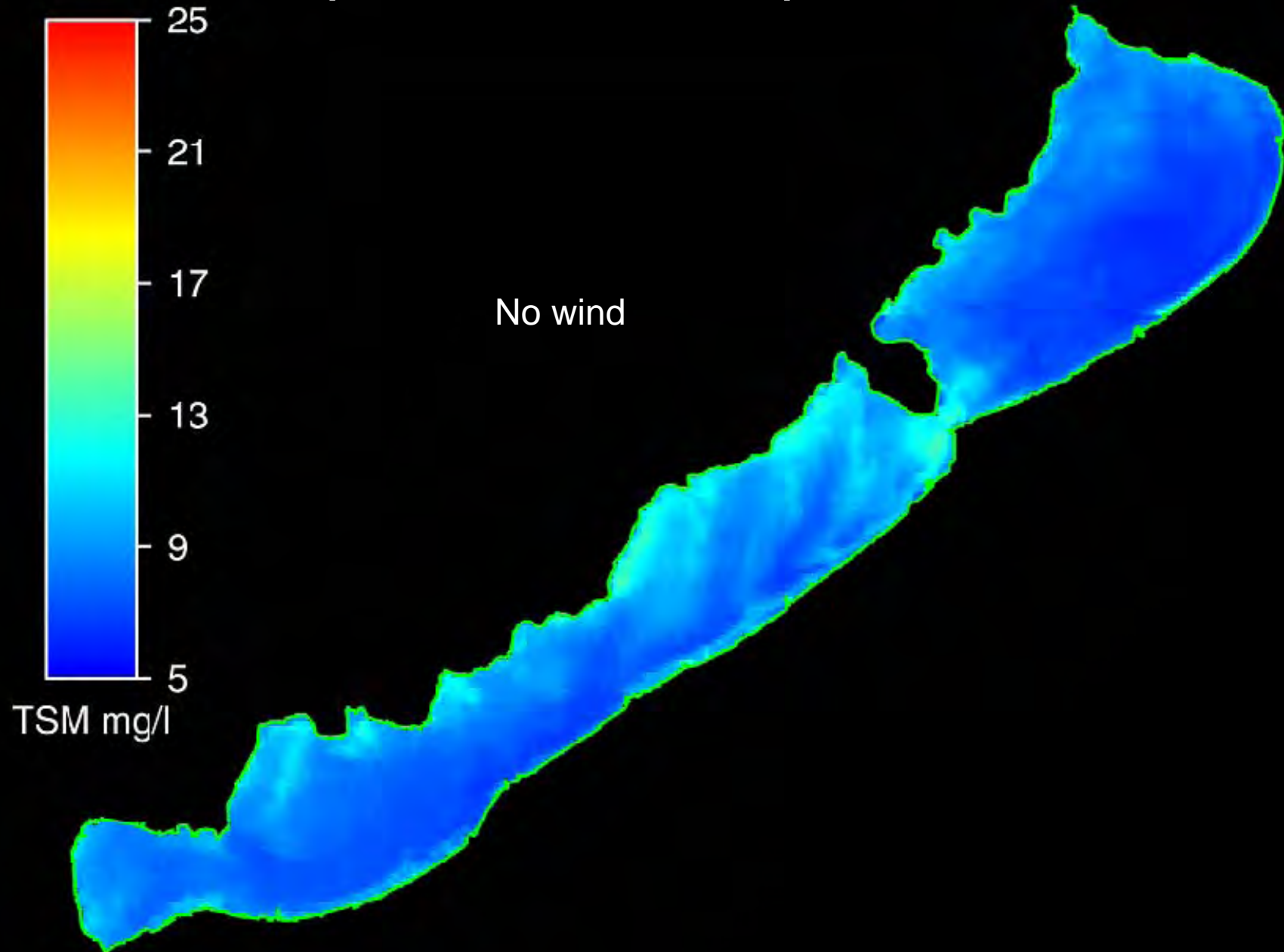
Suspended sediment map of Lake Balaton on 16 April 2007



