GLOBE
Schweiz Suisse Svizzera Switzerland

Q&A on Hydrology Tools

The GLOBE Program

GLOBE tools & equipment: Hydrology

Which parameters are measured with which method?

- Temperature: alcohol-filled thermometer (or probe)
- Transparency: >120cm tube with Secchi disk or Secchi disk on a rope
- Alkalinity: test kit
- pH: pH strips or probe
- Conductivity: probe
- Oxygen (O_2): test kit or probe
- Nitrate (NO_3^-): test kit (or probe)

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Which parameters are measured with which method?

Temperature

pH

Alkalinity

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Which parameters are measured with which method?

Transparency

Conductivity

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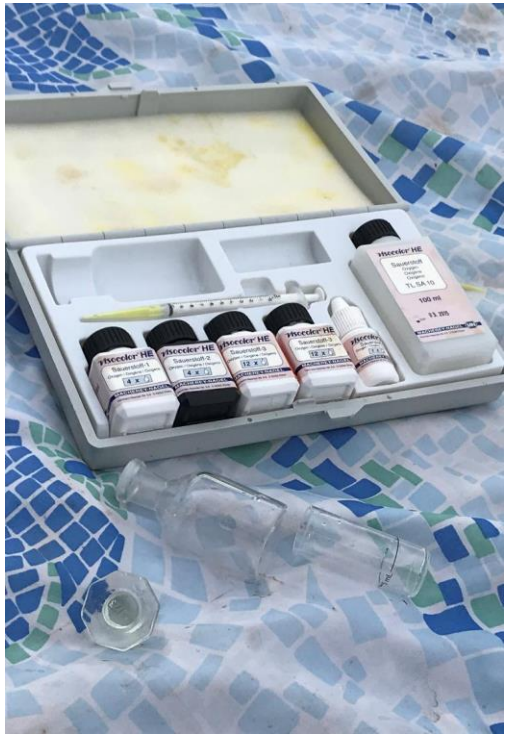
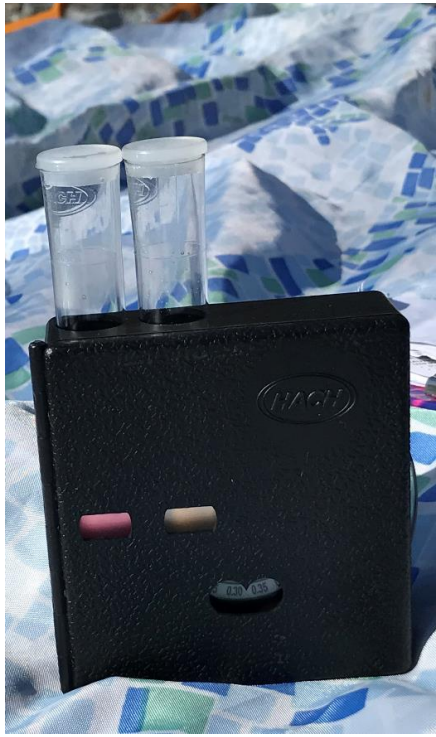
Which parameters are measured with which method?

Oxygen



Nitrate



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Instructions for oxygen measurement with Vernier Optical DO Probe

Ready-to-use optical probe with very delicate membrane at the tip and Go Direct for data transmission

Optical probe with storage container: Insert probe into lid and carefully screw on container.

Charging cable with USB for Go Direct: Charge for 2 hours before measurements.

Before the measurement:

Download the "Vernier Graphical Analysis" app (**note not version GW**) from a store to a smartphone.

1. Make sure the "Vernier Go Direct" is charged (2 hours).
2. Turn on the probe (flashes red).

Measurement instructions:

Turn on Bluetooth on smartphone, then launch "Vernier Graphical Analysis" app.

1. Click on "Sensor measurement" > a proximity coupling is in progress > GDX-ODO 01023A7 "Connect" click and "Done". LED of the probe flashes green!
2. Carefully unscrew protective cap (incl. cover).
3. Hold the tip of the probe into the water.
4. Start measurement in the app: click "Acquire".
5. Measure for at least 60 seconds until line in the graph remains constant, then click "Stop".
6. Read measured value in mg/l (click graphic symbol > statistics).
7. Repeat measurement at 2 different locations.
8. Calculate the mean value of the 3 measurements, write it down and transfer it later to the WebApp of GLOBE.
9. Rinse tip with distilled water and screw on storage container.

