Data in Brief 50 (2023) 109557

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Dataset on onshore groundwaters and offshore submarine spring of a Mediterranean karst aquifer during flow reversal and saltwater intrusion

B. Ladouche[a,b,*], J.C. Maréchal[a,b,*], C. Lamotte[a], V. Durand[c], V. Bailly-Comte[a,b], V. Hakoun[a,b]

[a] BRGM, Univ Montpellier, Montpellier, France
[b] G-eau, UMR 183, INRAE, CIRAD, IRD, AgroParisTech, Institut Agro, BRGM, Montpellier, France
[c] Antea-Groupe, Agence Rhône – Alpes – Méditerranée, Pérols, France

ARTICLE INFO

Article history:
Received 7 August 2023
Revised 31 August 2023
Accepted 4 September 2023
Available online 9 September 2023

Dataset link: Dataset on onshore groundwaters and offshore submarine spring of a Mediterranean karst aquifer during flow reversal and saltwater intrusion (Original data)

Keywords:
Karst aquifer
Discharge
Groundwater level
Specific conductivity
Water temperature
Lagoon water level

ABSTRACT

Groundwater from various shallow and deep reservoirs converges in interaction with marine waters into the limestone aquifer of the Balaruc peninsula (Thau lagoon, southern France). This aquifer faces temporary phenomena of marine water intrusion through the Vise submarine spring located at −29.5 m below the lagoon level. Since the 1960s, seven flow reversal phenomena have occurred, the last one occurring between 11/28/2020 and 03/14/2022. During these phenomena, which can last from a few weeks to several months, the salty water is absorbed from the lagoon to the conduit of the submarine spring, which leads to the salinization of the underlying karst aquifer. The monitoring of flow, water specific conductivity and water temperature data from the karst submarine spring is a key element of the research project to understand the hydrogeological functioning of the karst aquifer under normal conditions or during flow reversal periods. This monitoring allows the characterization of the (in- or out-) flows at the submarine spring, the evaluation of the volume or mass balances, the identification of the hydrogeological and physico-chemical responses (water temperature, specific

* Corresponding author.
E-mail address: b.ladouche@brgm.fr (B. Ladouche).
Social media: @VivHkn (B. Ladouche)

https://doi.org/10.1016/j.dib.2023.109557

conductivity) observed within the karstic aquifer. Here, we present the means implemented offshore to acquire data at the submarine spring over the 06/25/2019 - 12/31/2022 time period together with lagoon water's physico-chemical parameters and levels and onshore groundwater's physico-chemical parameters and levels acquired at springs and boreholes from the karst aquifer.

Specifications Table

Subject	Environmental Science
Specific subject area	Groundwater-seawater interaction, karst hydrogeology, saltwater intrusion, karst spring
Type of data	Table Image Figure
How the data were acquired	The submarine spring discharge was measured in an experimental device with a one-meter-diameter flowmeter (Optiflux 4300W model, Krohne) connected to a data logger installed on the lagoon shore. Water level, water electric conductivity and temperature of submarine spring were measured in the experimental device with two OTT PLS C in situ probes connected on land to an OTT NetDL data logger equipped with a GPRS modem. Measuring lagoon water level in a strainer tube using an ultrasonic sensor (H-lagoon, Table 1). Water level, water specific conductivity (SpC) at 25°C and temperature of karst aquifer were measured at springs and boreholes with Dipper PETC data logger (SEBA Hydrometry) equipped with a GPRS modem.
Data format	Raw Analyzed
Description of data collection	Hourly flow, water specific conductivity and temperature data from the submarine spring, located -29.5 m below the lagoon level, as well as the piezometric level of the aquifer and the lagoon water level were measured (see table 2). These same parameters were observed during a flow reversal and saltwater intrusion at the submarine spring over a period of 471 days (11/28/2020 to 14/03/2022) as well as the physico-chemical monitoring within the karst aquifer.
Data source location	Institution: BRGM (https://www.brgm.fr/fr/reference-projet-acheve/dem-eaux-thau-gestion-ressources-eau-souterraine-aquifere-cotier-karstique) City/Town: Balaruc-Les-Bains Region: Occitanie Country: France Latitude and longitude: (WGS84) 43.443490 ; 3.671810 Secondary data: (104-P-001) [1] Institution: IFREMER(https://doi.org/10.13155/89133) City/Town: Bouziques Region: Occitanie Country: France Latitude and longitude: (WGS84) 43.434851 ; 3.664119
Data accessibility	Repository name: Mendeley Data identification number: Direct URL to data: https://data.mendeley.com/datasets/fpdkw88z84/2 Ladouche, Bernard; Marechal, Jean Christophe; Lamotte, Claudine; Durand, Vincent; Bailly-Comte, Vincent; Hakoun, Vivien (2023), “Dataset on onshore groundwaters and offshore submarine spring of a Mediterranean karst aquifer during flow reversal and saltwater intrusion”, Mendeley Data, V2, doi: 10.17632/fpdkw88z84.2

Table 1
Coordinates of observation points and hypertext links to the BRGM groundwater database (BSS).

Name	BSS_Id	Latitude (WGS84)	Longitude (WGS84)	x_L93 (m)	y_L93 (m)	Distance to Vise spring (m)	Municipality name
Vise	BSS002JDMR	43.443489	3.671810	754410	6260718	0	BALARUC-LES-BAINS
H-lagoon	-	43.439037	3.672460	754483	6260247	480	BALARUC-LES-BAINS
104-P-001 [1]		43.438510	3.664119	753791	6260160	1150	BOUZIGUES
Issanka	BSS002JCUL	43.479322	3.698325	756512	6264734	4500	POUSSAN
Ambressac	BSS002JEKD	43.443212	3.698095	756539	6260705	2130	BALARUC-LES-BAINS
Cauvy	BSS002JDNJ	43.445715	3.683795	755453	6260924	1070	BALARUC-LES-BAINS
F4	BSS002JDVA	43.444097	3.677482	754868	6260789	460	BALARUC-LES-BAINS
F6	BSS002JDXA	43.444903	3.675118	754676	6260877	310	BALARUC-LES-BAINS
S12	BSS002JDNH	43.440356	3.677917	754907	6260374	700	BALARUC-LES-BAINS
CGE	BSS002JEHM	43.463001	3.688929	755777	6262898	2600	BALARUC-LE-VIEUX
P4 La Balme	BSS002JEKE	43.456913	3.702067	756846	6262232	2900	BALARUC-LES-BAINS
DemT1	BSS004AXZH	43.445064	3.675114	754675	6260896	310	BALARUC-LES-BAINS

