

Advancing aquatic science and EO cal/val using optical measurements by an automated profiler

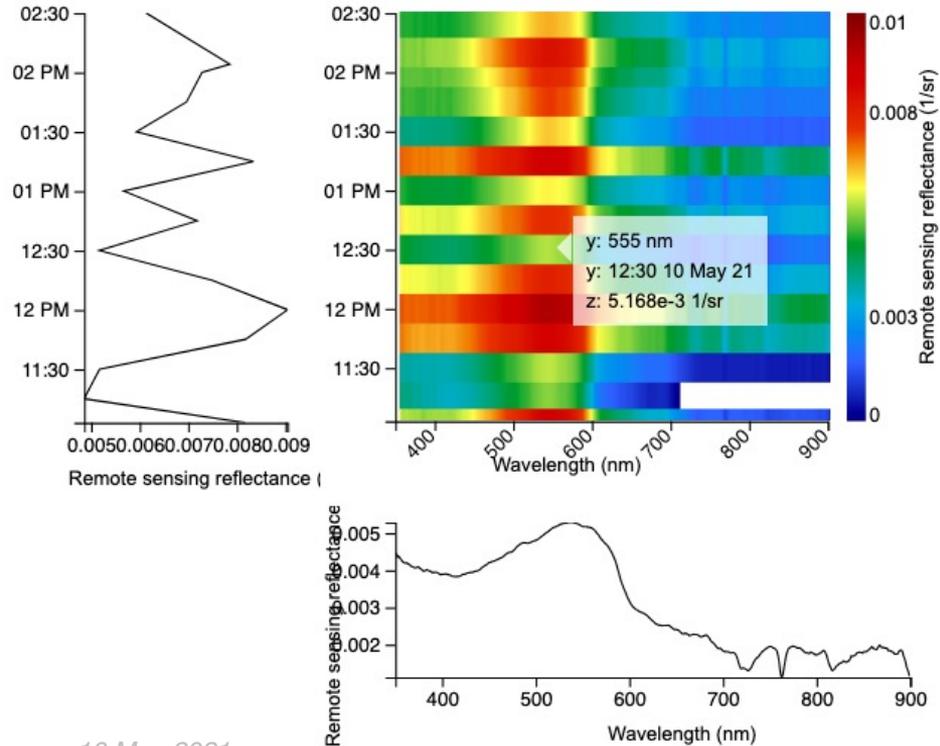
Daniel Odermatt¹, Camille Minaudo², Abolfazl Irani Rahaghi¹, Johny Wüest²

¹Eawag, Dept. Surface Waters – Research and Management, Remote Sensing Group

²Swiss Federal Institute of Technology Lausanne, ENAC, Aquatic Physics Group



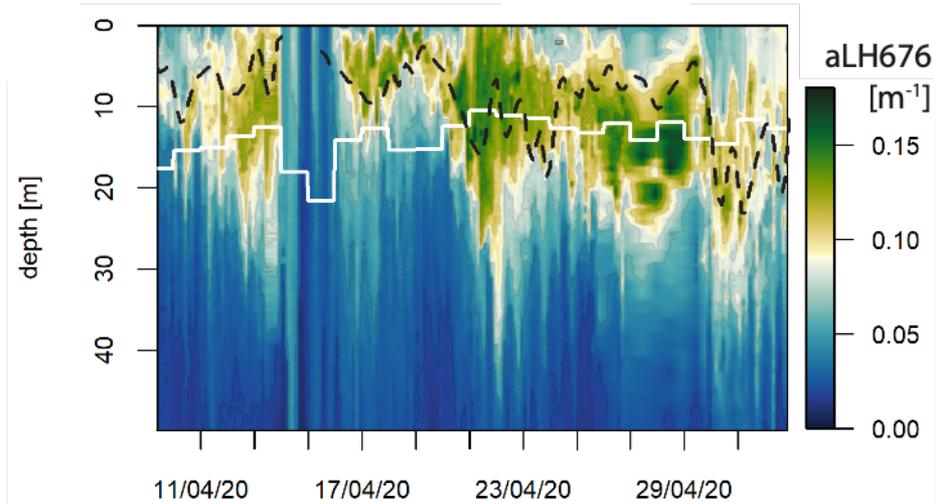
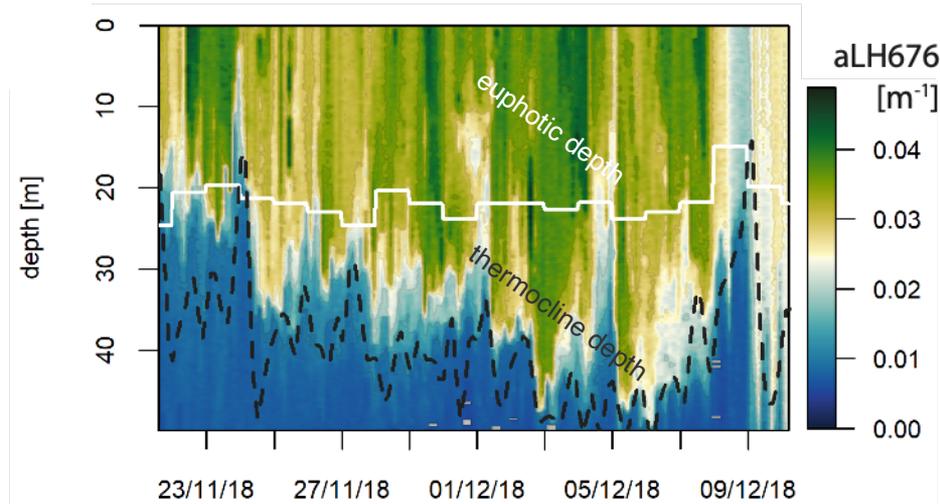
Challenge 1: Reflectance uncertainties



