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Data Article

Datasets of solid and liquid discharges of an urban Mediterranean river and its karst springs (Las River, SE France)

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ARTICLE INFO

Article history:

Received 16 June 2020

Revised 7 July 2020

Accepted 9 July 2020

Available online 13 July 2020

Keywords:

Karst spring

Urban stream

Solid yield

Discharge

Grain-size

Mediterranean river

Dardennes springs

flood

ABSTRACT

This data paper presents: (1) the liquid and solid discharge characteristics of the Las River, an urban Mediterranean stream flowing to the Bay of Toulon (south of France), and (2) the water height of the main karst springs supplying the Las River. We assessed the river's discharge with hydrological observations and we explored floods characteristics influencing its solid discharge [1]. The location of the monitoring station near the river's mouth was selected accordingly to accessibility and technical constraints, as far downstream as possible. The vast majority of tributaries (such as possible underground springs, stormwater outlets, urban runoff) were taken into account. A multi-parameter probe (temperature, pressure, turbidity and electric conductivity) and a sediment

DOI of original article: [10.1016/j.jhydrol.2020.125194](https://doi.org/10.1016/j.jhydrol.2020.125194)

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<https://doi.org/10.1016/j.dib.2020.106022>

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trap were deployed continuously for 17 months, from October 2012 to March 2014. At the river's sources, probes (temperature, water height) were deployed to characterize karst springs. Time series were averaged at a daily time step, and water height converted in discharge when the rating curve was available. Sediment samples were analyzed for grain-size distribution. Datasets may help to estimate karsts' contributions to the Mediterranean Sea and to assess their influence on rivers discharge and solid yield. Stakeholders may also use the maximum water height to evaluate the flooding risk. Our data also contribute to linking the catchment freshwater to the coastal sea, a connection yet to be fully explored.

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Specifications table

Subject	Water Science and Technology Earth-Surface Processes
Specific subject area	Hydrology
Type of data	Table
How data were acquired	Multi-parameter probe (YSI 600 OMS-V2), CTD and pressure probes for groundwater (DIVER Schlumberger, STS); Laser diffraction particle size analyzer (LS13320 Beckman&Coulter)
Data format	Raw Analyzed Filtered
Parameters for data collection	Las River: Probes were moored for 17 months near the Las River outlet. Probes were cleaned on-site fortnightly to avoid the sensors fouling. Sediment sampler was deployed near the river's outlet. Karst spring Ragas: 2 probes were recording close one another and data was cross-validated. Probes were cleaned on-site every 6 months and calibration checked. Probes were absolute pressure sensors. Water height was calculated using a supplementary probe for atmospheric pressure. Dardennes reservoir: Dardennes karst springs are flooded, discharging at the bottom of a reservoir. 1 probe was recording absolute pressure. Water height was calculated using a supplementary probe for atmospheric pressure. Karst spring Saint Antoine: 1 probe was recording water height with a pressure sensor with vented cable.
Description of data collection	Las River: Measurements of water level, temperature, electric conductivity, and turbidity were recorded at 5 min time step and then averaged daily. Data were quality controlled and were converted to daily liquid discharge and daily solid yield. Sediments collected with the sampler were analysed for grain-size. Karst springs Ragas, Dardennes and Saint Antoine: Measurement of pressure and temperature were recorded at 15 min time step and then averaged daily. Gauging station at Saint Antoine spring is a standard open channel flow with hydraulic rating curve.
Data source location	Ragas Spring (Le Revest-les-Eaux, France); (43.181°N, 5.935°E); Elevation 149 m asl Dardennes Springs (Le Revest-les-Eaux, France); (43.177°N, 5.932°E); Elevation 100 m asl St-Antoine Spring (Toulon, France); (43.144°N, 5.912°E); Elevation 20 m Las River monitoring station (Toulon, France); (43.122357°N, 5.895227°E); Elevation 2 m asl
Data accessibility	With the article
Related research article	Dufresne, C., Arfib, B., Ducros, L., Duffa, C., Giner, F., Rey, V. Karst and urban flood-induced solid discharges in Mediterranean coastal rivers: The case study of Las River (SE France). Journal of Hydrology (2020) https://doi.org/10.1016/j.jhydrol.2020.125194

