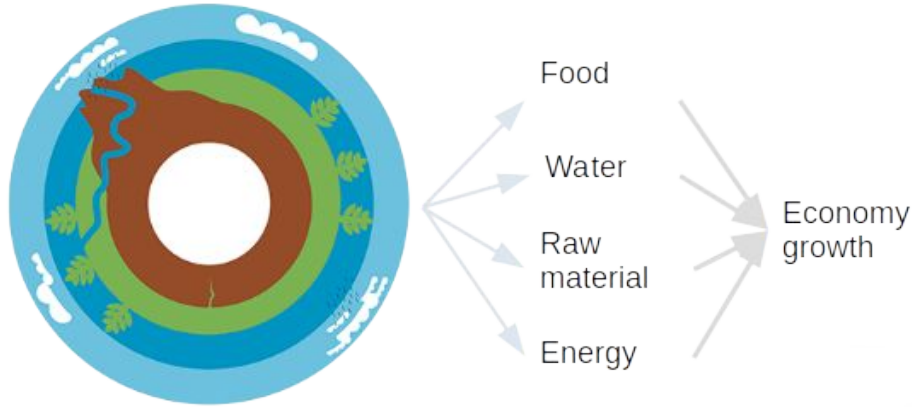# SIMILE: An integrated monitoring system to understand, protect and manage sub-alpine lakes and their ecosystem

Daniele Strigaro, *Massimiliano Cannata, Fabio Lepori, Camilla Capelli, Michela Rogora, and Maria Brovelli*

Introduction

Timeline

Food
Water
Raw material
Energy

Economy growth

- More complex transformations
- More resources requested
- More natural risks
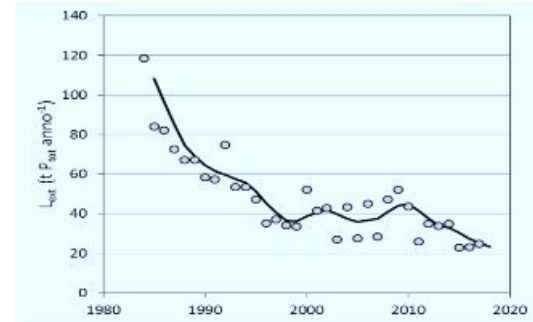- More resources exploitation
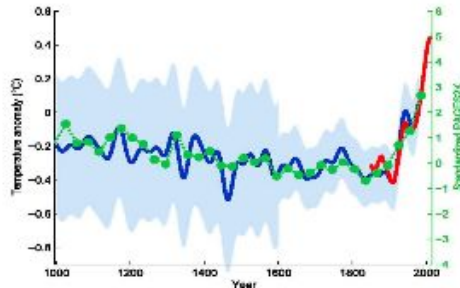
Introduction

Nutrient loads

Mitigation actions

Climate change

These changes affect and alter the known dynamic.
Global warming affects the water temperature and consequently the nutrient concentration in water bodies [1]

The need of monitoring

[1] Lepori, F.; Roberts, J.J.; Schmidt, T.S. A paradox of warming in a deep peri-Alpine lake (Lake Lugano, Switzerland and Italy). Hydrobiologia 2018, 824, 215–228.