1. Value of the Data

- This dataset provides new information on a Mediterranean coastal karst aquifer which is characterized by a submarine spring which presents periods of flow reversals.
- This dataset compiles information on the submarine spring flow and its specific conductivity and temperature (for a period of 3.5 years), lagoon water level, as well as groundwater level, specific conductivity and temperature measurements within the karst aquifer.
- The data can be useful to hydrogeologists in their research on understanding the functioning of coastal karst aquifers and more broadly on understanding marine intrusion phenomena in heterogeneous environments through karst conduits.
- To our knowledge, this data is an unique example where total flow reversal was monitored.
- Submarine spring flow, groundwater data (level, temperature and specific conductivity), as well as water levels and water density of the lagoon may be used in density dependent numerical models.

2. Objective

This dataset was generated to study the behavior of a Mediterranean coastal (lagoon) karst aquifer for which the flow reversal phenomenon has occurred several times in the past through a submarine karst spring. The equipment and the monitoring of the submarine spring constitute a key element of the research project to understand of the hydrogeological functioning of the karst system during regular conditions, when fresh groundwater flows out of the submarine spring, as well as during disruptive events, when flow reversal and salty water intrusion through the spring occur [5–7].

3. Data Description

The location of the Vise submarine spring, observation boreholes and stations for measuring the level and the salinity of the lagoon are reported in Fig. 1 (all sites are projected in Lambert 93 in the RGF 93 geographic reference system – ESPG:2154). Sites' coordinates (WGS 84 and EPSG:2154) with hypertext links to the French geological survey's BRGM groundwater database (BSS) and straight distances to the Vise spring are reported in Table 1.

Table 2 presents for each site, the date intervals for each parameter and indicates the type of device used to collect the data.

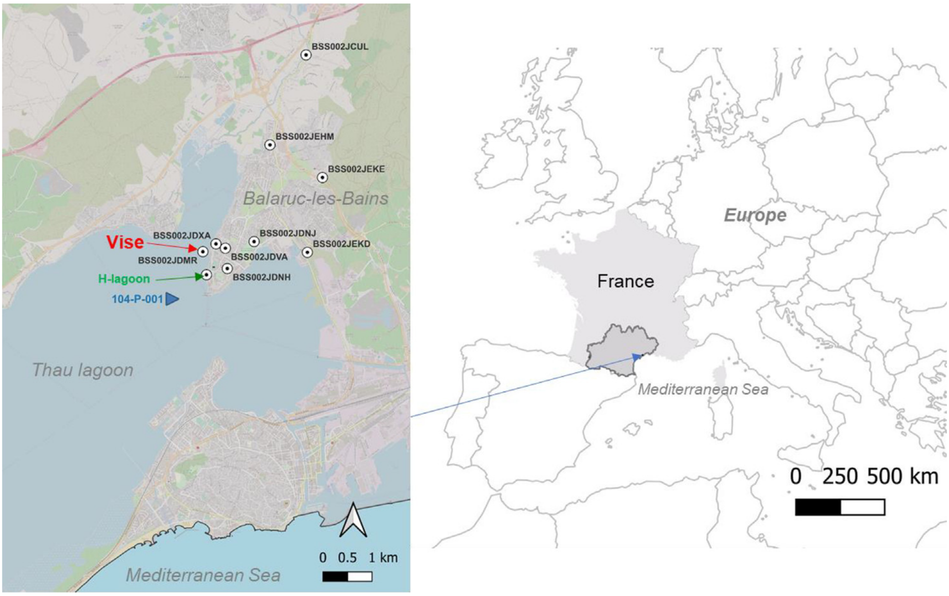


Fig. 1. Map of the Balaruc peninsula with the location of the Vise submarine spring, boreholes and lagoon water level gauge.

Table 2
Date range and type of device used to collect parameter data.

