DATA PAPER

Patos Lagoon, Brazil, Suspended Particulate Matter (SPM) data compendium

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Abstract
Patos Lagoon is the largest choked coastal lagoon in the world (250 km long, 40 km wide and mean depth of 5 m), with banks formed by sand and predominantly muddy bottom. The circulation is mainly driven by wind and river flow, with a minor contribution of the local microtidal regime. This lagoon is one of the most studied coastal water bodies in Brazil. The Patos Lagoon suspended particulate matter (SPM) data compendium consists of over four decades (1978–2019) of SPM data gathered from multiple research and monitoring projects. Data consist of SPM in situ samplings, remote sensing derived SPM estimates, rating curve approach for SPM estimates and SPM derived from turbidity measurements. Only measurements with a detailed description of the sampling and analysis protocols were used. The present data set offers valuable contributions as it allows the assessment of trends on the data and the short- and long-term spatial and temporal variability of SPM concentrations in an area where permanent monitoring stations are not available. From these records, the SPM concentrations ranged from 0.4 g/m³ up to 1,000 g/m³. The Patos Lagoon SPM Compendium has been made publicly available at Tavora, Fernandes and Möller (2020).

KEYWORDS
Patos Lagoon, SPM compendium, suspended particulate matter

Dataset
Identifier: https://doi.org/10.1594/PANGAEA.920899
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM in situ data in the estuary of Patos Lagoon - ANA (1978-2019)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920917
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM in situ data in the estuary of Patos Lagoon - 'Material em Suspensão' Project (1979-1986)
Publisher: PANGAEA
Publication Year: 2020
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Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920904
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)

Title: SPM in situ data along Patos Lagoon - 'Espinha de Peixe' Project (1986)
Publisher: PANGAEA
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Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920911
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)

Title: SPM in situ data along Patos Lagoon - 'Lagoa dos Patos' Project (1987-1989)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920900
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)

Title: SPM in situ data in Camaquã River and Guaíba River - Baisch (1988-1990)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920907
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)

Title: The rating-curve approach derived SPM in Guaíba River and Camaquã River from monthly river discharge data - Jung (1988-1990)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920906
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)

Title: SPM in situ data in Patos Lagoon Estuary - 'Laboratório de Hidroquímica' (1989-1991)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920918
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)

Title: SPM in situ data in Patos Lagoon estuary and adjacent continental shelf - PLATES (1992-1993)
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Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920922
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM in situ data from the Rio Grande Channel to the Guaiaba River basin and its tributaries: Rivers Jacuí, Cai, Rio dos Sinos, and Gravataí - SARPOA (1994-1996)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920905
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM in situ data at Patos Lagoon estuary in 4 stations: Feitoria, Marambaia, Praticagem, and Porto Rei - Fernandes (1998)
Publisher: PANGAEA
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Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920913
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM in situ data along Patos Lagoon - 'Pró-Mar de Dentro' Project (1998-2000)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920903
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM in situ data in Patos Lagoon estuary - ECOSUD (2002-2004)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920902
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM derived data using a local established statistical relationship between turbidity and SPM in situ in Guaiaba River - DMAE (2003-2013)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920915
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
Title: SPM estimates derived from MODIS-aqua data along Patos Lagoon - MODIS (2003-2019, Nechad et al. 2010)
Publisher: PANGAEA
Publication Year: 2020
Resource Type: Metadata document
Version: 1.0
Identifier: https://doi.org/10.1594/PANGAEA.920914
Creator: Tavora, J; Fernandes, EHL; Möller Jr, OO (2020)
1 | INTRODUCTION

Coastal regions are among the most vulnerable areas to climate change impacts, with direct susceptibility to catastrophic meteorological and oceanographic events from both oceans (e.g. tropical and extra-tropical cyclones) and land (e.g. extreme fluvial discharges). These events impact several national security issues due to the occurrence of higher waves and rising sea level at the coast, more substantial precipitation producing floods and severe wind conditions. An increase in precipitation produces severe impacts at the coast and drainage basin, increasing the suspended particulate matter (SPM) concentrations from terrestrial discharge transported towards the coast. This process tends to be reinforced in areas of unsustainable farming due to bank erosion. Thus, understanding the long-term variability of SPM concentrations in coastal areas is a major concern. Conventional methodologies to monitor SPM concentrations in coastal waters use field-based approaches, which are limited in space and time, expensive to install and maintain, and some of the produced data get lost over time. These limitations become particularly important in developing countries, resulting in a poor understanding of the long-term spatial and temporal variability of SPM concentrations and their consequences. The lack of this data makes it impossible to predict how coastal areas will respond to long-term climate changes and how we can mitigate these effects. Patos Lagoon, located in southern Brazil (Figure 1), is no exception. Although (and also because) it is the largest choked coastal lagoon in the world (Kjerfve, 1986), no permanent SPM monitoring stations are available. The lagoon has an area of 10,000 km² and a single connection to the Atlantic Ocean (700 m wide) at its southern limit, which is fixed by 4 km long jetties (Silva et al., 2015). The Lagoon drains a basin of 200,000 km², hosting 260 towns and cities and a population of 7,000,000 inhabitants. The main tributaries to the lagoon are (1) Guaíba River, (2) Camaquã River and (3) the São Gonçalo Channel (Figure 1). The latter is 76 km long and connects the Mirim and Patos lagoons, where the flow is controlled by a dam, and runs only towards Patos Lagoon (Oliveira et al., 2015; Oliveira, 2019). Coastal water influence in the lagoon occurs mainly in the lower 60 km from the lagoon’s mouth, defining the Patos Lagoon Estuary (Figure 1). The lagoon main body is mostly freshwater, although salinity can occur as far as 100 km from the mouth after prolonged droughts.