The SIMILE project

System for the Integrated Monitoring of Insubric Lakes and their Ecosystems

An innovative project to improve the analysis of lake water quality, integrating data from sensors, satellite images and information provided by the public.
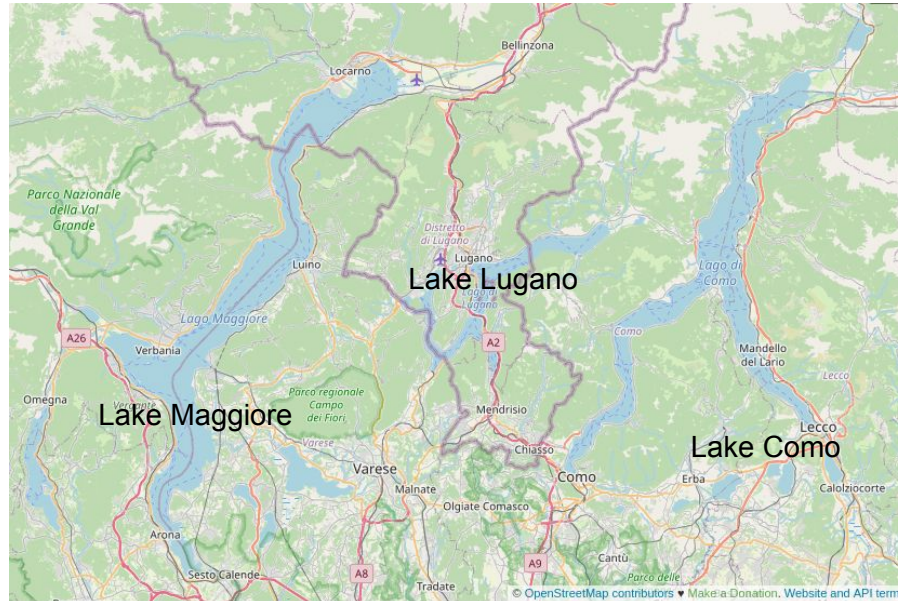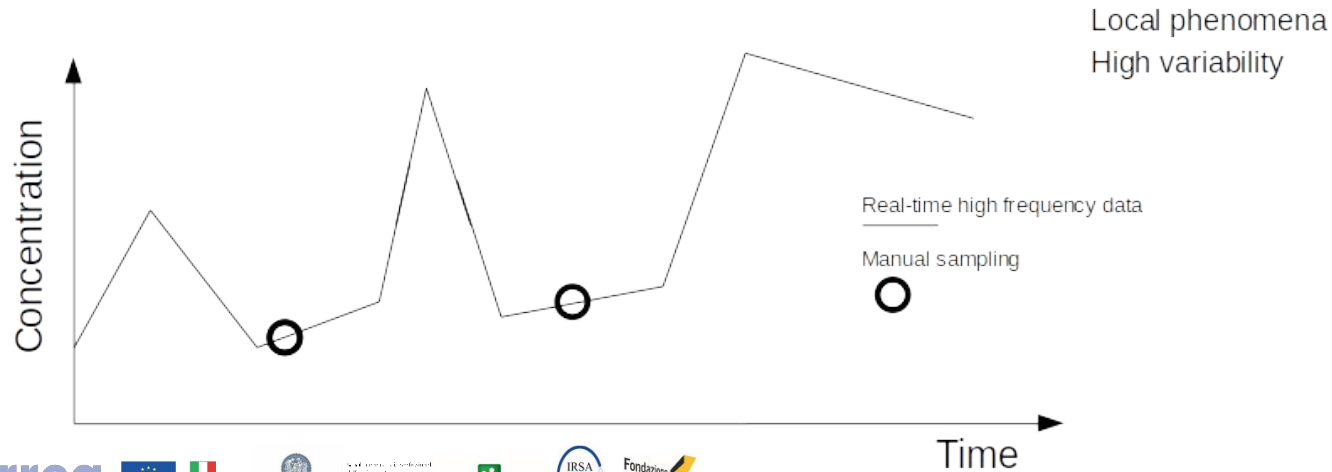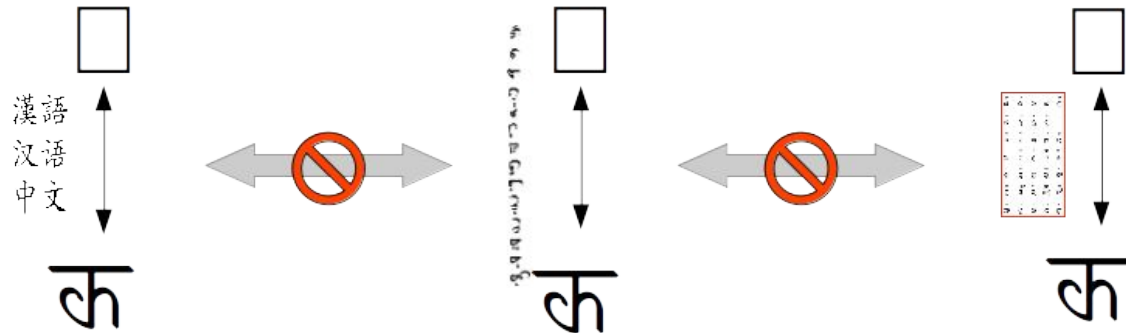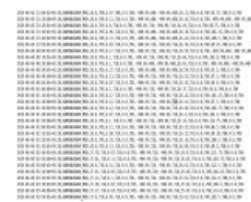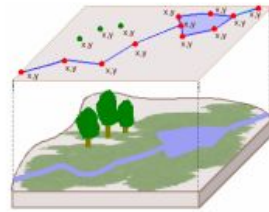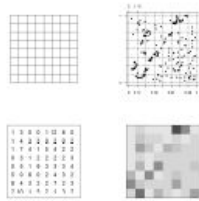
The problem - 1