Value of the data

- Our datasets cover the watershed-sea continuum and provide scarce data from the river's sources of water to the sea
- Datasets can be used to study key processes governing karst floods, the water sources of an urban stream and the solid discharge to coastal seas. Datasets may also help stakeholders to understand rapid rises of the water level and predict flood hazard.
- Datasets provide the solid and liquid discharge of an urban stream in a Mediterranean climate covering low-flow and flood periods in relation to the water level in karst springs and may be used for further insights for rainfall-karst springs behavior, urban flood, river's yield to the coastal ocean.
- A benchmark for future studies dedicated to solid discharge to the sea, hydrologic sediment yield and Mediterranean urban rivers
- Datasets provide insights on karst spring contribution to the discharge of Mediterranean rivers

1. Data description

Data presented in this article were collected to assess the solid and liquid discharge of the Las River to the Bay of Toulon (south of France). Datasets were used as forcings in a hydro-sedimentary model of the Bay of Toulon [2] able to simulate the sediment dynamics (transport, deposition, remobilization) in the coastal ocean, and to assess the influence of karst springs on flood events in a Mediterranean coastal river [1].

3 datasets are provided for the time period 06/10/2012 – 04/03/2014. If data is not available, it is marked as 'NA' in the files provided, and there is no interpolation for missing data. Fig. 1 shows the dataset for karst groundwater. The three springs are described in [1] and [3]. The dataset includes daily average: water level in Dardennes reservoir (m), water level in Ragas karst conduit connected to the overflow spring (m), water temperature in Ragas (°C), Saint Antoine spring discharge (m³/s). Fig. 2 shows the Las river dataset: the daily average temperature (°C) and the daily average electric conductivity (mS.cm⁻¹), and the daily water discharge (m³.day⁻¹) and daily solid discharge (kg.day⁻¹). A third dataset presents the grain-size proportion (%) of sediments trapped in the sampler (Table 1).

2. Experimental design, materials, and methods

2.1. Karst springs

The Ragas karst spring is a temporal overflow spring with high water level variations, ranging from 100 to 150 m asl. 2 CTD probes (DIVER-Schlumberger, pressure range 0–100 m) were installed at 92 m asl in the karst conduit by caving technics. Every six months, data were downloaded in-situ and calibration checked. The 2 probes were recording close to one another and used for data cross-validation.

The Dardennes springs discharge in the Dardennes Reservoir at 100 m asl, usually flooded by 10 to 23 m of water height. One CTD probe (DIVER-Schlumberger, pressure range 0–50 m) was installed by divers. Every 6 months, divers took back the probe for cleaning, data downloading and checking calibration. The reservoir water level was also daily monitored by the drinking water treatment plant at the dam.

Data was recorded at a 15 min time-step and a daily average was calculated with the 96 data. Probes measured absolute pressure (air + water height). Water height was calculated by subtracting the air pressure recorded at the dam with a barodiver probe (Schlumberger, range 0–1.5 m).

Table 1
Proportion (%) of grain-size class for sediment sampler.