These tributaries impose a seasonal runoff pattern typical to mid-latitudes, with high discharges in austral winter and late spring and low discharges during austral summer and fall (Marques et al., 2009), but also present interannual variability associated to ENSO cycles (Távora et al., 2019), which result in higher (El Niño) or lower (La Niña) freshwater discharge and residence times in the lagoon (Fernandes et al., 2002). The mean freshwater discharge is 2,400 m³/s. During El Niño years, the mean discharge is around 3,300 m³/s, but it can reach up to 12,000 m³/s (Moller et al., 1996), while in La Niña years the discharge is down to 1,700 m³/s (Vaz et al., 2006).

The coastal tidal regime is microtidal with a mean range of 0.23 m (Moller et al., 2001) and has little influence on the lagoon circulation (Fernandes et al., 2004; Moller et al., 2001). As the tidal amplitude is small, the combined effect of wind and freshwater water contribution becomes important in controlling the dynamics of the system. Möller and Castaing (1999) and Moller et al. (2001) explained that when the freshwater discharge is larger than 2,000 m³/s⁻¹, it controls the dynamics of the system, whereas, during smaller continental contribution periods, the wind effect becomes important (Fernandes et al., 2002). The combination of local and remote wind effects is determinant to establish exchanges between the estuary and coast, resulting in variable estuarine limits (Odebrecht et al., 2005). In this region, winds shift from NE to S-SW due to cold front passages (Moller et al., 1996) occurring in intervals between 5 and 15 days, and winds from the NE are prevalent throughout the year (Moller et al., 2001). The NE-SW wind regime is responsible for saltwater intrusion and extrusion in the estuarine zone (Bitencourt et al., 2020; Moller et al., 2001) and for vertical salinity structures (Möller & Fernandes, 2010), since its NE-SW shifts results in seaward (NE) or landward (SW) flows due to longitudinal pressure gradients established from the Ekman Transport direction (Moller et al., 2001).

The morphological and sedimentological features of Patos Lagoon have been described by Hartmann and Schettini (1996), Toldo et al. (2006) and Calliari et al. (2009). The bottom sediments are distributed as sandy sediments in the lagoon’s margins (5 m isobath) and muddy sediments (silt and clay) in deeper portions (central regions and channels). Recently, Bortolin et al. (2020) identified the geographic position of mud depocentres in the main lagoon as a result of hydrodynamic conditions. Silt (80%) and clay (15%) are the main sediment types observed in suspension in Patos Lagoon, and they come from the watershed and from wind-wave resuspension (Toldo et al., 2006). Each of the Patos Lagoon tributaries is responsible for flushing different types of sediments in suspension, with different particle sizes, shapes and mineralogy into the Lagoon (Ivanoff, 2020; Toldo, 1994).
During the transport throughout the lagoon, this material in suspension gradually deposits, with the coarser material being deposited near the head, and the finer material being gradually transported and deposited along the lagoon and estuary as a function of hydrological conditions (Hartmann & Schettini, 1996). This material eventually reaches the coastal area through the Patos Lagoon coastal plume (Fassoni-Andrade et al., 2015; Marques et al., 2010; Pagot et al., 2007) or deposit at the coast creating muddy facies (Calliari et al., 2009; Toldo, 1989).