Name/BSS	Parameter	Date from (dd/mm/yyyy) beging	Date to (dd/mm/yyyy) end	Instrument used for collection
Vise/BSS002JDMR	Flow	06/25/2019	12/31/2022	Krohne, Optiflux 4300W model
	SpC (mS/cm)	06/25/2019	10/13/2022	OTT PLS C (4b)
	Temperature (°C)	06/25/2019	10/13/2022	OTT PLS C (4b)
H-lagoon	Water level (m)	01/01/2017	12/31/2022	Ultrasonic sensor
Issanka/BSS002JCUL	Water level (m)	04/05/2019	12/31/2022	OTT PLS C (1b)
	SpC (mS/cm)	10/19/2019	12/31/2022	OTT PLS C (1b)
	Temperature (°C)	04/05/2019	12/31/2022	OTT PLS C (1b)
Ambressac/BSS002JEKD	Water level (m)	02/07/2018	12/31/2022	OTT PLS C (1b)
Cauvy/BSS002JDNJ	Water level (m)	01/01/2017	03/30/2022	OTT PLS C (1b)
	SpC (mS/cm)	01/01/2017	03/26/2022	OTT PLS C (1b)
	Temperature (°C)	01/01/2017	03/26/2022	OTT PLS C (1b)
F4/BSS002JDVA	Water level (m)	01/01/2017	12/31/2022	Dipper PETC data logger (4b)
	SpC (mS/cm)	01/01/2017	12/31/2022	Dipper PETC data logger (4b)
	Temperature (°C)	06/16/2020	12/31/2022	Dipper PETC data logger (4b)
F6/BSS002JDXA	Water level (m)	02/21/2019	12/26/2022	Dipper PETC data logger (4b)
	SpC (mS/cm)	06/16/2020	12/26/2022	Dipper PETC data logger (4b)
	Temperature (°C)	02/21/2019	12/26/2022	Dipper PETC data logger (4b)
S12/BSS002JDNH	Water level (m)	07/22/2020	03/02/2022	OTT PLS C (1b)
	SpC (mS/cm)	07/22/2020	03/05/2022	OTT PLS C (1b)
	Temperature (°C)	07/22/2020	03/05/2022	OTT PLS C (1b)
CGE/BSS002JEHM	Water level (m)	01/01/2017	12/31/2022	Dipper PETC data logger (10b)
	SpC (mS/cm)	01/01/2017	12/31/2022	Dipper PETC data logger (10b)
	Temperature (°C)	01/01/2017	12/31/2022	Dipper PETC data logger (10b)
P4 La Balme/BSS002JEKE	Water level (m)	01/01/2017	12/31/2022	Dipper PETC data logger (4b)
	SpC (mS/cm)	01/01/2017	12/31/2022	Dipper PETC data logger (4b)
	Temperature (°C)	01/01/2017	12/31/2022	Dipper PETC data logger (4b)
DemT1/BSS004AXZH	Water level (m)	07/07/2020	12/31/2022	Dipper PETC data logger (20b)
	SpC (mS/cm)	07/07/2020	12/31/2022	Dipper PETC data logger (20b)
	Temperature (°C)	07/07/2020	12/31/2022	Dipper PETC data logger (20b)

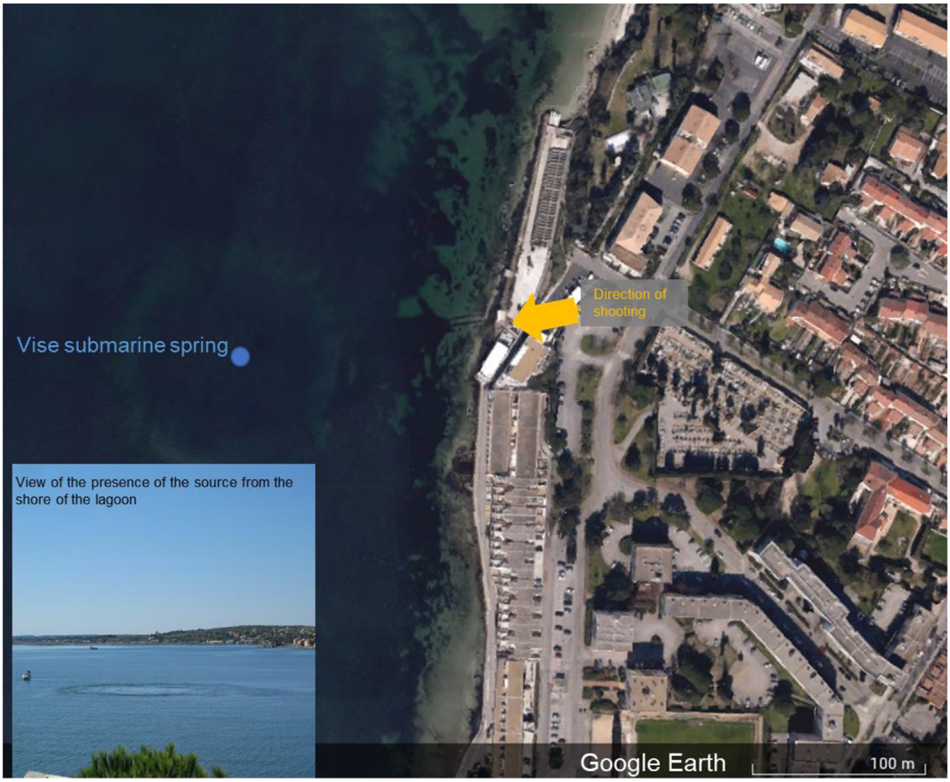


Fig. 2. Location of the Vise submarine spring into Thau Lagoon. The photograph (lower left) shows the impact of the Vise submarine spring on the lagoon surface.

Figs. 2–5 present and illustrate the experimental measurement device of the Vise submarine spring as well as the main phases of the installation works.

Fig. 6 presents (a) hourly flow of the Vise submarine spring, (b) hourly water level of the Thau lagoon, (c) piezometric levels measured in the boreholes of the karst aquifer. The gray frame indicates the period of flow reversal.

Fig. 7 presents specific conductivity (daily mean) of groundwater from boreholes located in the karst aquifer and at of flowing water at the submarine spring (Vise, BSS002JDMR). The gray frame indicates the period of flow reversal.

Fig. 8 presents the specifically designed device used to perform punctual velocity controls at the outlet of the stilling tube. This figure show also results of estimation of the flows of the submarine spring from measurements.

3.1. Submarine spring data

The submarine spring flow dataset is contained in the Vise_Submarine_Spring.xlsx file, which contains three excel sheets. The first sheet named “Flow” contains the data of the hourly averages of the flow rates measured at a time step of 5 minutes between 06/26/2019 and 12/31/2022. The number of data used (N) for the calculation of the arithmetic mean and the associated standard deviation are reported. During regular flowing conditions (i.e. groundwater flows out of the spring), the flow rate is positive. During flow reversal periods, the flow rate becomes negative. The “Comments” column is used to qualify this flow context. The second sheet