Sampler installation date (dd-mm-yyyy)	Sampler recovery date (dd-mm-yyyy)	Sediment grain-size class (μm)				
		0.04 – 4	4 – 20	20 – 63	63 – 200	200 – 2000
04-10-2012	10-10-2012	21.50	45.50	26.00	6.19	0.75
10-10-2012	24-10-2012	23.50	39.50	27.90	7.58	1.53
24-10-2012	30-10-2012	26.90	43.30	21.00	7.62	1.23
07-11-2012	21-11-2012	24.40	36.00	20.70	8.88	10.00
21-11-2012	05-12-2012	31.50	38.80	23.20	5.47	1.05
05-12-2012	19-12-2012	28.21	35.17	23.54	11.85	1.23
19-12-2012	04-01-2013	39.70	46.80	9.42	4.07	0.00
04-01-2013	16-01-2013	38.02	46.80	13.10	1.85	0.00
16-01-2013	30-01-2013	29.90	37.90	28.20	3.99	0.00
30-01-2013	13-02-2013	46.80	39.40	13.60	0.23	0.00
13-02-2013	27-02-2013	29.10	42.93	21.07	6.73	0.17
27-02-2013	04-04-2013	12.57	25.80	31.10	19.53	11.00
04-04-2013	17-04-2013	10.73	24.60	34.75	17.73	12.20
18-04-2013	06-05-2013	65.80	34.20	0.00	0.00	0.00
06-05-2013	23-05-2013	37.70	44.40	4.41	3.90	9.64
23-05-2013	05-06-2013	28.52	38.15	22.63	9.19	1.51
05-06-2013	19-06-2013	13.26	59.55	27.19	0.00	0.00
19-06-2013	03-07-2013	22.86	69.60	7.54	0.00	0.00
03-07-2013	17-07-2013	19.35	64.09	16.56	0.01	0.00
17-07-2013	05-08-2013	16.85	49.01	28.58	4.99	0.56
05-08-2013	20-08-2013	16.07	56.18	25.30	2.18	0.27
28-08-2013	12-09-2013	14.25	38.52	40.71	5.56	0.96
25-09-2013	09-10-2013	13.06	27.09	31.92	15.48	12.45
09-10-2013	23-10-2013	16.02	36.82	35.02	9.03	3.10
24-10-2013	07-11-2013	13.68	31.94	44.75	8.22	1.41
07-11-2013	20-11-2013	14.48	30.53	43.45	10.08	1.46
20-11-2013	06-12-2013	18.72	38.10	43.13	0.06	0.00
06-12-2013	07-01-2014	10.08	25.01	30.65	20.31	13.94

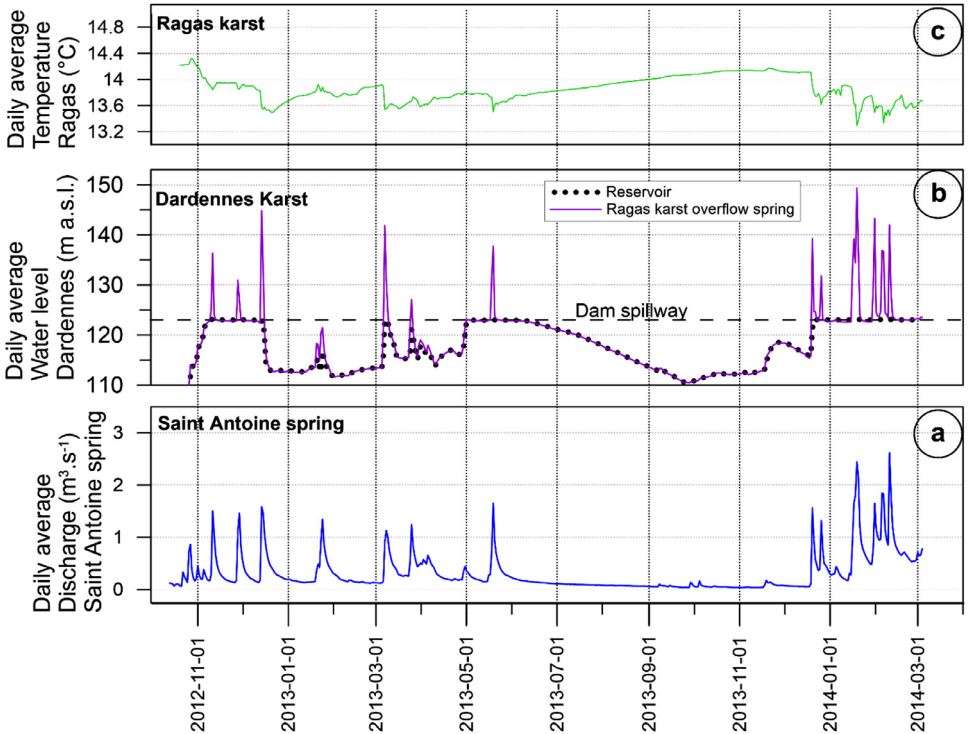


Fig. 1. Times series for karst springs. a: discharge at Saint Antoine spring, b: water level at Dardennes springs flooded in the Dardennes reservoir and Ragas karst overflow spring, c: groundwater temperature in the Ragas karst conduit.

A pressure sensor with vented cable (STS, range 0–3 m) was installed at the gaging station of Saint Antoine spring. The karst conduit discharging groundwater has been designed with concrete to make a standard open channel flow with a hydraulic rating curve.