Calliari et al. (2009) affirm that a considerable fluvial input of fine suspended sediments from the drainage basin accumulates in the estuary from a variety of sources. The SPM concentrations depend firstly on the freshwater discharge from the main tributaries, as well as on the entrance of saltwater which, depending on its intensity, can

**FIGURE 1** Patos Lagoon, Brazil. The three main tributaries are shown: Guaíba River, Camaquã River and São Gonçalo Channel (SGC). POA stands for Porto Alegre city, the biggest city surrounding the lagoon, and RG (Rio Grande City), where the Port of Rio Grande is established. Dashed line represents the estuarine upper boundary. Within the estuarine limits are also highlighted: SJ (Saco do Justino), MB (Mangueira Bay), AS (Arroio Simão), Praticagem Station (inside the Port of Rio Grande) and the Patos Lagoon inlet.
induce sediment resuspension as well as promote flocculation. The lagoon’s SPM concentration values range from about 10 gm\(^{-3}\) to over 700 gm\(^{-3}\) depending on the year (e.g. Hartmann & Schettini, 1996; Paim & Möller, 1986). However, SPM concentrations up to 1,000 gm\(^{-3}\) have been recorded at the Guaíba River mouth when heavy precipitation events coincide with NE winds. Dredging in the access channel to the Port of Rio Grande, in the lower estuary (Figure 1), is another aspect of the sedimentary dynamics. Every two years about 3,000,000 m\(^3\) of deposited particulate matter is dredged from the navigation channel (Bemvenuti, Angonesi & Gandra, 2005). The last two dredging operations occurred in 2013 (1,600,000 m\(^3\)) and 2019–2020 (18,000,000 m\(^3\)) (Fernandes et al., 2021). A large system like Patos Lagoon strongly driven by stochastic forcing (river discharge and wind) naturally presents complex variability from year to year and throughout different regions. The effort of gathering, recovering, homogenizing and making available the suspended particulate matter (SPM) sampling efforts in Patos Lagoon was long overdue. In the process, data were digitized or transcribed from long-dead research projects and specific monitoring and sampling efforts, chronologically ordered and checked for quality and discrepancies. It resulted in a broad temporal (i.e. 41 years) and spatial coverage now available for the entire academic community.

The long-term data set presented here represents an important baseline for future studies, providing clear indications for future monitoring strategies and potential information for preliminary responses on the fluxes from land to sea and their relationship with large-scale events due to climatic changes or anthropogenic impacts.

2 | DATA DESCRIPTION AND DEVELOPMENT

Data have been collected from the north (Guaíba River) to the south of the lagoon (up to the mouth of the estuary), although most data sampling was concentrated in the estuarine area (Figure 1). The data were compiled from over seventeen sources, each described in Section 2.1. The compiled observations cover the period between 1978 and 2019. Data sets were obtained from archives that incorporated data from multiple contributors, mainly particular measurement programmes and research projects, and were subsequently homogenized and merged. Data contributors are listed in Table S1.

There were small methodological differences between the data sets. After data acquisition, quality control procedures were performed based on the method used by Valente et al. (2016). It consists of checking for discrepancies and consistency (e.g. grouping and pre-processing data sets to ensure they are in a standard format and unit). During this process, data were discarded if they had (a) missing date (i.e. year, month and day), missing time and geographic coordinate fields; and (b) replicates (i.e. multiple observations with the same variable, date, latitude, longitude and depth). If replicates were found, only one observation was retained.

After all data were verified, they were grouped by project (e.g. ‘Material em Suspensão’ project), publication (e.g. Baish) or laboratory responsible for the data set (e.g. ‘Laboratório de Hidroquímica’ in the final data set. The compiled data were compared with the original data sets to certify that no errors occurred during merging. Also, during the compilation and quality control stage, two metadata strings were attributed to each observation: project or authors publication and year of data acquisition. The data set contains the name of the original data set and the year of data acquisition, in the format<dataset>-<start year>-<end year> (e.g. ECOSUD-2002-2004). Refer to Table 1 for units and symbols used in this compendium. Data campaigns and stations are also following string formats. Those, however, follow naming established by the project or author.

2.1 | Description of data sets

This section presents an overview of projects and initiatives composing the Patos Lagoon SPM compendium (Tavora et al., 2020). Most data sets were sampled with different research purposes covering different stations in the lagoon, with a more extensive sampling effort at the estuary. Figure 3 shows the stations at which data were collected, and Table 2 summarizes data collection by data set (i.e. instruments used and method of data acquisition). Additional information regarding environmental conditions reported during sampling campaigns are listed in Table S2.