The analysis of unknown effects is required to understand how ecosystems react to the individuated new pressures

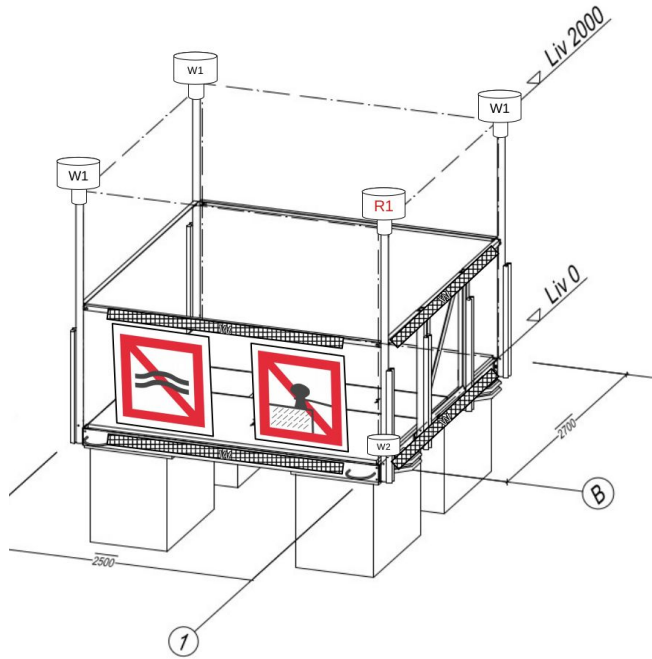Traditional methods are a fundamental source of information but with some limitations:

- Temporal resolution
- Spatial resolution
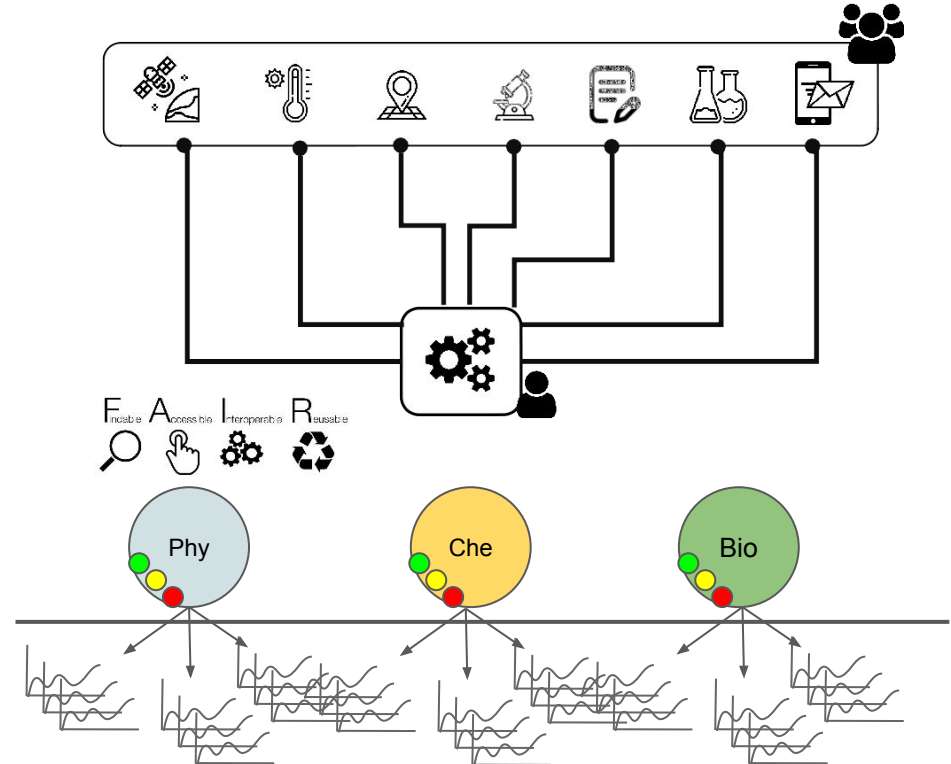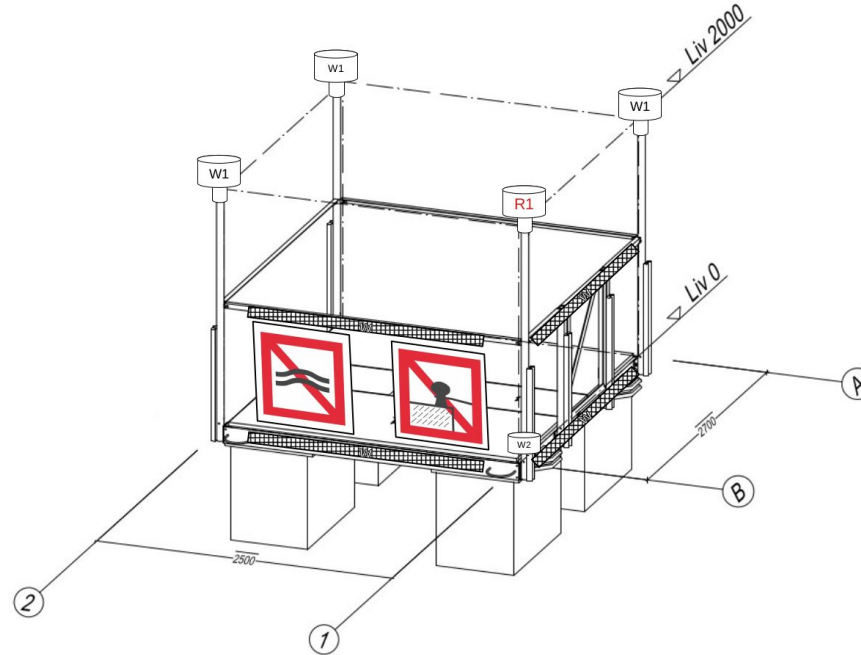- High cost of instruments and technical personnel