2.2. Las river outlet

A multi-parameter probe (YSI 600 OMS-V2) recorded temperature, pressure, turbidity and electric conductivity data every 5 min over the deployment period in the Las River. Before each record, an automatic wiper cleaned the turbidity probe twice to avoid any incorrect measurement. The device was cleaned on-site fortnightly to avoid the sensors fouling. Every three months, sensors were cleaned and recalibrated with standard solutions in-laboratory to prevent measuring drift. Recorded data was post-processed to correct the absolute pressure by subtracting the atmospheric pressure in a way to only take into account the variations due to the water height above the device. The unchanging water height under the probe (15 cm) was added.

The river's flow was estimated with a rating curve linked to the water height. The rating curve was established with 41 discharge measurements carried out with the dilution method by injection of a fluorescent dye [4].

A digital filter corrected turbidity data to eliminate the sharp variations, not likely representative of the entire water column. We established a single relationship between the turbidity data and the suspended solid concentration (SSC) based on water samplings filtrations [1]. We assumed that the suspended solid concentration is homogeneous through the shallow and narrow stream section. We also assumed that recorded data is representative of the entire vertical

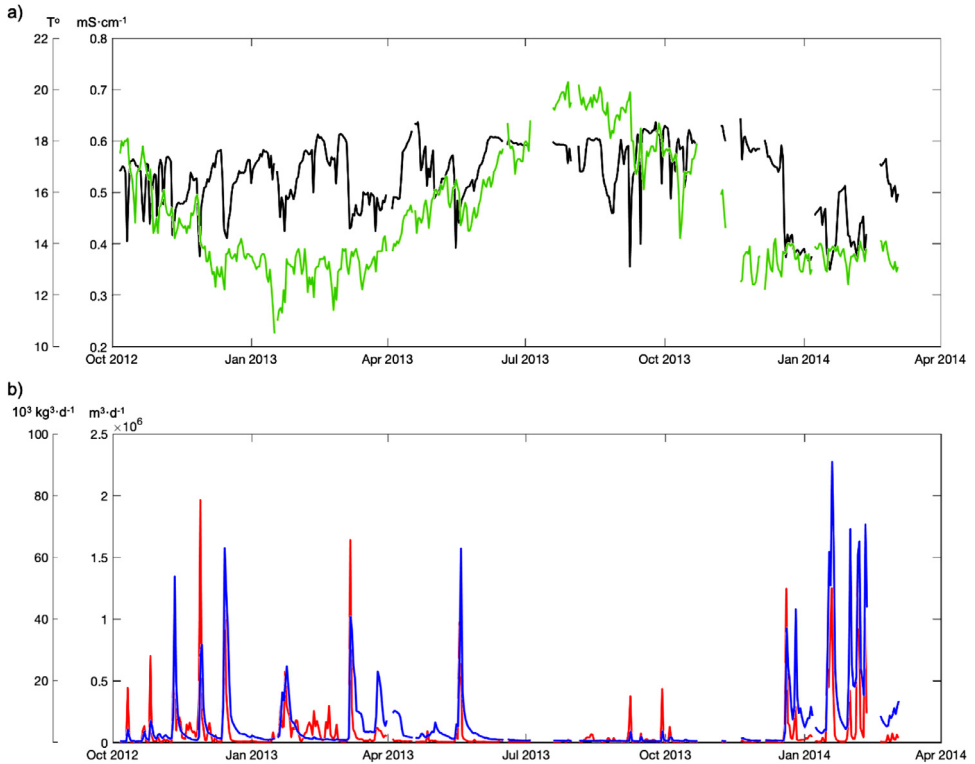


Fig. 2. Times series for the Las River. a: water temperature (green) and electric conductivity (black), b: Daily solid discharge (red) and daily water discharge (blue).

cross-section and consequently, of the solid discharge to the sea. The solid discharge was calculated with the SSC multiplied by the water discharge at every time step and summed daily.