2.1.1 | ANA (1978–2019)

The ‘Agência Nacional de Águas’ (ANA; http://www.snrh.gov.br/hidroweb) is responsible for coordinating a national hydrometeorological network, a system that gathers about 4,641 monitoring stations in Brazil. The hydrometeorological stations are each operated by partner entities or contracted by ANA, which are responsible for planning, standardization of procedures and equipment, inspection and organization of data. A station located in Camaquã River from 1978 to 2019 is shown here, with SPM in situ data acquired by the Geological Service of Brazil (CPRM).
2.1.2 | ‘Material em Suspensão’ project (1979–1986)

This project was designed in three phases considering different regions of Patos Lagoon. Hartmann and Schettini (1991) described the procedures during Phase II (from May 1982 to December 1983, totalling 19 cruises). In situ sampling was performed in 30 stations, located mainly in three transverse sections, and water samples were collected using a modified Ottmann horizontal bottle. When local depth was greater than 3 m, surface, mid water column and bottom were sampled, and only at surface and bottom otherwise. SPM was measured gravimetrically on pre-weighted acetate cellulose filter (0.45 μm pore size). Water samples were filtered, and filters were weighted in a precision scale.

2.1.3 | ‘Espinha de Peixe’ project (1986)

Niencheski, et al. (1988) described the ‘Espinha de Peixe’ project. Cruises happened from 6 January to 3 February 1986, at which sampling cruises were carried out in 60 stations. Of these, seventeen stations were sampled in the estuary region, and the remaining were divided into E-W and N-S transects in the lagoon, thus covering all regions of the lagoon. In the E-W direction, data were obtained from margin to margin (refer to Figures 1 and 3).

Water samples were collected at the surface and near the bottom using a plastic bucket or a 3 L Ottman horizontal bottle. SPM analysis were carried out by ‘Laboratório de Hidroquímica’ at ‘Universidade Federal do Rio Grande (FURG)’. SPM was measured gravimetrically on pre-weighted Gelman GA (0.45 μm pore size) filters. After quality assessment of data, only January 1986 data were kept in the compendium.

2.1.4 | ‘Lagoa dos Patos’ project (1987–1989)

Another study of the dynamics and structure of Patos Lagoon led to the ‘Lagoa dos Patos project’. Chemical and SPM evaluations of that project were made available in a MSc. Dissertation by Vilas Boas (1990) and study by Hartmann and Schettini (1996). Data were acquired between December 1987 and December 1988 in nineteen stations along the lagoon. The project was composed of monthly expeditions with the goal of studying distribution and behaviour of parameters affecting water quality. A total of thirteen monthly cruises were carried out from North to South of the lagoon. Stations were located in the navigational channel, and samples were obtained at the surface, mid water column and bottom. All SPM samples were acquired using the methodology by Aminot and Chaussepied (1983).

2.1.5 | Baish (1988–1990)

The objective of Baish (1994) PhD. research was to study the environmental behaviour and impact of trace metal elements, SPM, particulate organic carbon and particulate organic nitrogen fluxes from rivers to the Patos Lagoon system. SPM presented here was obtained from May 1988 to August 1990 for Camaquã River and from January 1988 to June 1990 for Guaíba River following the methodology proposed by Aminot and Chaussepied (1983).

2.1.6 | Jung (1988–1990)

Jung (2017), MSc., research used the sediment rating curve approach to derive SPM concentrations from riverine outflow at Guaíba River (from 1988 to 1990), Camaquã River (1988–1990) and São Gonçalo Channel (2009–2014). The method assumes uniform flow in the water column; therefore, SPM estimates are considered uniform from surface to bottom. The author’s work used monthly averaged SPM field data from ANA (see Section 2.1.1), Baish (1994) (see Section 2.1.5) and Ávila (2013) (data set not available) to calibrate its rating curve equation. The SPM data presented here are the information estimated from the monthly riverine outflow for Guaíba and Camaquã Rivers. Jung (2017) rating curve equations and calibrated coefficients were later published by Jung et al. (2020).

2.1.7 | ‘Laboratório de Hidroquímica’ (1989–1991)

As an initiative of the ‘Laboratório de Hidroquímica’, at ‘Universidade Federal do Rio Grande (FURG)’, water sampling cruises were carried out in the Patos Lagoon estuarine area. This data set is composed of groups of data made available by Niencheski and Windom (1994) and Baumgarten et al. (2001).
**TABLE 2** Summary of data collection methods

