

Unravelling the Contribution of Turbulence and Bubbles to Air-Water Gas Exchange in Running Waters

SND-ID: 2021-307-1. **Version:** 1. **DOI:** <https://doi.org/10.5878/j46g-rw37>

Download data

Contribution_of_turbulence_and_bubbles_to_air-water_gas_exchange_in_running_waters.tsv (12.36 KB)

Associated documentation

Contribution_of_turbulence_and_bubbles_to_air-water_gas_exchange_in_running_waters_VariableDescription.pdf (493.41 KB)

Klaus_2022_bubble_flume_k.pdf (1.8 MB)

Vingiani_2021_chamber_method.pdf (2.65 MB)

Download all files

2021-307-1-1.zip (~4.95 MB)

Citation

Klaus, M., Labasque, T., Botter, G., Durighetto, N., & Schelker, J. (2021) Unravelling the Contribution of Turbulence and Bubbles to Air-Water Gas Exchange in Running Waters (Version 1) [Data set]. Swedish University of Agricultural Sciences. Available at: <https://doi.org/10.5878/j46g-rw37>

Alternative title

EXSONIC

Creator/Principal investigator(s)

Marcus Klaus - Swedish University of Agricultural Sciences, Department of Forest Ecology and Management

Thierry Labasque - University of Rennes 1, Géosciences Rennes

Gianluca Botter - University of Padova, Padova, Italy, Department of Civil Architectural and Environmental Engineering

Nicola Durighetto - University of Padova, Padova, Italy, Department of Civil Architectural and Environmental Engineering

Jakob Schelker - University of Vienna, Vienna, Austria, Department of Functional and Evolutionary Ecology

Research principal

[Swedish University of Agricultural Sciences](#)

Principal's reference number

SLU.seksko.2021.IÅ-2.

Description

Aquatic ecosystems exchange gases with the atmosphere and this exchange is critical for many

ecosystem processes and the global greenhouse gas cycle. However, it is difficult to determine how fast gases exchange with the atmosphere, especially in running waters where bubbles can speed up the exchange of certain gases. Here, we provide a data set on air-water gas exchange velocities, collected during an outdoor flume experiment. We used experimental stream channels to create a wide range of flow conditions, and tested how these conditions effect the rate at which different gases in the water exchange with the atmosphere. Besides gas exchange velocities for direct air-water exchange and exchange mediated by bubbles, the data set also contains data on, among others, flow conditions, turbulent kinetic energy dissipation rate, bubble flux rate and ambient underwater sound pressure signatures. The experimental design and data are described in articles by Vingiani et al. (2021) and Klaus et al. (2022).

main data contributions:

(1) Gas exchange velocity estimates based on mass balance of various gases in flume water
Concentrations of helium, xenon, argon och methane were measured in the in- and outlet water of the flumes using mass-spectrometry . A mass balance of the gases yielded air-water gas exchange velocities.

(2) turbulent kinetic energy dissipation estimates based on Acoustic Doppler Velocimetry
Three-dimensional flow velocities were measured at 24 locations per flume using an Acoustic Doppler Velocity meter. Spectral analysis was applied to derives turbulent kinetic energy dissipation rates.

(3) sound pressure signatures derived from Hydrophone and microphone recordings
Ambient sound was recorded at 12 locations per flume using a hydrophone and a microphone. Spectral analysis was used to derive sound signatures associated with water flow / turbulence and air bubbles.

Data contains personal data

No

Language

[English](#)

Time period(s) investigated

2019-07-22 - 2019-08-06

Variables

37

Data format / data structure

[Numeric](#)

Data collection 1

- Description of the mode of collection: Acoustic Doppler Velocimetry
- Time period(s) for data collection: 2019-07-22 - 2019-08-06
- Instrument: Nortek Vectrino+ - Acoustic Doppler Velocity meter

Data collection 2

- Description of the mode of collection: Mass balance of various gases (He, Ar, Xe, CH₄) in flume water
- Instrument: - Continuous flow membrane-introduction mass spectrometry (CF-MIMS)

Data collection 3

- Description of the mode of collection: Hydrophone / microphone measurements
- Instrument: Benthowave BII-7016

Geographic spread

Geographic location: [Austria](#)

Geographic description: Lunzer:::Rinnen Experimental Flumes, WasserCluster Lunz, Lunz am See, Austria

Funding 1

- Funding agency: The Lars Hierta Memorial Foundation

Funding 2

- Funding agency: European Commission EU H2020-INFRAIA-project AQUACOSM
- Funding agency's reference number: 731065
- Project name on the application: EXSONIC

Funding 3

- Funding agency: European Commission's Horizon 2020 Excellent Science Programme
- Funding agency's reference number: H2020-EU.1.1.-770999

Funding 4

- Funding agency: Austrian Academy of Sciences
- Project name on the application: HYDRO-DIVERSITY

Research area

[Earth and related environmental sciences](#) (Standard för svensk indelning av forskningsämnen 2011)

[Oceanography, hydrology and water resources](#) (Standard för svensk indelning av forskningsämnen 2011)

[Geoscientific information](#) (INSPIRE topic categories)

[Inland waters](#) (INSPIRE topic categories)

Keywords

[Turbulence](#), [Sounds](#), [Discharge/flow](#), [Gas](#), [Model](#), [Watercourse](#), [Bubble](#)

Publications

Vingiani, F., Durighetto, N., Klaus, M., Schelker, J., Labasque, T., & Botter, G. (2021). Evaluating stream CO₂ outgassing via drifting and anchored flux chambers in a controlled flume experiment. *Biogeosciences*, 18, 1223–1240.

DOI: <https://doi.org/10.5194/bg-18-1223-2021>

Klaus, M., Labasque, T., Botter, G., Durighetto, N., & Schelker, J. (2022). Unraveling the contribution of turbulence and bubbles to air-water gas exchange in running waters. *Journal of Geophysical Research: Biogeosciences*, 127, e2021JG006520.

DOI: <https://doi.org/10.1029/2021JG006520>

If you have published anything based on these data, [please notify us](#) with a reference to your publication(s). If you are responsible for the catalogue entry, you can update the metadata/data description in DORIS.

Polygon (Lon/Lat)

15.06546648544, 47.852971835537
15.06546648544, 47.85233468217
15.066450739244, 47.85233468217
15.066450739244, 47.852971835537
15.06546648544, 47.852971835537

Accessibility level

Access to data through SND
Data are freely accessible

Use of data

[Things to consider when using data shared through SND](#)

Versions

Version 1. 2021-12-01

Homepage

<https://www.researchgate.net/project/ExSONIC-Experimental-evaluation-of-stream-atmosphere-gas-exchange-by-hydro-acoustics>

Contact for questions about the data

Marcus Klaus
marcus.klaus@slu.se

Download metadata

[DataCite](#)

[DDI 2.5](#)

[DDI 3.3](#)

[DCAT-AP-SE 2.0](#)

[JSON-LD](#)

[PDF](#)

[Citation \(CLS\)](#)

[File overview \(CSV\)](#)

Published: 2021-12-01

Last updated: 2022-04-22