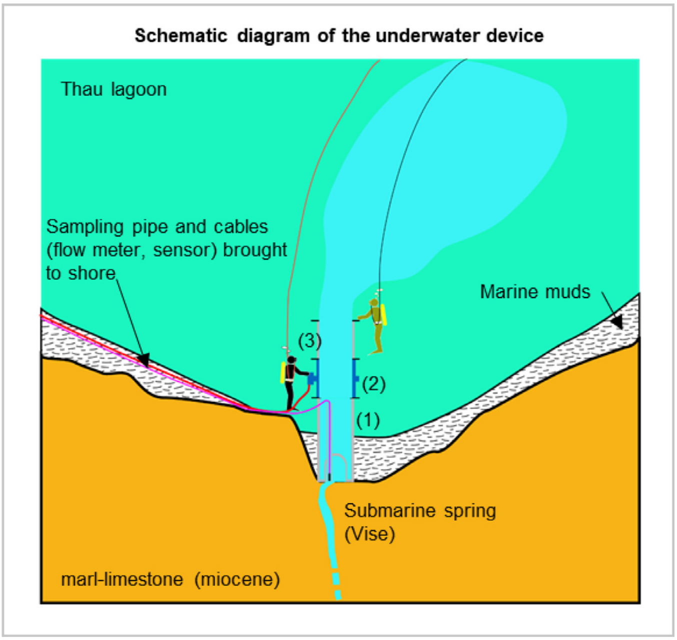


Fig. 3. Principle diagram (not to scale) of the instrumentation of the submarine spring in its context of emergence according to the diving explorations. (1): flow collector, (2): flowmeter, (3): stilling tube.

named “SpC” and the third sheet named “Temp” contain, data of the hourly averages of water specific conductivity and temperature data, respectively, measured at a 5 minutes time step between 06/26/2019 and 10/13/2022. In the “SpC” and “Temp” excel sheets, the data from the 2 measurement probes of the experimental device are presented. The number of data used (N) for the calculation of the arithmetic mean and the associated standard deviation are reported. During flow reversal periods, the specific conductivity and temperature measured are those of the lagoon water, these measurements make it possible to qualify the physico-chemical properties of the salty water infiltrated by the karst spring during disruptive events.

3.2. Lagoon data

The lagoon water level dataset is contained in the Thau_Lagoon.xlsx file, which contains two excel sheets. The first excel sheet named “WaterLevel” contains the hourly data of the lagoon water levels measured at the H-lagoon site (Fig. 1, Table 1). The data is expressed in meters above sea level. Measured lagoon water level fluctuations were repeatedly checked at the reference point using a manual water level gauge. The second excel sheet contains the raw salinity and temperature data measured at station 104-P-0001 [1] acquired on a weekly time step which can be used to estimate the variations of the water density in the lagoon. Interpolated data to daily time steps are also reported (period from 01/01/2017 to 12/26/2022).

3.3. Groundwater

The groundwater dataset is contained in the Thau_karst_groundwater.xlsx file, which has 9 sheets, one for each of the following stations referenced in Table 1 (BSS002JCUL; BSS002JEKD;

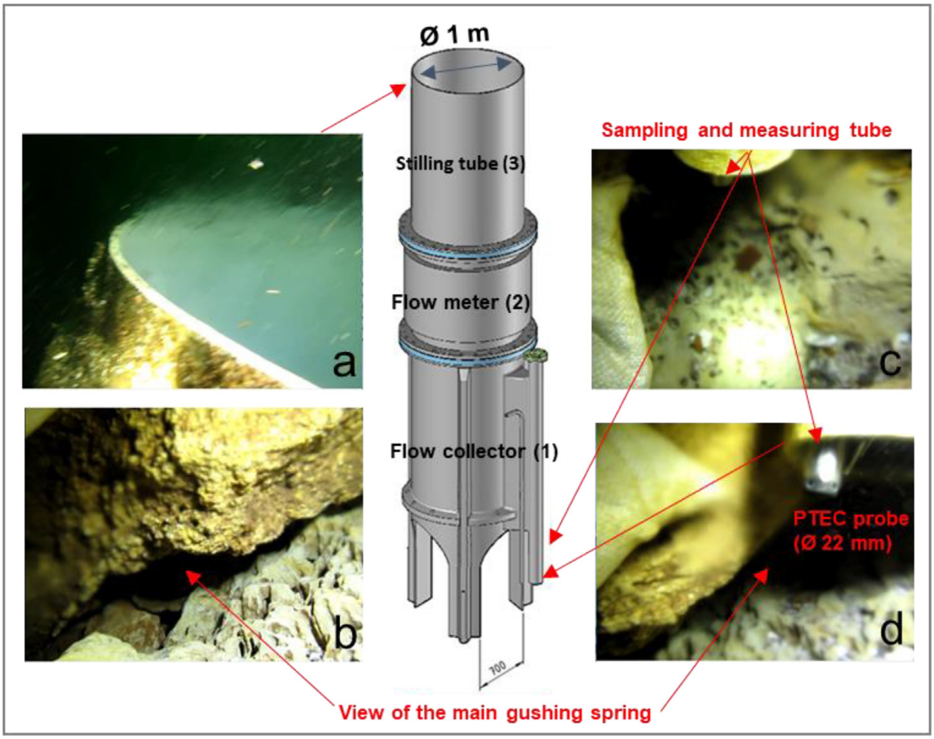


Fig. 4. Details of the design of the device used to collect and measure the flow rate at the submarine spring composed of (1) a flow collector, (2) an electromagnetic flowmeter, and (3) a stilling tube. This figure also presents underwater photographs of the main griffin from the spring (b), two views (c, d) of the measuring tube located in the immediate vicinity of the griffin (the PTEC probe is visible and provides the space scale). View (a) shows halocline when the fresh groundwater flowing out of the stilling tube meets the salty-water from the lagoon.

BSS002JDNJ; BSS002JDVA; BSS002JDXA; BSS002JDNH; BSS002JEHM; BSS002JEKE; BSS004AXZH). Each sheet contains piezometric data (expressed in m.a.s.l) between 01/01/2017 and 12/31/2022 for the longest time series (Fig. 6, Table 2). With the exception of point BSS002JEKD, the sheets also provides the groundwater temperature and specific conductivity data. Information on the depth of the measurement probe is indicated into the metadata section of each excel sheet.