| Data set                  | Instrument                                      | Method                                                                                                                                                                                                 |
|---------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ANA (1978-2019)           | –                                                | Water samples were filtered with the aid of a vacuum pump with pre-weighed cellulose acetate filters (0.45 μm pore size and 45 mm in diameter). SPM concentration was the result of the difference in weight of the filter before and after filtration. A Metler H-54 analytical scale with 0.01 mg accuracy was used. |
| ‘Material em Suspensão’   | Water sampling with modified Ottoman horizontal   | SPM was measured gravimetrically on pre-weighted acetate cellulose Gelman GA (0.45 μm pore size, 47 mm diameter) filters. After procedures, filters were dried at 75°C and re-weighted.                                     |
| project (1979-1986)       | bottle                                           |                                                                                                                                                                                                          |
| ‘Espinha de Peixe’ project| Water sampling with plastic bucket or a 3 L      | SPM was measured based on methodology described by Aminot and Chaussepied (1983): gravimetrically on pre-weighted acetate cellulose Gelman GA (0.45 μm pore size and 45 mm diameter) filters. After procedures, filters were dried. A Metier H-54 analytical scale with 0.01 mg precision was used. |
| (1986)                    | Ottoman horizontal bottle                        |                                                                                                                                                                                                          |
| ‘Lagoa dos Patos’ project | Water sampling with plastic bucket               | SPN was measured as recommended in Aminot and Chaussepied (1983): gravimetrically on pre-weighted acetate cellulose Gelman GA (0.45 μm pore size) filters. After procedures, filters were dried. A Metier H-54 analytical scale with 0.01 mg precision was used. |
| (1987-1989)               |                                                  |                                                                                                                                                                                                          |
| Baish (1988-1990)         | –                                                | Rating curve approach for SPM estimates calculated with monthly river discharge data.                                                                                                                                                      |
| Jung (1988-1990)          | –                                                |                                                                                                                                                                                                          |
| ‘Laboratório de           | Water sampled using Van Dorn bottles (1.5 L)    | SPN was measured as recommended in Aminot and Chaussepied (1983): gravimetrically on pre-weighted acetate cellulose Gelman GA (0.45 μm pore size) filters. After procedures, filters were dried. A Metier H-54 analytical scale with 0.01 mg precision was used. |
| Hidroquímica’ (1989-1991)|                                                  |                                                                                                                                                                                                          |
| : Niencheski and Windom   |                                                  |                                                                                                                                                                                                          |
| : Niencheski et al. (1999)|                                                  |                                                                                                                                                                                                          |
| ‘Laboratório de           | Water sampled using Van Dorn bottles (1.5 L)    | SPN concentrations were estimated according to the protocols latter published by Baumgarten et al. (1996). The authors detail good practices protocol for SPM measurements. Steps are briefly described here as (1) preliminary treatment of 0.45 μm pore size acetate cellulose filters, (2) blank test, (3) water sample filtration, (4) washing the filter with distilled water for removal of NaCl, three times, (5) NaCl test which consists of dripping silver nitrate (if a white precipitate forms, repeat step (4), (6) drying and weighing the filter and (7) calculation of SPM. |
| Hidroquímica’ (1989-1991)|                                                  |                                                                                                                                                                                                          |
| : Baumgarten, Niencheski  |                                                  |                                                                                                                                                                                                          |
| : and Veeck (2001)        |                                                  |                                                                                                                                                                                                          |
| PLATES (1992-1993)        | –                                                | SPN was measured as recommended in Aminot and Chaussepied (1983): gravimetrically on pre-weighted acetate cellulose Gelman GA (0.45 μm pore size) filters. After procedures, filters were dried. A Metier H-54 analytical scale with 0.01 mg precision was used. |
| SARPOA (1994-1996)        | –                                                | SPN was measured as recommended in Aminot and Chaussepied (1983): gravimetrically on pre-weighted acetate cellulose Gelman GA (0.45 μm pore size) filters. After procedures, filters were dried. A Metier H-54 analytical scale with 0.01 mg precision was used. |