WISPstation measurements, Greifensee, 10 May 2021.

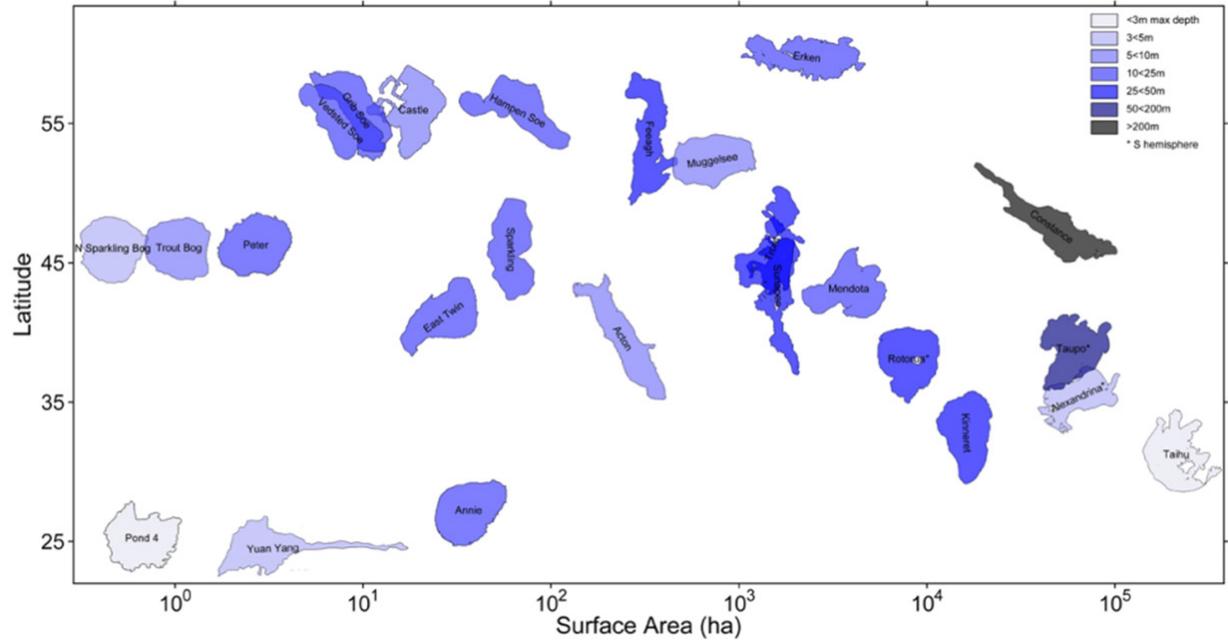
Screenshot from www.datalakes-eawag.ch

Challenge 2: Vertical gradients



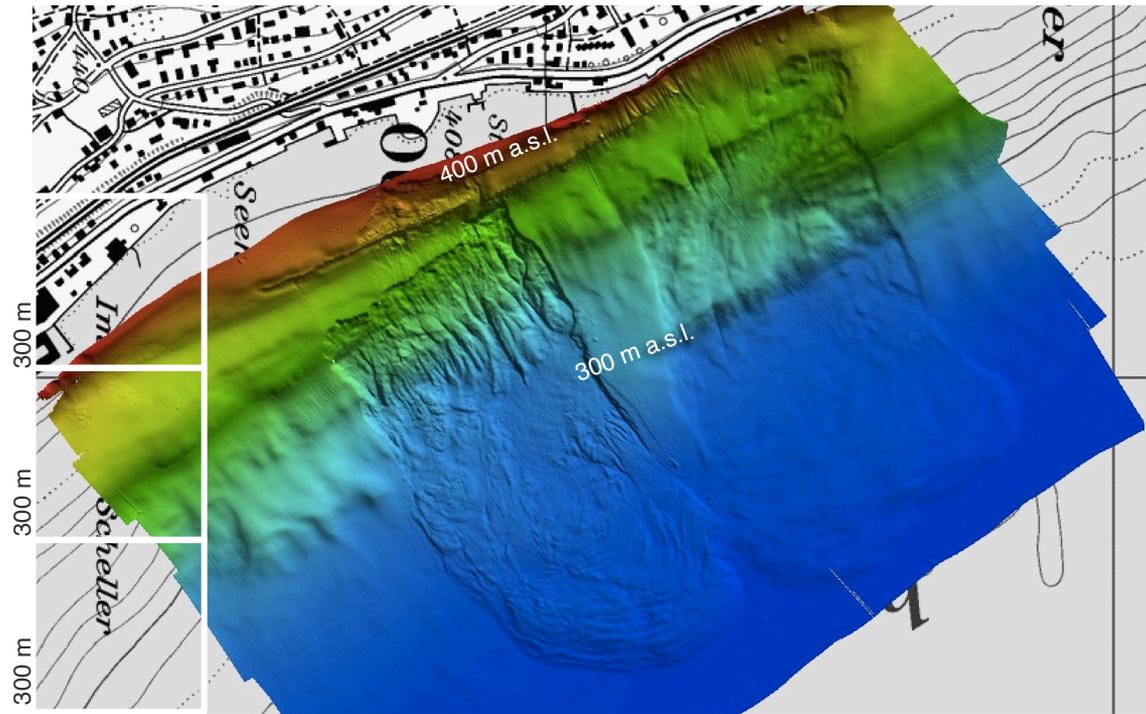
Minaudo, C., Odermatt, D., Bouffard, D., Irani Rahaghi, A., Lavanchy, S., and Wüest, A. (submitted). Diel and seasonal drivers of vertical patterns in inherent water optical properties of a large lake.

Challenge 3: EO cal/val and aquatic science



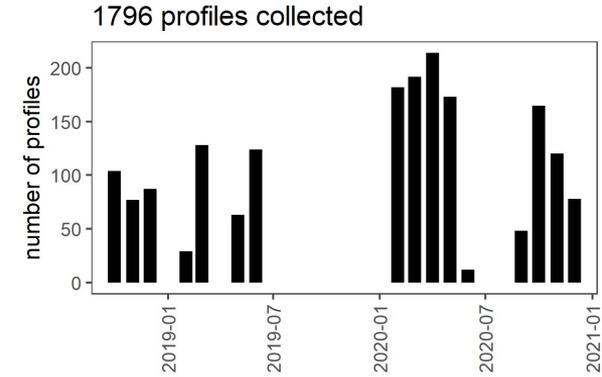
Hamilton, D.P. et al., 2015. A Global Lake Ecological Observatory Network (GLEON) for synthesising high-frequency sensor data for validation of deterministic ecological models. *Inland Waters* 5, 49–56. <https://doi.org/10.5268/IW-5.1.566>

Challenge 4: Lake morphology



Multibeam echosounding bathymetry in Lake Zurich at Oberrieden.
From 'Underwater Landscapes', F. Anselmetti et al., Swiss Geoscience Meeting 2013.