4. Experimental Design, Materials and Methods

4.1. Description of the submarine spring flow context

The Vise submarine spring (BSS002JDMR) located in the Thau lagoon (southern France) is one of the most important natural outlets of the Jurassic karstified limestone aquifer [2], the other overflow outlets of the karst aquifer being the springs of Cauvy (BSS002JDNJ), Ambressac (BSS002JECB) and Issanka (BSS002JCUL) located onshore on the peninsula of Balaruc [3].

The submarine spring flows into the Thau lagoon at a depth of 29.5 m [4], at the level of a bench of shell limestone attributed to the Miocene [2] (Fig. 3). The main spring emerges from a shell limestone slab and has a rectangular orifice of reduced size (1.2 m x 0.18 m to 0.25 m, Fig. 4b). The opening seems to extend in depth following a circular conduit 0.5 m - diameter, explored over a few meters depth (4-5 m) only.

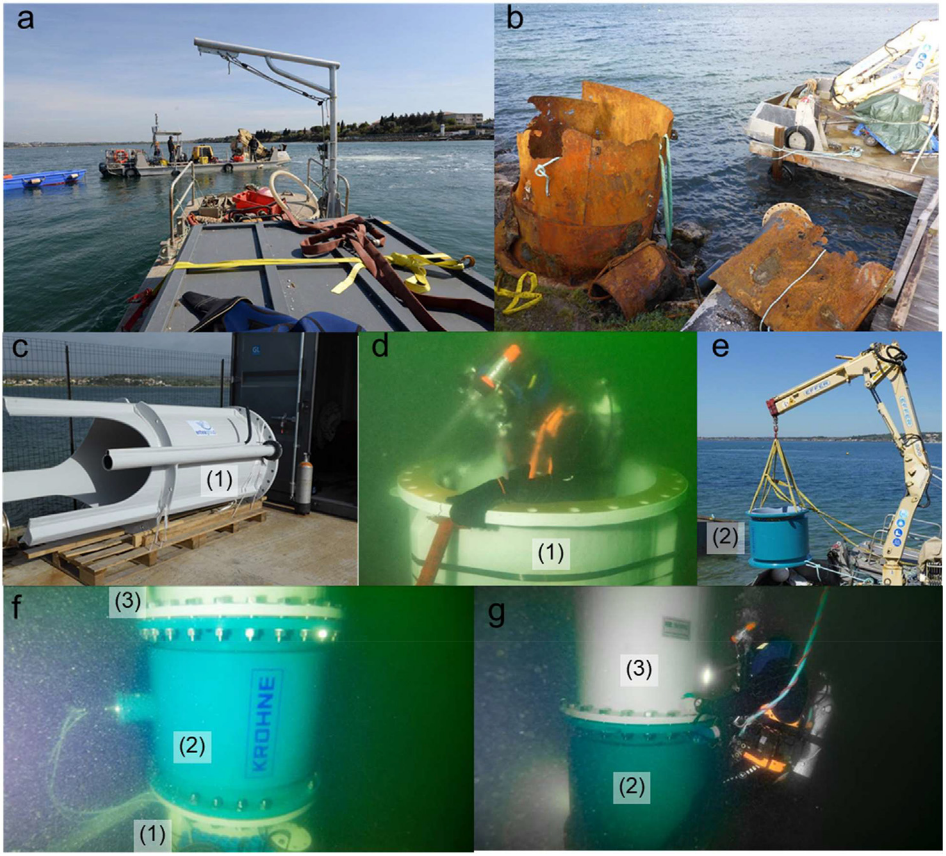


Fig. 5. Collection of the different views taken during the stages of the installation site. (a) placement of the barges directly above the spring. (b) view of the old metal nozzle that was present on the submarine spring. (c) view of the lower part (flow collector, 1) of the new device. (d) view of a diver installing the water collector on the underwater spring. (e, f) view of the electromagnetic flowmeter(2). (g) view of the stilling tube (3) installed above the flowmeter (2).

4.2. Description of the experimental device

4.2.1. Preparatory work around the sub-marine spring

All the underwater operations were carried out from two work barges by a team of three professional divers assisted by a pilot (Fig. 5a). A silt-removal operation using a sucker tool and the installation of a metal formwork (2m x 2m) around the submarine spring was done to facilitate the removal of the old metal nozzle and the installation of the experimental device on the submarine spring (Fig. 3, Fig. 4, Fig. 5g).

4.2.2. Description of the experimental device

Following the diving surveys carried out in May 2018, a fiberglass water collection device was designed to replace the old, totally corroded metal nozzle (Fig. 5b) which had been installed in the 1980s for spring capture [3].

The new water collector (Fig. 5c) installed in May 2019 has the following characteristics:

- One-piece tube in vinyl ester with molding appearance gel coat, smooth inner face and raw outer face of gelcoat;