(Continues)
| Data set                        | Instrument                                                                 | Method                                                                                                           |
|-------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| *Fernandes (1998)*            | Water sampled using horizontal bottle samplers, consisting of a PVC pipe closed at the ends by rubber stoppers and released by a messenger sent from the surface | SPM concentrations were estimated according to the protocols latter published by Baumgarten et al. (1996) (see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information). |
| *Pró-Mar de Dentro* project (1998-2000) | –                                                                          | –                                                                                                                |
| ECOSUD (2002-2004)            | Surface water samples were collected using a Van Dorn bottle.                | Water samples for SPM were stored at 5°C in proper bottles and analysed using the methods described by Baumgarten et al. (1996): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| DMAE (2003-2013)              | Turbidity was acquired using a Hach model turbidimeter2100P which provides the turbidity in NTU (Nephelectric Turbidity Unit) with an accuracy of ±2% | Water turbidity and field acquired SPM acquired for this data set. With both data, a linear regression curve was established, and turbidity data were converted to SPM measurements. Initially, a solution of high SPM was elaborated from 300 litres of water from the Guaíba River. The water was stored in drums and left to stand for 24 hr After this period it was carefully siphoned, followed by the collection of the decanted material. In lab, after stirring, aliquots of this solution were diluted in different proportions, and then, turbidity and SPM of these aliquots were obtained. All readings were done in triplicates. The SPM-turbidity regression was obtained with $r = 0.98$. The analysis of the SPM was through filtration in millipore membranes of cellulose acetate with a pore size of 0.45 μm. The filters were oven dried for 24 hr at 60°C, cooled in a desiccator, weighed and stored. After filtering the samples, the drying and weighing process was repeated. The ratio of the difference in dry mass pre- and post-filtration by the filtered volume provides the SPM. The representativeness of the measured turbidity as an approximation of the SPM on the Guaíba River, was verified with 2 campaigns repeating the procedure. |
| MODIS-aqua (2003-2019)        | –                                                                          | SPM was retrieved from atmospherically corrected MODIS-aqua daily scenes using three different algorithms and results were tested against SPM field data using data sets DMAE (2003–2013) and LOCOSTE (2012–2019) |
| *Porto do Rio Grande* (2000-2018): dredging 2000 | –                                                                          | Samples were processed following methods proposed by Baumgarten et al. (1996): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| *Porto do Rio Grande* (2000-2018): 2006 | –                                                                          | Samples were processed following methods proposed by Baumgarten et al. (1996): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| *Porto do Rio Grande* (2000-2018): 2007 | –                                                                          | Samples were processed following methods proposed by Baumgarten et al. (1996): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| *Porto do Rio Grande* (2000-2018): 2008 | –                                                                          | Samples were processed following methods proposed by Baumgarten et al. (1996): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| *Porto do Rio Grande* (2000-2018): 2009 | –                                                                          | Samples were processed following methods proposed by Baumgarten et al. (1996): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
Niencheski and Windom (1994) described data obtained in cruises carried out in June and August 1989; May, June, and August 1990; and December and April 1990. Water samples were collected at twenty fixed stations along the estuary and one fixed station in São Gonçalo Channel. At each station, both surface and bottom water samples were collected using Van Dorn bottles and stored in plastic bottles. Analysis of SPM followed the procedures described in Aminot and Chaussepied (1983). More information can be found in Niencheski and Windom (1994); Niencheski et al. (1999).

Baumgarten et al. (2001) presented the data collected in a shallow and small bay (Saco da Mangueira) located in Patos Lagoon estuary. In this area, three sites were sampled:

| Data set | Instrument | Method |
|----------|------------|--------|
| ‘Porto do Rio Grande’ (2000-2018): 2010 | – | Samples were processed following methods proposed by Baumgarten et al. (1996): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| ‘Porto do Rio Grande’ (2000-2018): 2011 | – | Samples were processed following methods proposed by Baumgarten et al. (2010): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| ‘Porto do Rio Grande’ (2000-2018): 2012 | – | Samples were processed following methods proposed by Baumgarten et al. (2010): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| ‘Porto do Rio Grande’ (2000-2018): 2013 | – | Samples were processed following methods proposed by Baumgarten et al. (2010): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| ‘Porto do Rio Grande’ (2000-2018): 2014 | – | Samples were processed following methods proposed by Baumgarten et al. (2010): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| ‘Porto do Rio Grande’ (2000-2018): 2017 | – | Samples were processed following methods proposed by Baumgarten et al. (2010): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| ‘Porto do Rio Grande’ (2000-2018): 2018 | – | Samples were processed following methods proposed by Baumgarten et al. (2010): see methods in Hidroquimica-1989–1995: Baumgarten et al. (2001) for detailed information. |
| LOCOSTE (2012-2019): Ávila et al. (2014) | – | SPM estimates were calculated from a linear regression between simultaneous field measurements of turbidity and SPM. The filtration of those samples was performed following the procedures by Loring and Rantala (1992). Filtration of samples was performed through a pre-weighted 0.47-μ acetate cellulose filter. After sample filtering, filters should be rinsed, dried and re-weighted. The SPM concentration in each sample is calculated from the weight of the SPM retained on the filter and the volume of water filtered. |
| LOCOSTE (2012-2019): field campaigns carried out in 2014, 2015, 2018 and 2019 | Turbidity was measured using a JFE Advantech™ Rinko-profiler Conductivity, Temperature and Depth (CTD), while water samples were collected at the surface simultaneously to the CTD vertical profiles using a bucket. | SPM was calculated from linear regression established above using turbidity data. |
| LOCOSTE (2012-2019): Estuarina | Turbidity was measured using a JFE Advantech™ Rinko-profiler Conductivity, Temperature and Depth (CTD). | The water samples were filtered in the laboratory by applying the gravimetric method until the moment when the filter saturation was reached. A vacuum pressure pump and 45-μm cellulose nitrate filters with a diameter of 47 mm were used. The filters were weighed on a precision scale before and after filtration in order to obtain SPM. Authors followed the method described in Baumgarten et al. (2010) (same procedures for SPM as in Baumgarten et al. (1996)) in this step. |
| UFRGS (2015-2017) | The water samples were filtered in the laboratory by applying the gravimetric method until the moment when the filter saturation was reached. A vacuum pressure pump and 45-μm cellulose nitrate filters with a diameter of 47 mm were used. The filters were weighed on a precision scale before and after filtration in order to obtain SPM. Authors followed the method described in Baumgarten et al. (2010) (same procedures for SPM as in Baumgarten et al. (1996)) in this step. |
were monthly sampled for fifteen months (April 1994 to September 1995). Water sampling on the surface and bottom was executed using a Van Dorn bottle, and SPM concentrations were estimated according to the protocols latter published by Baumgarten et al. (1996).