Local phenomena
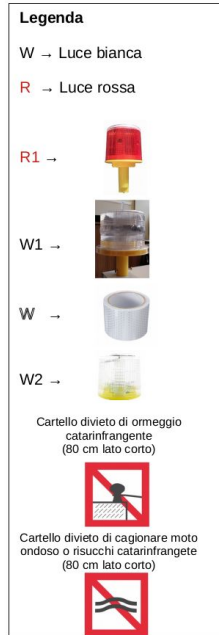High variability

Real-time high frequency data

Manual sampling

Concentration

Time

The problem - 2

Two working tasks

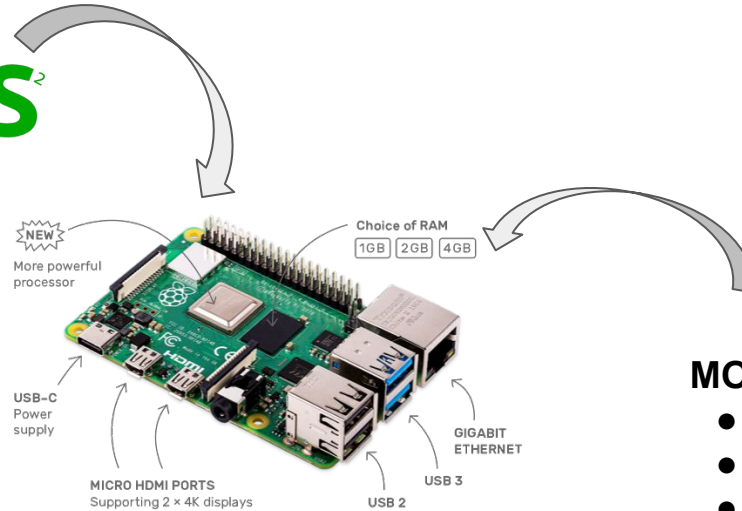| Monitoring system	Business Intelligence Interface