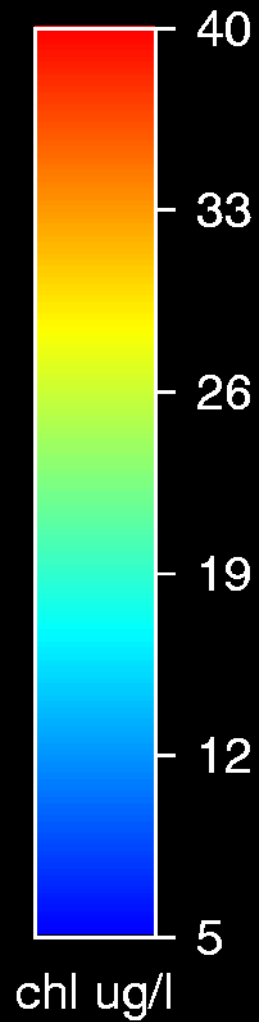
# Suspended sediment, 10 september 2008



# Suspended sediment, 11 september 2008

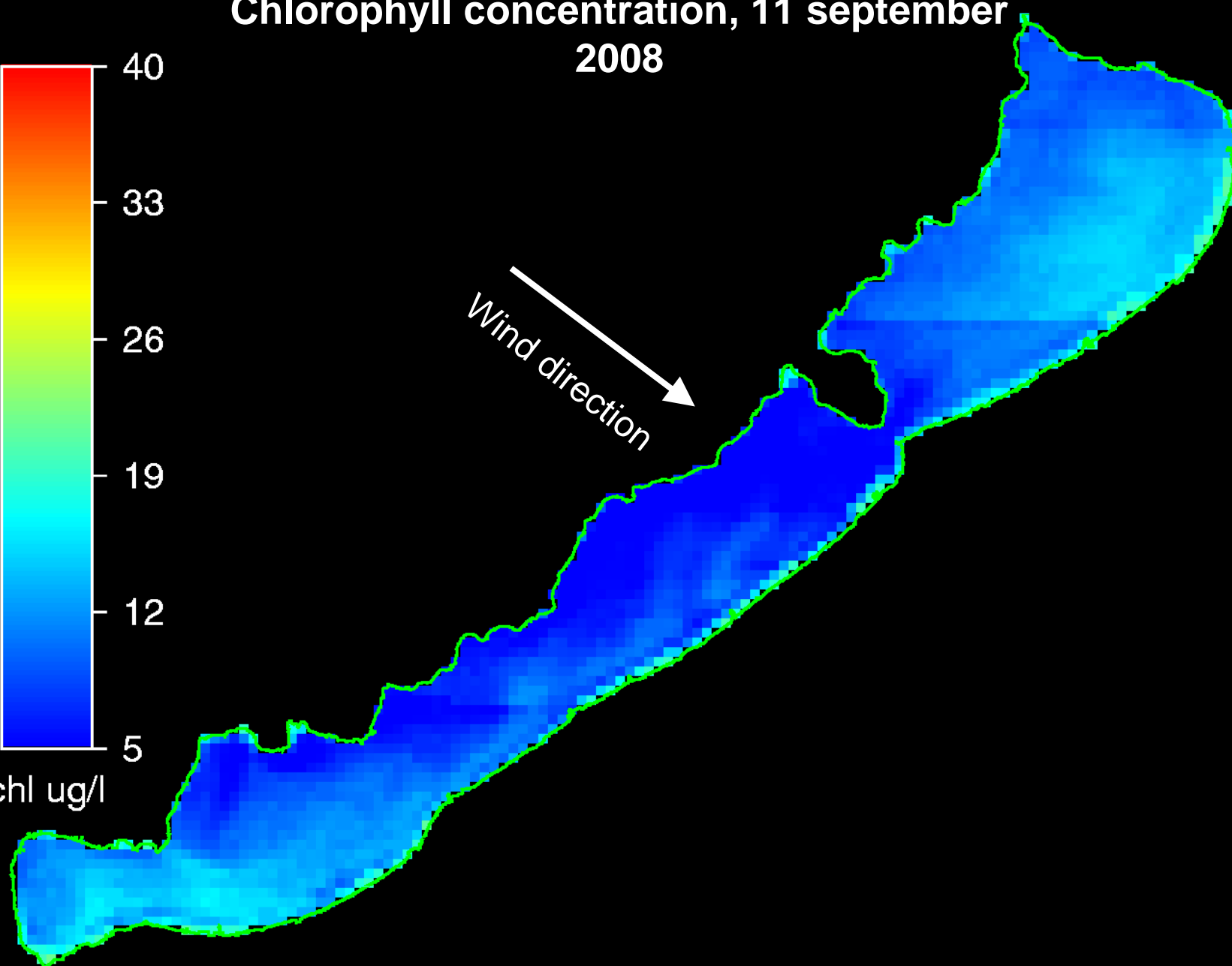


# Chlorophyll concentration, 11 september 2008



Wind direction

A white arrow pointing from the upper-left towards the lower-right, indicating the wind direction over the water body.





## MODIS-based monitoring of water quality parameters of Lake Balaton

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- Regular overpasses and qualitative algorithm allow for investigation of temporal and spatial patterns
- Large amount of ground truth data should provide significant results if correct algorithms can be found

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- No robust atmospheric correction for these bands over highly turbid waters available yet
- Errors too large for quantitative results