LéXPLORE and Thetis profiler in Lake Geneva



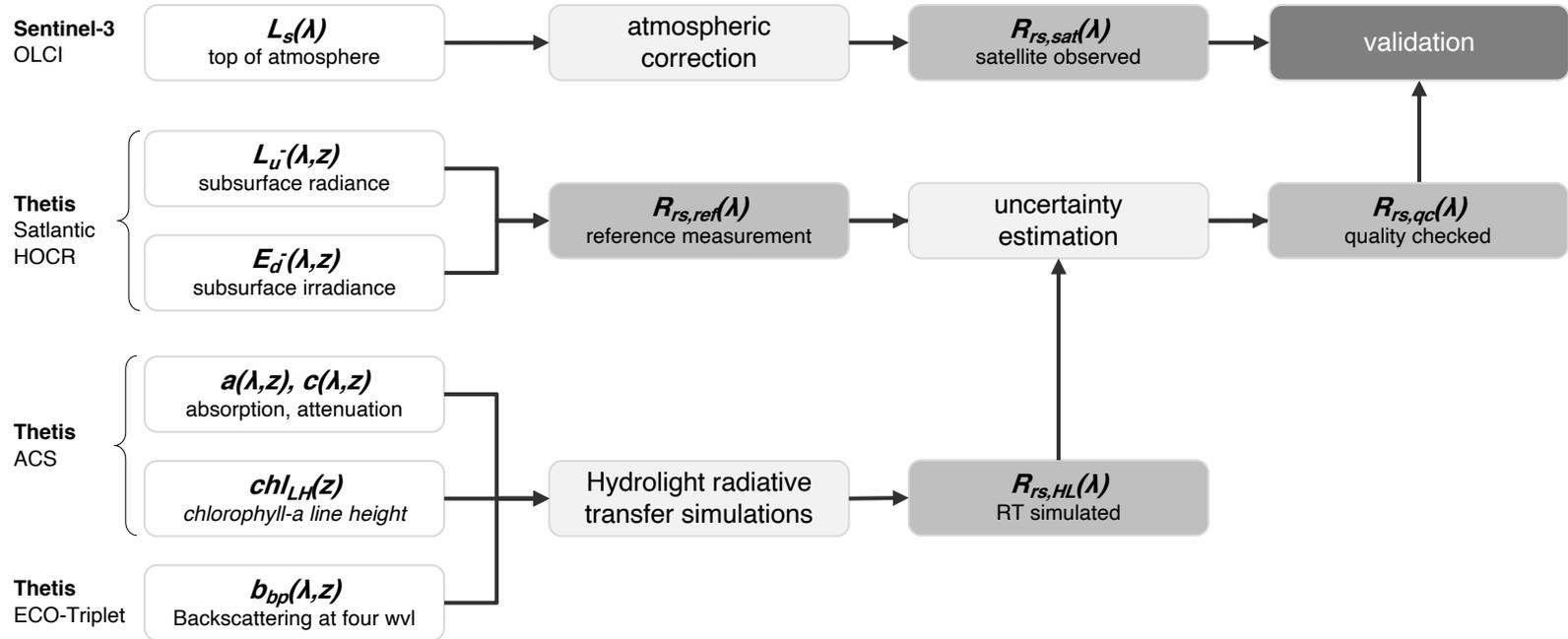
Minaudo, C., Odermatt, D., Bouffard, D., Irani Rahaghi, A., Lavanchy, S., and Wüest, A. (submitted). The imprint of primary production in high-frequency profiles of lake optical properties.

