In-situ monitoring of CO_2 in an intermittent stream

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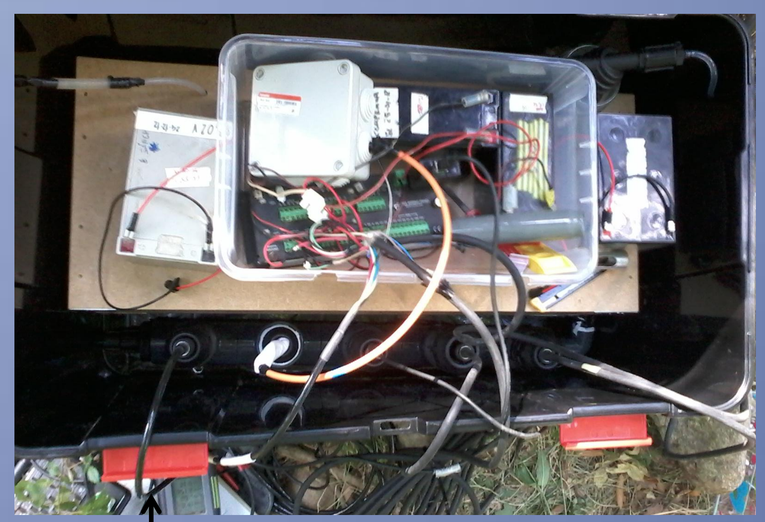
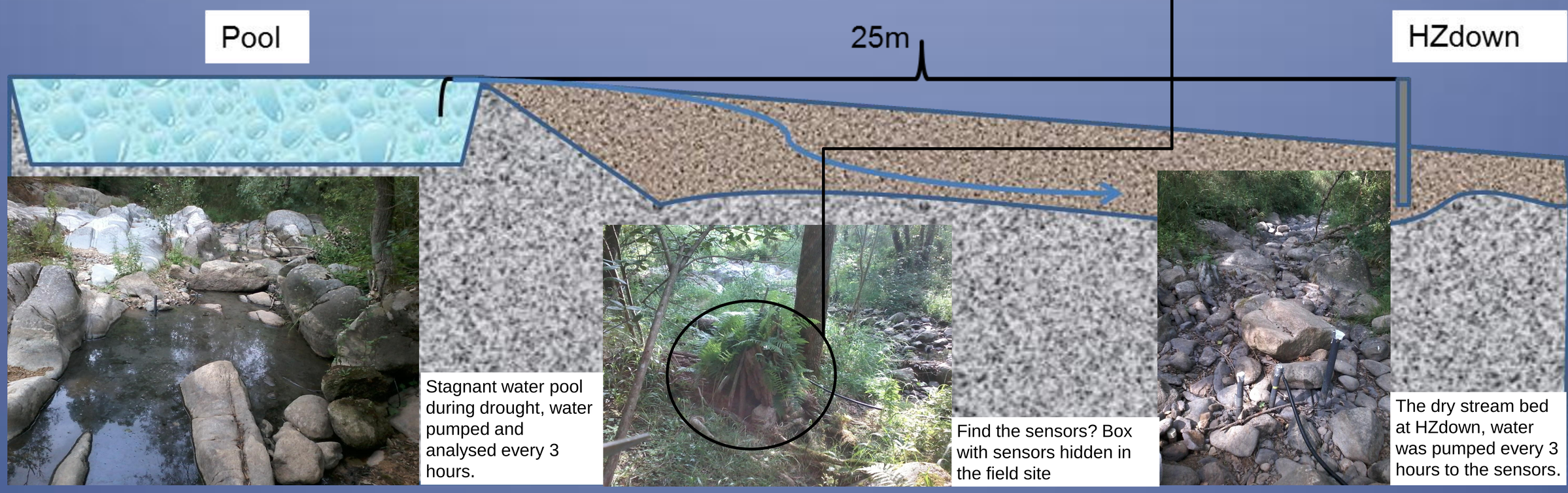
Introduction

Intermittent streams were recently discovered as a factor underestimating the CO_2 emissions of aquatic ecosystems, because they are not included once they are dry (Gomez-Gener et al., 2016; Von Schiller et al., 2015). We addressed this gap by in-situ Monitoring of Hyporheic Zone (HZ) pore water in an intermittent Mediterranean Stream (Fuirosos, see poster Brandt et al.) during summer drought.