2.1.8 | PLATES (1992–1993)

The project ‘Interação Plataforma Continental-Estuário da Lagoa dos Patos-PLATES’ established a series of campaigns for data acquisition from 1992 to 1993. Hartmann and Schettini (1996) described the PLATES series of SPM sampling expeditions in Rio Grande Channel from March 1992 to January 1993. 45 weekly samples were collected at five stations along the narrowest section of the navigational channel (about 700 m wide). Samples were obtained at surface and bottom, filtered and measured following the method described by Aminot and Chaussepied (1983).

2.1.9 | SARPOA (1994–1996)

With the intention of creating a model of interaction of nutrients and physical factors that conditioned plankton blooms in the estuaries, this project was financed by the European Economic Community (BEL) with support from the University of Dundee (UK). During the 2 years of sampling efforts (August 1994, February and September 1995, and February 1996), four expeditions were conducted on board of R/V Larus. Sampling cruises counted on nineteen stations located from Rio Grande Channel to Guaíba River basin and its tributaries (Rivers Jacuí, Caí, Rio dos Sinos, and Gravataí). The SPM samples were estimated using protocols by Aminot and Chaussepied (1983), and further information is described in Yunes et al. (1994, 1998).

2.1.10 | Fernandes (1998)

Fernandes (2001), PhD, project aimed to further understand the Patos Lagoon hydrodynamics based on the implementation of the TELEMAC model. The authors executed SPM field measurements at four stations: Feitoria, Marambaia, Praticagem (between 27 and 29 October 1998) and at Porto Rei (between 05 and 06 November 1998). SPM measurements were carried out at the surface, middle depth and bottom using horizontal bottle samplers. These consist of a simple PVC pipe closed at the ends by rubber stoppers and released by a messenger sent from the surface. Sub-samples were stored in plastic bottles for further filtration and determination of SPM content. Samples were filtered through CA filters of 45 µm pore size as described in Baumgarten et al. (1996).

2.1.11 | ‘Pró-Mar de Dentro’ project (1998–2000)

A very comprehensive study of the Patos Lagoon was carried out by the ‘Pró-Mar de Dentro’ Project. During the period between February 1999 to January 2000, twelve sampling expeditions were performed (i.e. eight stations were established in the Patos Lagoon main axis, three stations in the main tributaries – Guaíba River, Camaquã River, and São Gonçalo Channel, and one station in the inner continental shelf, just outside the Patos Lagoon inlet). Data and results were reported in the year 2000 by a partnership with ‘Japan International Cooperation Agency’ (JICA), the project sponsor.

2.1.12 | ECOSUD (2002–2004)

This data set was acquired in a research programme funded by the European Commission known as ECOSUD (Estuaries and Coastal Areas: Basis and Tools for a more Sustainable Development) and is described in the work of Niencheski and Baumgarten (2007). It includes the realization of four field campaigns (one every season). The research campaigns were conducted in Mangueira Bay and the southern estuarine portion of Patos Lagoon (i.e. Rio Grande Channel) in order to obtain SPM during contrasting salinity conditions in October 2002, June 2003, December 2003 and April 2004. At each station, surface samples were collected using a Van Dorn bottle. Water samples for SPM were stored at 5°C in proper bottles and analysed using the methods described by Baumgarten et al. (1996).