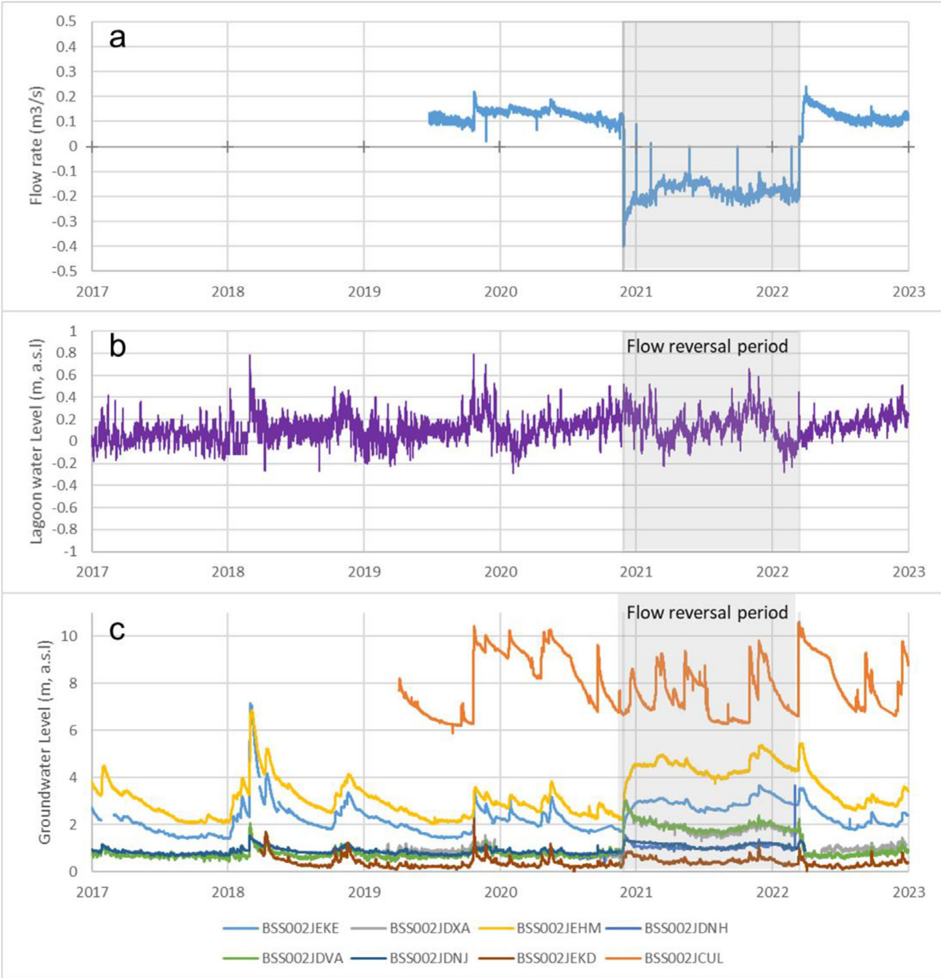


Fig. 6. (a) hourly average flowrate of the Vise submarine spring, (b) hourly water level of the Thau lagoon, (c) piezometric levels measured in the boreholes of the karst aquifer. The gray frame indicates the period of flow reversal.

- White color;
- Diameter: 1016 mm, height 2700 mm (with three arches of 700 × 700 mm at the base), thickness 12 mm, with flange DN 1000 mm PN 6 bars in the upper part;
- PVC side tube with DN 100 flange, shrunk and secured to the central tube; this tube is intended to receive the measurement probes;
- Lateral tube in PE DN 32 mm, shrunk and made integral with the central tube, this tube serves as a suction tapping at the right of the griffin for a pump installed on the ground for water sampling.

To meet the constraints of immersion, the absence of moving parts, and the absence of constriction to allow the passage of a diver, only flow measurements by ultrasound or electromagnetism could reasonably be considered. We opted for an electromagnetic flowmeter which is more compact, measures in both directions (i.e. inflow or outflow) and allows an accuracy of around 5%. The model installed was supplied by the Krohne company (Fig. 5e, f).

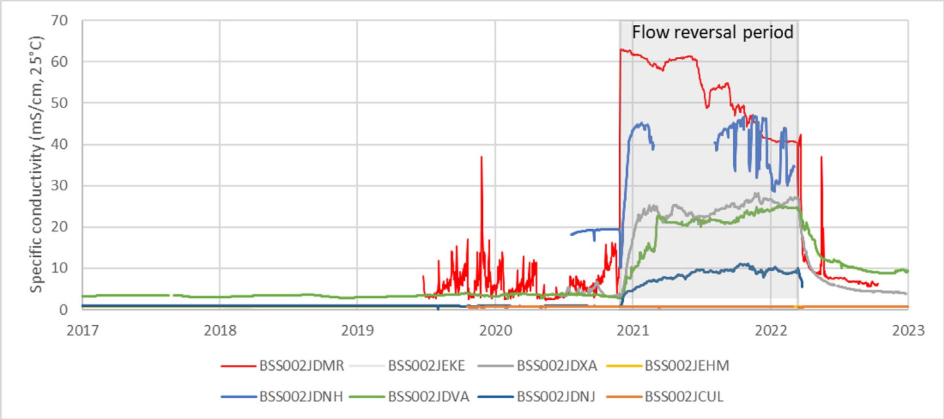


Fig. 7. Specific conductivity (daily mean) of the water measured in the boreholes of the karst aquifer, on shore springsand at the Vise submarine spring (BSS002JDMR). The gray frame indicates the period of flow reversal.

The model delivered by Krohne has the following characteristics:

- Optiflux 4300W model waterproof flowmeter with waterproof connectors,
- diameter DN 1000 mm,
- remote electronics on land and connected to the flowmeter by two cables of 180 m with waterproof connectors,
- measurement range that can reach a flow in both directions from 0 to 20,000 m^3/h adjusted on site from 0 to 5,000 m^3/h,
- A DN 1000 mm fiberglass upper stilling 1.5 m high tube was then placed above the flow meter -(Fig. 5e, f).