Monitoring system - Raft placement

Monitoring system - Edge computing

ist**SOS**²
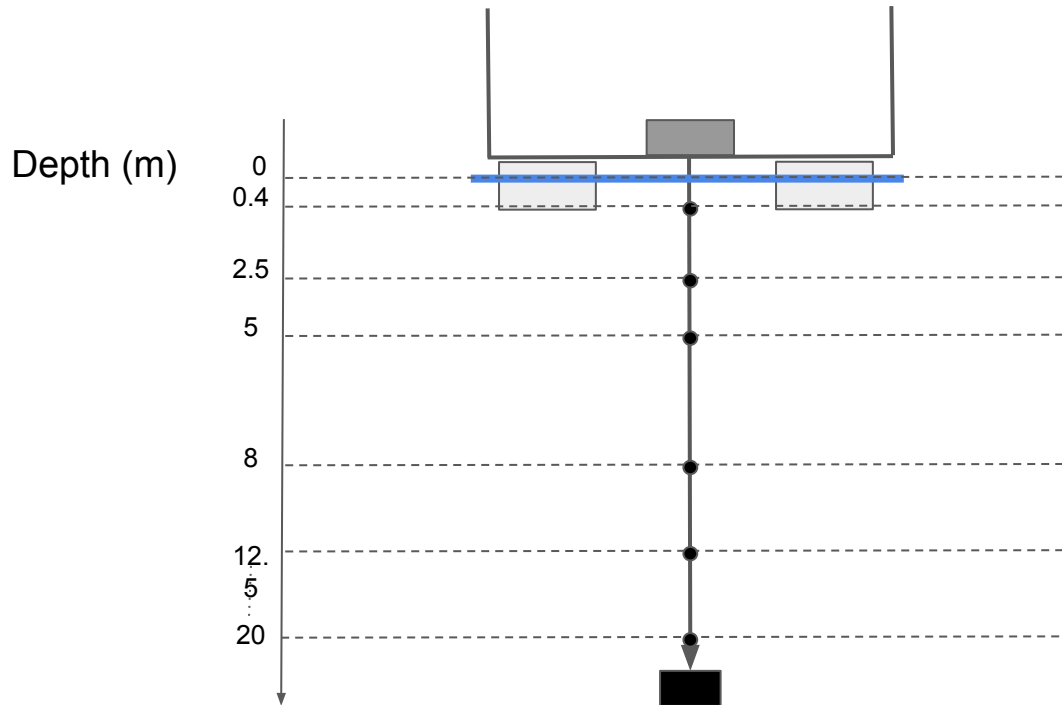

NB-IoT o **LTE-CATM1**

MODBUS Sensors
- Temperature
- Dissolved Oxygen
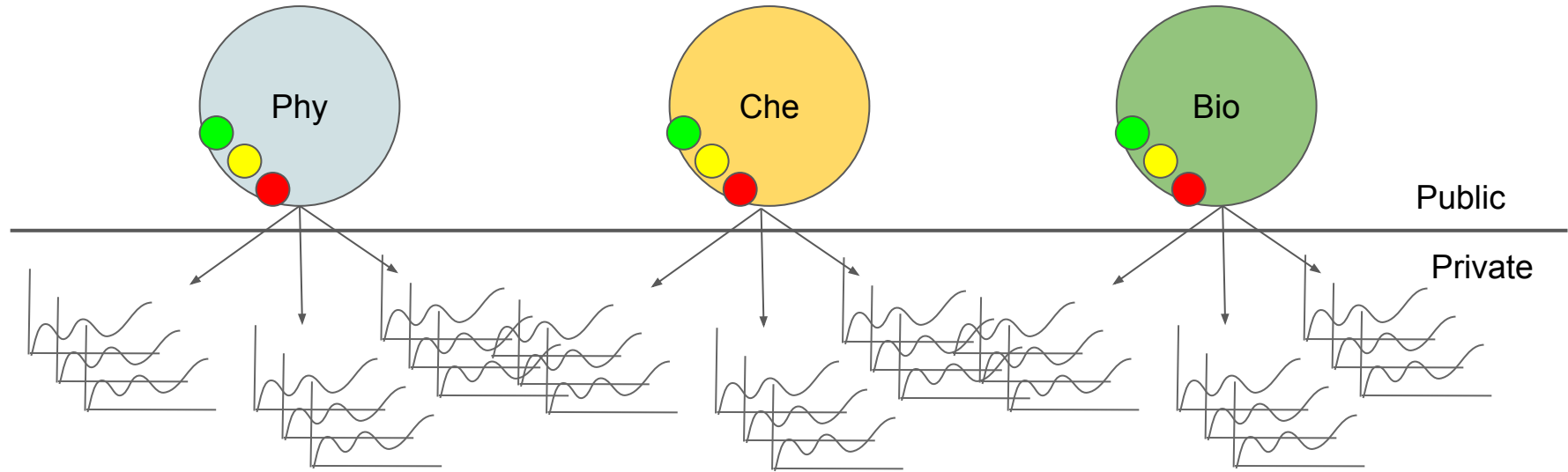- Chlorophyll
- Weather station