Methodology

We pumped alternating surface water from a *Pool* located in an uplift area of granitic bedrock and pore water of the *HZdown* in 50cm depth 25m downstream of the pool into a pipe, where we had several sensors installed (foto right). In the following we present data from continuous measurements of Dissolved CO_2 , which were taken with a Vaisala GMM221 CO_2 probe, as proposed by Johnson et al. (2010) equipped with a gas permeable membrane.





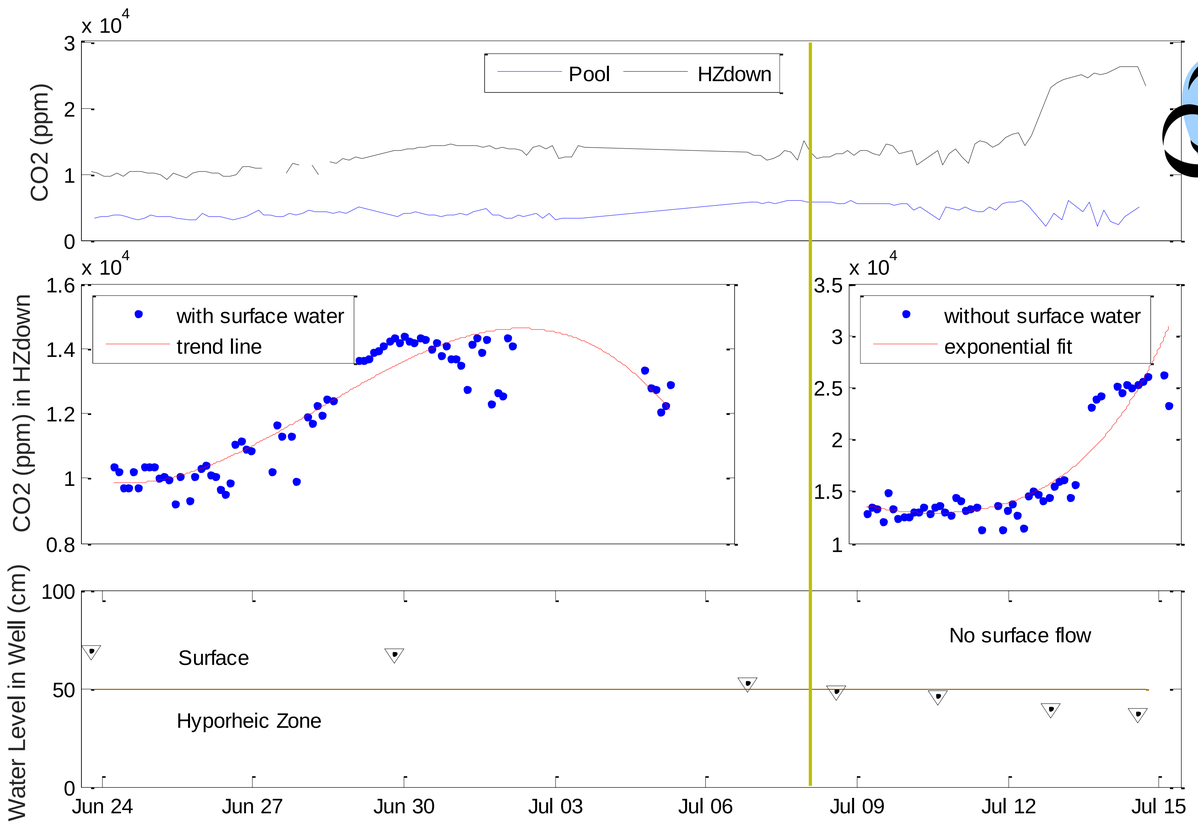
Stagnant water pool during drought, water pumped and analysed every 3 hours.