4.2.3. Installation of the experimental measuring device

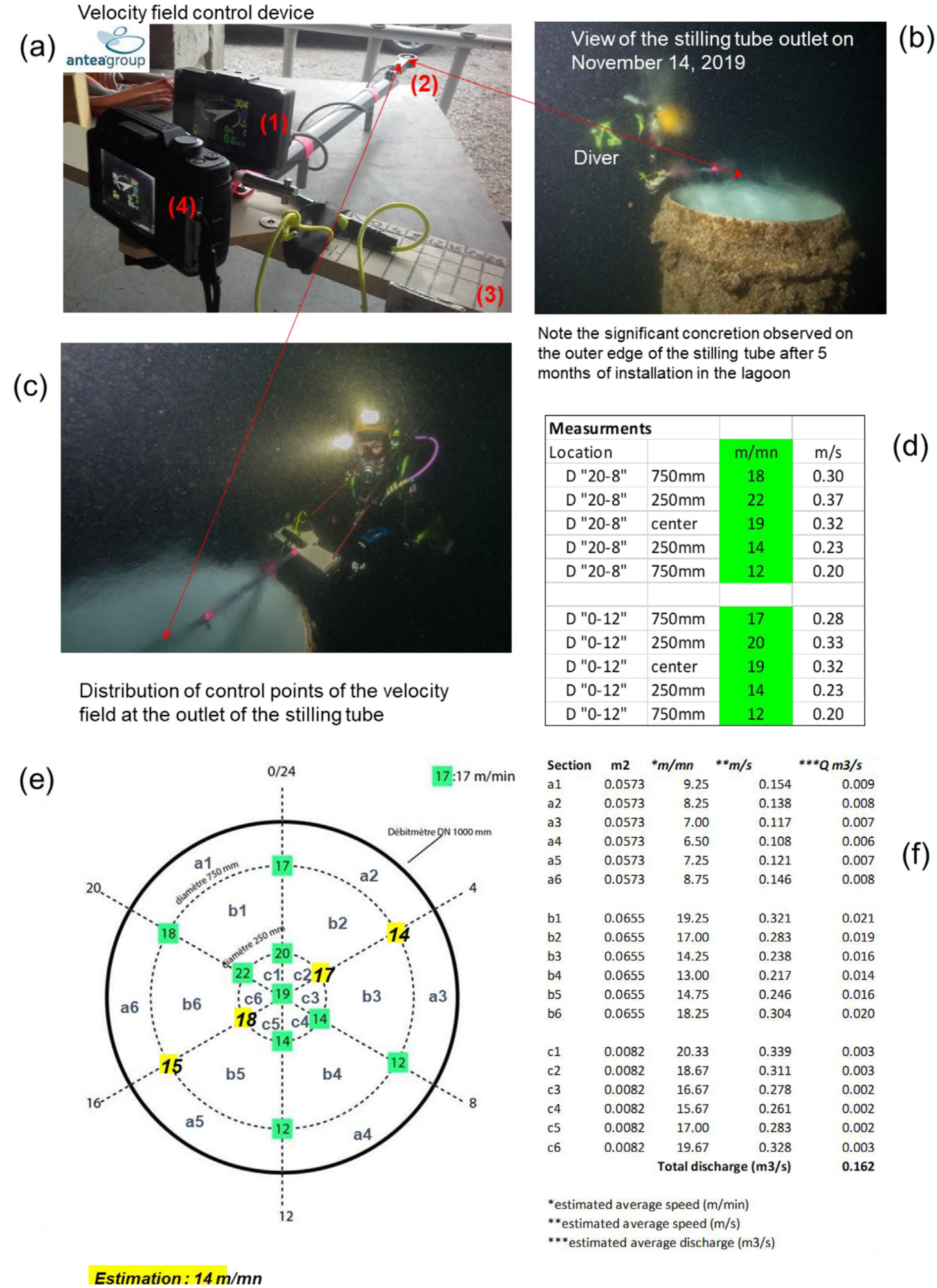
To ensure the stability and water tightness of the system, one m3 of concrete was poured around the collector. The filling of the void around the water collector was then carried out with gravel and the materials previously extracted during the desilting. These various works represented a cumulative diving time of 51 hours.

After installing the flowmeter, two level-conductivity-temperature probes were placed in the DN 100 mm tube in order to measure these variables in line with the griffin, at a depth of 29.55 m. These probes have been duplicated to ensure redundancy intended to reinforce validation and secure measurements. The characteristics of the probes are as follows (type OTT PLS C): Pressure range: 0-40 m of water; Temperature range -5/+45°C; SpC range 0-100 mS/cm.

Cables and hoses between the spring and the shore were fixed on concrete pads to ensure their ballast then buried under 0.3 to 0.5 m of sediments. These four cables and hoses approximately 180 m long are distributed as follows: 32 mm diameter HDPE tube for water sampling, 50 mm diameter corrugated PELD sheath for the power supply cable and the flowmeter measurement cable, PELD corrugated sheath diameter 50 mm for the two OTT-PLC probes. A 2 m^3/h vacuum pump was installed to ensure on-demand sampling of water from the Vise in order to be able to carry out water sampling and manual control measurements.

All cables from the experimental device were connected in an electrical cabinet which includes the following parts: the necessary electrical protections; the electronic box of the flowmeter; an OTT NetDL measurement unit equipped with a GPRS modem and the following inputs: 6 inputs 4–20mA; 1 RS485 SDI12 input.

The measuring station was programmed to communicate the rawdata to a BRGM data server. Flow, level, SpC and temperature recording and remote transmission began on June 25, 2019.



Measurments			
Location		m/mn	m/s
D "20-8"	750mm	18	0.30
D "20-8"	250mm	22	0.37
D "20-8"	center	19	0.32
D "20-8"	250mm	14	0.23
D "20-8"	750mm	12	0.20
D "0-12"	750mm	17	0.28
D "0-12"	250mm	20	0.33
D "0-12"	center	19	0.32
D "0-12"	250mm	14	0.23
D "0-12"	750mm	12	0.20

Section	m2	*m/mn	**m/s	***Q m3/s
a1	0.0573	9.25	0.154	0.009
a2	0.0573	8.25	0.138	0.008
a3	0.0573	7.00	0.117	0.007
a4	0.0573	6.50	0.108	0.006
a5	0.0573	7.25	0.121	0.007
a6	0.0573	8.75	0.146	0.008
b1	0.0655	19.25	0.321	0.021
b2	0.0655	17.00	0.283	0.019
b3	0.0655	14.25	0.238	0.016
b4	0.0655	13.00	0.217	0.014
b5	0.0655	14.75	0.246	0.016
b6	0.0655	18.25	0.304	0.020
c1	0.0082	20.33	0.339	0.003
c2	0.0082	18.67	0.311	0.003
c3	0.0082	16.67	0.278	0.002
c4	0.0082	15.67	0.261	0.002
c5	0.0082	17.00	0.283	0.002
c6	0.0082	19.67	0.328	0.003
			Total discharge (m3/s)	**0.162**

*estimated average speed (m/min)
**estimated average speed (m/s)
***estimated average discharge (m3/s)

Fig. 8. (a) View of the device specially developed to performed punctual velocity controls at the outlet of the stilling tube [1: *Seacraft ENC underwater navigation unit*, 2: *flow velocity sensor*, 3: *underwater slate*, 4: *waterproof camera*]. (b, c) Diver performing a velocity control measurement at the outlet of the stilling tube. d) Results of velocity measurements. (e) Location of velocity measurement and estimation points. (f) Estimation of the flows of the different sections from estimated velocity, estimation of total discharge of submarine spring.