2.3. Sediment sampler

A sediment sampler was deployed near the outlet to characterize the suspended solid yield. The device, fully described by Phillips [5], is designed to trap suspended matter that flows in the stream by slowing down the ambient flow, which induces sedimentation by settling. The sediment sample is composed of particulate matter that flows in the river for the entire duration of the deployment period. Its efficiency in trapping a representative time-integrated sample of the suspended solid discharge has been shown [5] and verified for the Las River [1]. Both sediment sampler and multi-parameter probes were fixed in a protection frame to avoid damage and obstruction of the devices (Fig. 3). We fortnightly collected the sediments retained by the sampler, along with the cleaning maintenance of the multi-parameters probe. Some samples were yet collected less often, due to a high water level in the river, making the collect impossible. The collected samples were dried at 40°C for conservation and weighted. Sediment trap samplings were processed with an LS13320 Beckman&Coulter laser diffraction particle size analyzer. The analyzer provides size distribution in volume with a sizing range from 0.04 to 2000µm. Water was added to the dried sediment samplings, and the solutions were agitated (200rpm) and homogenized for 12 hrs. Just before analysis, the agitation is raised to 800rpm, and sampling is

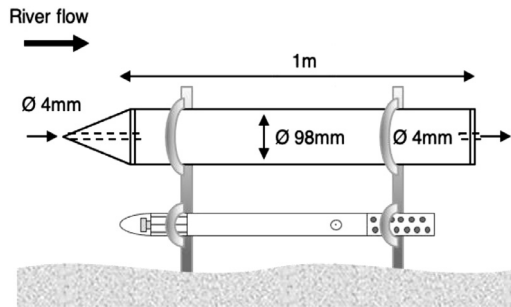


Fig. 3. Schematic of the instrumental setup with the sediment sampler (top) and multi-parameter probe (bottom). Note that the two devices were moored side by side and are here illustrated one on top of the other for clarity purposes.

pipetted in the vortex. The grain-size analysis is repeated three times on each sampling to get a significant result, and the average proportion is used to qualify the sampling.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have, or could be perceived to have, influenced the work reported in this article.

Acknowledgments

The funding was provided by IRSN, Region PACA and Toulon Provence Méditerranée (TPM). Karst springs data have been monitored in the frame of the DARDENNES project funded by the Agence de l'Eau (RMC), the city of Toulon, Veolia Eau, Cenote Company, and Aix-Marseille University. This work benefited from the fruitful discussions within the framework of the KARST observatory network (www.sokarst.org) initiative from the INSU/CNRS, which aims to strengthen knowledge sharing and promote cross-disciplinary research on karst systems. The authors also wish to thank all persons who participated in the fieldwork.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.dib.2020.106022](https://doi.org/10.1016/j.dib.2020.106022).

References

- [1] C. Dufresne, B. Arfib, L. Ducros, C. Duffa, F. Giner, V. Rey, Karst and urban flood-induced solid discharges in Mediterranean coastal rivers: the case study of Las River (SE France), *J. Hydrol.* (2020) <https://doi.org/10.1016/j.jhydrol.2020.125194>.
- [2] C. Dufresne, C. Duffa, V. Rey, R. Verney, Hydro-sedimentary model as a post-accidental management tool: application to radionuclide marine dispersion in the Bay of Toulon (France), *Ocean Coast. Manage.* 153 (2018) 176–192, doi:[10.1016/j.ocecoaman.2017.12.026](https://doi.org/10.1016/j.ocecoaman.2017.12.026).
- [3] C. Baudement, B. Arfib, N. Mazzilli, J. Jouve, T. Lamarque, Y. Guglielmi, Groundwater management of a highly dynamic karst by assessing baseflow and quickflow with a rainfall-discharge model (Dardennes springs, SE France), *BSGF* 188 (6) (2017) 40 doi:[10.1051/bsgf/2017203](https://doi.org/10.1051/bsgf/2017203).
- [4] P.-A. Schnegg, C. Perret, A. Hauet, D. Parrel, G. SAYSSET, P. VIGNON, Stream gauging by dilution of fluorescent tracers and state of the art of the EDF hydroclimatological observation network, in: *Proc. 9th Conference on Limestone Hydrogeology*, Besançon, France, 2011.
- [5] J.M. Phillips, M.A. Russell, D.E. Walling, Time-integrated sampling of fluvial suspended sediment: a simple methodology for small catchments, *Hydrol. Process* 14 (2000) 2589–2602.