Find the sensors? Box with sensors hidden in the field site

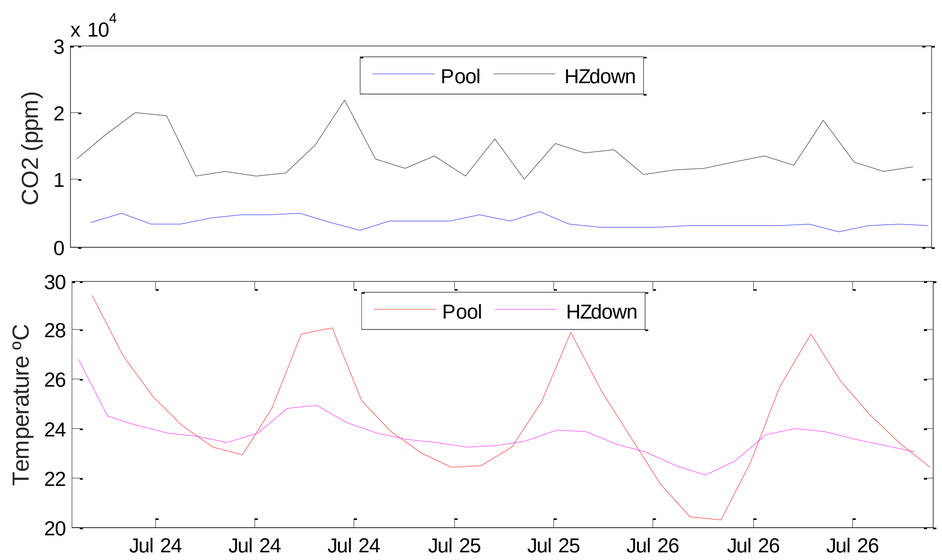
The dry stream bed at HZdown, water was pumped every 3 hours to the sensors.

Preliminary Results

The graph shows 3 weeks of drying from fragmentation to no surface flow. Dissolved CO_2 concentration in the pool showed less changes (4200 ± 900 ppm) during drought than pore water of the HZ. Concentrations from the HZ went from 15000 ppm (on the first day the stream was dry) up to 26000 ppm after 5 days. We fitted an exponential curve to this abrupt increase (R^2=0.97) .



The graph explores CO_2 and temperature after rewetting, due to a rain event in July. The concentration in HZ stayed continuously high at around 15000ppm, while the pool remained at about 5000ppm.Diarnal cycles as observed for temperature were not very pronounced for both sites.



Next steps

- Adding Colored and protein-like dissolved organic matter in-situ data.
- Mass balance between pool and HZ
- Compare CO2 data from pool with Net Ecosystem Production
- Compare with O2 data of the HZ from Tanja Brandt.

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References
Cole, Jonathan J.; Prairie, Yves T.; Caraco, Nina F.; McDowell, William H.; Tranvik, Lars J.; Striegl, Robert G. et al. (2007): Plumbing the global carbon cycle: integrating inland waters into the terrestrial carbon budget. In Ecosystems 10 (1), pp. 172–185.
Gómez-Gener, Lluís; Obrador, Biel; Marcé, Rafael; Acuña, Vicenç; Catalán, Núria; Casas-Ruiz, Joan Pere et al. (2016): When Water Vanishes: Magnitude and Regulation of Carbon Dioxide Emissions from Dry Temporary Streams. In Ecosystems 19 (4), pp. 710–723.
Johnson, Mark S.; Billett, Michael F.; Dinsmore, Kerry J.; Wallin, Marcus; Dyson, Kirstie E.; Jassal, Rachhpal S. (2010): Direct and continuous measurement of dissolved carbon dioxide in freshwater aquatic systems—method and applications. In Ecohydrology 3 (1), pp. 68–78.
Schiller, Daniel von; Marcé, Rafael; Obrador, Biel; Gómez, Lluís; Casas, Joan Pere; Acuña, Vicenç; Koschorreck, Matthias (2014): Carbon dioxide emissions from dry watercourses. In Inland waters 4 (4), pp. 377–382.