Custom Thetis sensor configuration

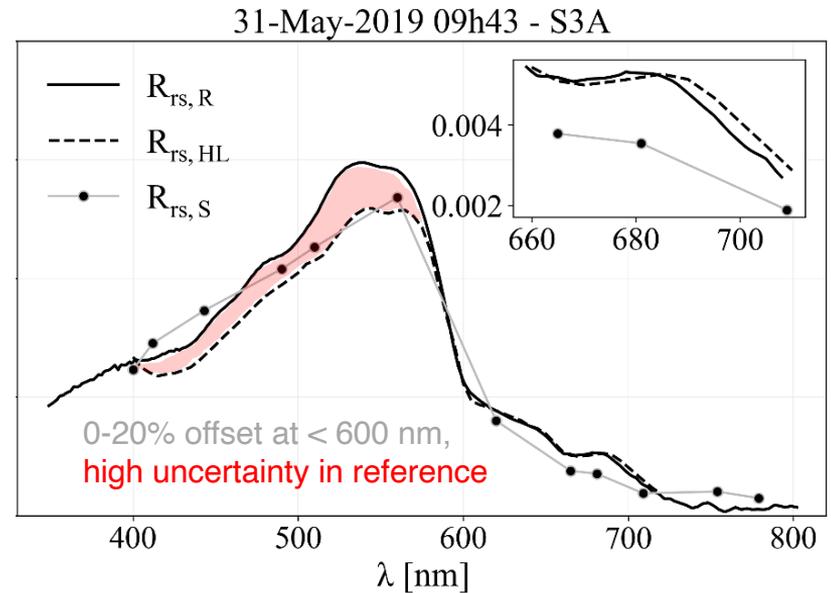
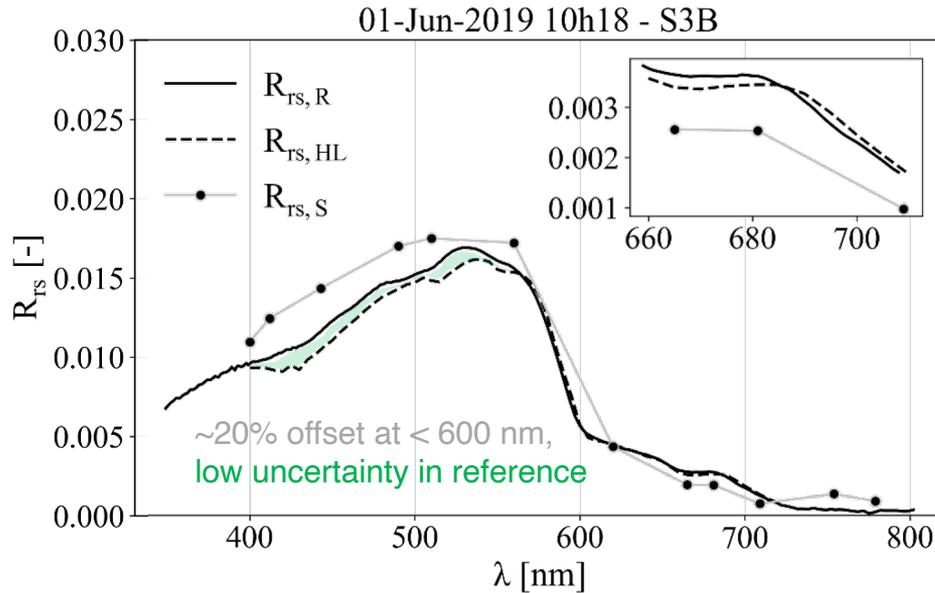
Instrument	Variables	Δz [cm]
<i>Sea-Bird CTD SBE 49</i>	Water temperature, conductivity, pressure ⁽¹⁾	0.55
<i>Sea-Bird SBE 63</i>	Dissolved oxygen concentration	10.6
<i>WetLabs AC-S</i>	Hyperspectral absorption, attenuation 81 channels from 400 to 730 nm	2.2
<i>Sea-Bird ECO Triplet BB3W</i>	Backscattering at 440, 532, 630	10
<i>Sea-Bird ECO Triplet BBFL2w</i>	Backscattering at 700 nm Chlorophyll-a fluorescence (EX/EM: 470/695 nm) CDOM fluorescence (EX/EM: 370/460 nm)	10
<i>Satlantic HOCR ICSW</i>	Hyperspectral downwelling irradiance, 180 channels from 300 to 1200 nm	10
<i>Satlantic HOCR R08W</i>	Hyperspectral upwelling radiance, 180 channels from 300 to 1200 nm	10
<i>Sea-Bird ECO PARs</i>	Photosynthetically active radiation (400 to 700 nm)	10

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Thetis optical closure logic



Sentinel-3 reflectance validation uncertainties



Response to challenges

Rrs uncertainties

Optical closure simulations
(and E_d^+ upgrade)

Vertical gradients

Autonomous IOP measurements

Cal/val and aquatic science

Parameter set serves both tasks
and inspires collaboration

Lake morphology

Parking at large depth prevents biofouling
but is harder to maintain than above-
surface radiometers

Outlook

LéXPLORE concession is secured until 2027

Thetis research funding until end of year

Cal/val measurement protocols are in preparation

Collaboration with other Thetis operators is a high priority

Efficient up-scaling of technology must be investigated

Thank you for your attention please visit www.datalakes-eawag.ch