Monitoring system

- 6 sensors to measure Dissolved Oxygen
- 1 weather station
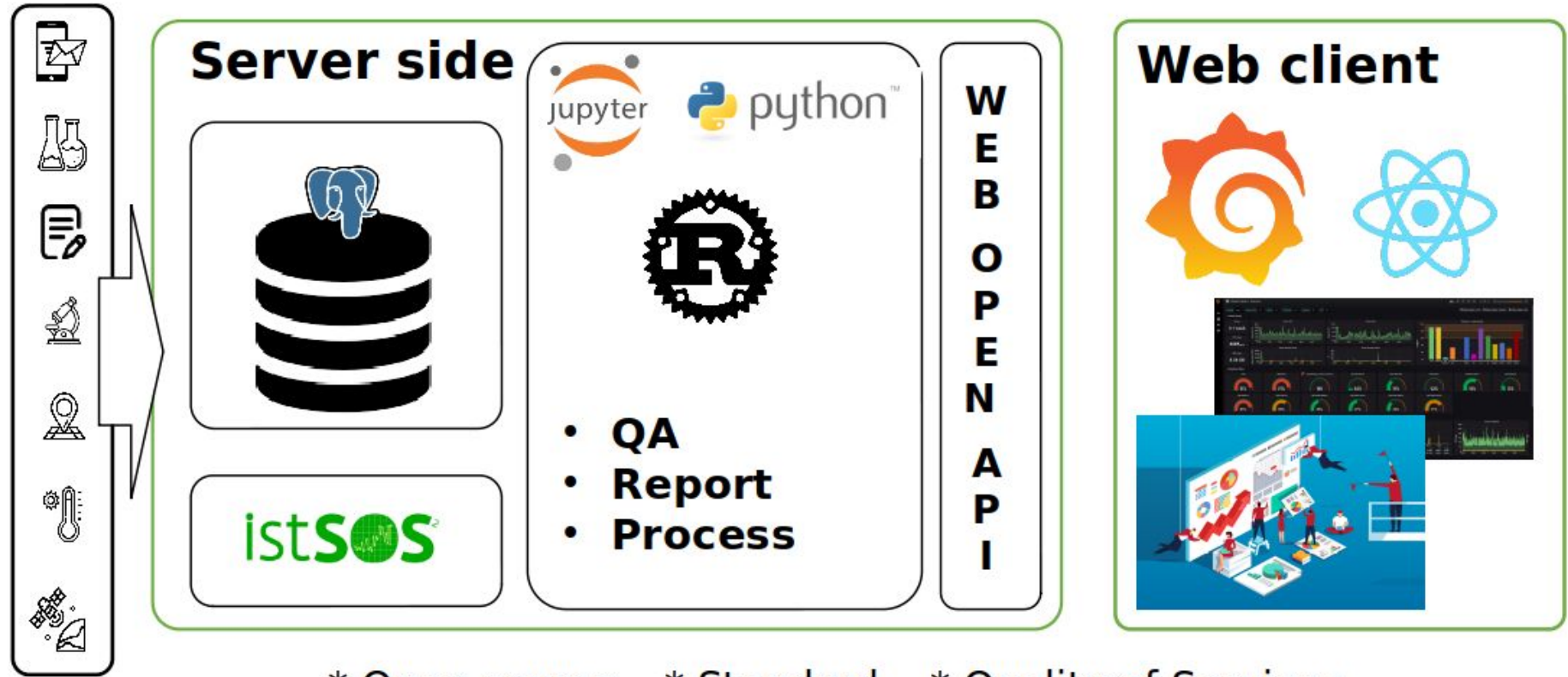- 2 sensors to measure Chlorophyll-a and Cyano

Depth (m)

0
0.4
2.5
5
8
12.5
20

Business Intelligence Interface

Three indexes to indicate the health state of the lakes

Server Architecture

Server side

jupyter   python™

R

- QA
- Report
- Process

istSOS²

WEB OPEN API

Web client

* Open source   * Standard   * Quality of Services

Thank you