4.3. Verification of the submarine flow measured by the experimental measuring device

The Krohne electromagnetic flowmeter has been factory calibrated by the manufacturer, the absolute uncertainty is less than 5%. After the installation in the marine environment, we imagined an experiment to check the proper functioning of the experimental device.

The control of the velocity field at the outlet of the experimental device's stilling tube was carried out using a device specially developed within the framework of this project (Fig. 8a). The device is made up of a Seacraft ENC underwater navigation unit (1) equipped with a speed sensor (2) initially developed to record the movement of a diver underwater (azimuth, depth, distance). The flow velocity sensor is set at the end of a bar with marks in order to more easily position the measurement points at the outlet of the stilling tube. The measurements from the central (1) are noted by the diver on an underwater slate (3) and also filmed by a small waterproof camera (4).

The velocity field control measurements allow to estimate the order of magnitude of the flows from the submarine source (0.16 m^3/s on November 14, 2019). These measurements are used to validate the data produced by the electromagnetic flowmeter, the average daily flow being 0.139 m^3/s (+/- 0.007) on November 14, 2019.

4.4. Data collection and result synthesis

The raw data collected at the submarine spring of the Vise and within the groundwater observatory are stored in the Hydras 3 software (OTT company). The exports in excel were carried out in order to present the results (Vise_Submarine_Spring.xlsx, Thau_karst_groundwater.xlsx) in the Mendeley repository directory. The calculations of the hourly average values and the associated standard deviations were carried out with used of dynamic pivot tables of Excel.

Ethics Statements

Authors have read and follow the ethical requirements for publication in Data in Brief. This work meets these requirements and authors confirme that the current work does not involve human subjects, animal experiments, or any data collected from social media platforms

Data Availability

Dataset on onshore groundwaters and offshore submarine spring of a Mediterranean karst aquifer during flow reversal and saltwater intrusion (Original data) (Mendeley Data)

CRediT Author Statement

B. Ladouche: Conceptualization, Methodology, Funding acquisition, Data curation, Writing – original draft; **J.C. Maréchal:** Writing – review & editing; **C. Lamotte:** Conceptualization, Methodology, Writing – review & editing, Project administration; **V. Durand:** Conceptualization, Methodology; **V. Bailly-Comte:** Conceptualization, Methodology, Writing – review & editing; **V. Hakoun:** Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This work is part of the Dem'Eaux Thau Project, funded by: European Community, French State, Région Occitanie, Agence de l'Eau RMC, SMBT, City of Balaruc-Les-Bains, Montpellier Méditerranée Métropole and BRGM.

References

[1] Grondin Evans, Fari Chloe, Duval Magali, SURVAL, Plaquette explicative à l'usage des utilisateurs de SURVAL (2022), doi:10.13155/89133.
[2] F. Widhen, M. Séranne, G. Ballas, P. Labaume, E. Le-Ber, P. Pezard, F. Girard, C. Lamotte, B. Ladouche, Long-term evolution of a carbonate reservoir submitted to fresh, saline and thermal waters interactions – Jurassic carbonates in the coastal area of the Gulf of Lion margin (southern France), BSGF 194 (7) (2023) Page 25, doi:10.1051/bsgf/2023005.
[3] Ladouche B., Lamotte C., Hemelsdael R., Pétré M.A., Dewandel B., Léonardi V., Seidel J.L., Seranne M. DEM'Eaux Thau - Synthèse et valorisation préliminaire des données sur l'hydrosystème de Thau (34). BRGM/RP-68483-FR. http://infoterre.brgm.fr/rapports/RP-68483-FR.pdf.
[4] Courtois et Ladouche, Projet PANACHE – Mesures sur la source sous-marine de la Vise, étang de Thau, Compte-rendu des 2 campagnes de terrain 2004 et 2005 (2005) BRGM/RP-53840-FR http://infoterre.brgm.fr/rapports/RP-53840-FR.pdf.
[5] B. Ladouche, J.-C. Maréchal, V. Hakoun, B. Dewandel, P. Perrochet, C. Lamotte, Inversac de la Source Sous-Marine de la Vise sous la Lagune de Thau: Mécanisme et Modélisation, 2022 Rapport final. BRGM/RP-70839-FR http://infoterre.brgm.fr/rapports/RP-70839-FR.pdf.
[6] B. Ladouche, M. Seranne, V. de Montety, C. Ranchoux, B. Dewandel, V. Hakoun, J.-C. Maréchal, C. Lamotte, P. Pezard, E. Le Ber, A. Temani, D. Neyens, N. Brillouet, R. Hemelsdaël, M.A. Pétré, H. Camus, F. Widhen, M. Hery, J.L. Seidel, V. Léonardi, V. Bailly-Comte, N. Coppo, DEM'Eaux Thau: Rapport de synthèse final, 2023 Rapport final. BRGM/RP-72479-FR http://infoterre.brgm.fr/rapports/RP-72479-FR.pdf.
[7] M.A. Pétré, B. Ladouche, J.L. Seidel, R. Hemelsdaël, V. de Montety, C. Batiot-Guilhe, C. Lamotte, Hydraulic and geochemical impact of occasional saltwater intrusions through a submarine spring in a karst and thermal aquifer (Balaruc peninsula near Montpellier, France), Hydrol. Earth Syst. Sci. 24 (11) (2020) 5656–5672, doi:10.5194/hess-24-5655-2020.