Important to know:

- The tip of the probe must NEVER touch the ground, otherwise the membrane will be broken.
- Readings are automatically temperature and pressure compensated.

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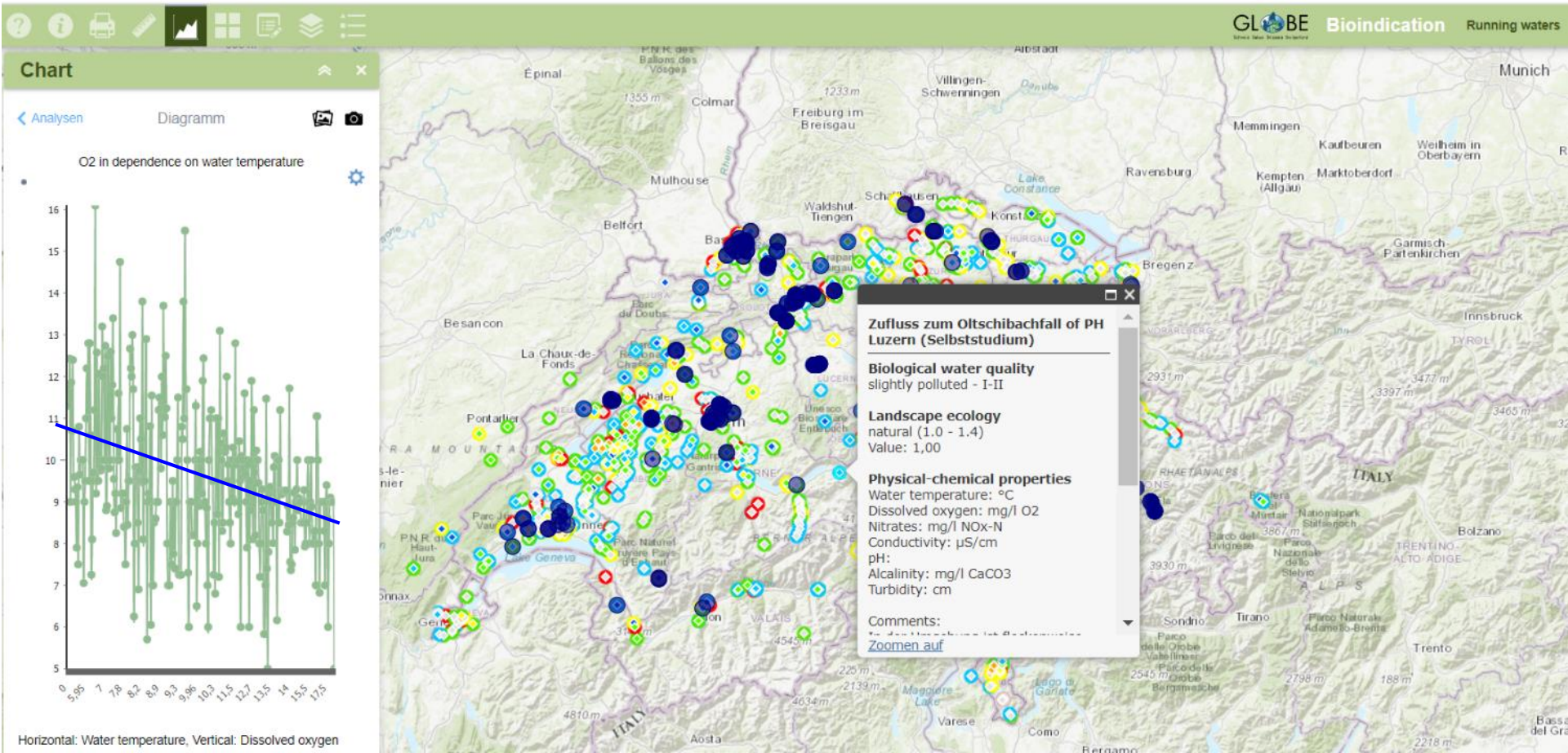
- Enter hydrology data via data entry “Hydrosphere”
- Option for GLOBE Switzerland: Enter data in ArcGis online



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What do parameters say and how do they interact?

Temperature: is important for aquatic life (biomass, diversity), temperature doesn't say anything about water quality

- Influences **pH**: in pure water pH is 7.0 at 25 °C, pH is 7.47 at 0 °C, and pH is 6.63 at 50 °C
- Influences **conductivity**: number of mobile ions and mobility of charge carriers increases with increasing temperature = conductivity rises
- Influences concentration of **O_2**: the higher the temperature, the less dissolved O_2 in water

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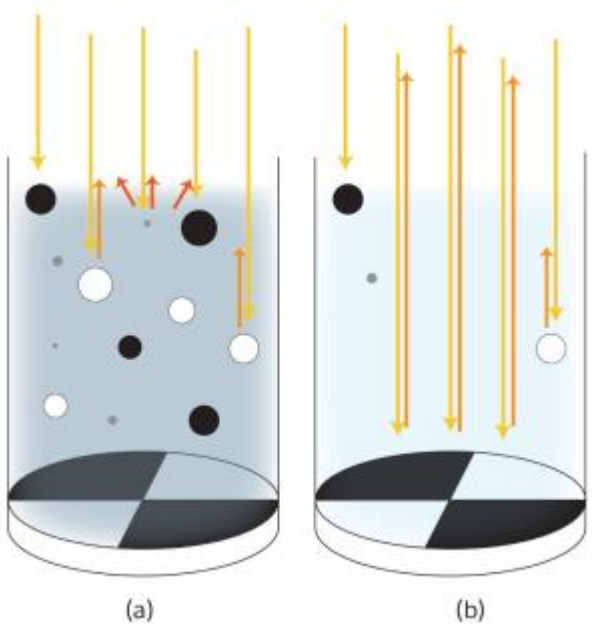
What do parameters say and how do they interact?

Transparency: influences aquatic plants (biomass, O_2 production), be careful with judgement of water quality

- Might influence **pH** and indirectly **O_2**(via plant growth)



(a) Turbid water (low transparency) with many particles; the light does not reach the Secchi disc; the Secchi disc is no longer visible from above. (b) Clear water (high transparency) with only a few particles; large parts of the light penetrate to the Secchi disc and are are reflected from there; the Secchi disk is visible. © GLOBE Switzerland

- Sun light
- Dispersed light
- Reflected light
- White particle
- Black particle
- Particle with <1µm diameter

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What do parameters say and how do they interact?

Alkalinity: is important for life in water, especially for pH sensitive species

- Influences **pH**: the higher the alkalinity the less the pH value is influenced by added acid (e.g. rain, snowmelt). Water with high alkalinity is well buffered. Water with <100mg/l $CaCO_3$ is poorly buffered and highly pH sensitive.

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What do parameters say and how do they interact?

pH (hydrogen ion concentration): influences aquatic life (biomass, diversity)

- **Temperature** influences pH: In pure water pH is 7.0 at 25 °C, pH is 7.47 at 0 °C, and pH is 6.63 at 50 °C
- **Transparency** might influence pH: Depending on the type of suspended particles in the water

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What do parameters say and how do they interact?

Conductivity: important for the orientation of fish species; indicator for water quality (indirect measurement of TDS) in combination with other parameters

- Conductivity has no effect on other parameters
- Range of conductivity
  - Snow: 5 to 30 µS/cm
  - Tab water: 750 µS/cm (range 100 to 1000 µS/cm)
  - Irrigation water: >1800 µS/cm is problematic for plants

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What do parameters say and how do they interact?

Oxygen: influences aquatic plants (biomass, O_2 production)

- Dissolved O_2 depends on water temperature
- The O_2 saturation value is 14.6 mg/l at 0 °C and drops to 9.1 mg/l at 20 °C
- Aquatic plants enhance O_2 during day
- Even small waterfalls increase O_2 content

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What do parameters say and how do they interact?

Nitrate: influences aquatic plants (growth, biomass, O_2 production); Water eutrophication

- Indirect influences on concentration of O_2: aquatic plants need nitrates for growth; plants then produce O_2. To high nitrate concentration in water leads to eutrophication, the O_2 concentration sinks, and nitrite (toxic for aquatic organisms) is formed based on nitrate