2.1.13 | DMAE (2003–2013)

The ‘Departamento Municipal de Águas e Esgotos-DMAE’ data were acquired at the Guaíba River mouth from 2003 to 2013 on a daily basis. The data set was assembled by de Andrade Neto et al. (2012) gathering daily river discharge data from the main rivers that contribute to Guaíba River, and water turbidity data recorded at 30 min interval. The turbidity data were converted to SPM concentration throughout calibration procedures in laboratory following standard procedures.
2.1.14 | MODIS-aqua (2003–2019)

Seventeen years of daily MODIS-aqua data were used to estimate SPM concentrations by Tavora et al. (2020). The satellite scenes were atmospherically corrected using the approach proposed by Wang and Shi (2007) and checked for quality of Remote Sensing Reflectance in a quality control system proposed by Wei, Lee and Shang (2016). It consists of a scoring system ranging from 1 (perfectly acquired data) to zero (unusable). Values corresponding to scores lower than 0.6 were excluded from the data set. SPM was then estimate based on three semi-analytical algorithms: Nechad et al. (2010) using the red band (645 nm), Han et al. (2016) and Novoa et al. (2017). Data available are the averaged value of each sampling box along the N-S axis (as in Figure 1), of the lagoon, rivers mouth and lagoon inlet.

2.1.15 | ‘Porto do Rio Grande’ (2000–2018)

The ‘Programa de Monitoramento do Porto do Rio Grande’ is the network responsible for the Porto do Rio Grande environmental data and counts with more than 40 scientists from different laboratory units from the ‘Instituto de Oceanografia’ at ‘Universidade Federal do Rio Grande’. The sampling programme was defined by the Brazilian National Environmental Agency (IBAMA). Annual reports gather a number of large data sets related to the aquatic environment covering the lower estuary and the adjacent ocean. It also covered dredging campaigns in the year 2000, and environmental reports of seasonal samplings from 2006 to 2017. More can be found at Asmus and Zamboni (2001); Asmus et al. (2002); Asmus and Silva (2006, 2007, 2008, 2009); FERNANDES and ROSA (2010, 2011, 2012) and in the ‘Porto do Rio Grande’ website (http://porto riogr ande.com.br).

Water samples were obtained on the surface, mid water column and bottom. Water sampling was carried out at stations located along the estuary’s access channel (Canal do Rio Grande) and in ‘Porto Velho’ (Canal do Norte). Samples were processed following methods proposed by Baumgarten et al. (1996); Baumgarten et al. (2010).

Ávila et al. (2014) described data from campaigns carried out in 2012. Data consist of in situ measurements in seven cruises at nine stations each, performed from February to October. Samples were taken along the estuarine area of Patos Lagoon. A second data set was acquired in 2017 in a 2-day expedition in the Patos Lagoon estuary. Field measured SPM was acquired and measured following the method by Baumgarten et al. (2010).

Further turbidity and SPM data were gathered from multiple field campaigns carried out in 2014, 2015, 2018 and 2019. Turbidity data were measured using a JFE Advantech™ Rinko-profiler Conductivity, Temperature and Depth (CTD), while water samples were collected at the surface simultaneously to the CTD vertical profiles using a bucket. The filtration of those samples was performed following the procedures by Loring and Rantala (1992).

Another set of turbidity data (called ‘Estuarina’ in the data sets) was also acquired during field campaigns for the Coastal and Estuarine Physical Oceanography lectures on the undergraduate course in Oceanology at ‘Universidade Federal do Rio Grande’. Campaigns were carried out on the austral spring years of 2016, 2017, 2018 and 2019. The turbidity-SPM regression (developed for the second set of data) was also applied to this set of data given the turbidity acquired using the very same equipment.

2.1.16 | LOCOSTE (2012–2019)

As an initiative of the ‘Laboratório de Oceanografia Costeira e Estuarina-LOCOSTE’, at FURG, oceanographic cruises were carried out in the Patos Lagoon estuarine area between 2012 and 2019 in a series of expeditions.

Ávila et al. (2014) described data from campaigns carried out in 2012. Data consist of in situ measurements in seven cruises at nine stations each, performed from February to October. Samples were taken along the estuarine area of Patos Lagoon. A second data set was acquired in 2017 in a 2-day expedition in the Patos Lagoon estuary. Field measured SPM was acquired and measured following the method by Baumgarten et al. (2010).

Further turbidity and SPM data were gathered from multiple field campaigns carried out in 2014, 2015, 2018 and 2019. Turbidity data were measured using a JFE Advantech™ Rinko-profiler Conductivity, Temperature and Depth (CTD), while water samples were collected at the surface simultaneously to the CTD vertical profiles using a bucket. The filtration of those samples was performed following the procedures by Loring and Rantala (1992).

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2.1.17 | UFRGS (2015–2017)

Two years of field sampling concurrent with Landsat8/OLI overpass was acquired by Scotta (2018) PhD Thesis. The author carried out nine water sampling campaigns onboard a vessel from November 2015 to March 2017 on the same days of Landsat8/OLI overpass. A total of 144 surface water samples were collected and later analysed for SPM content following the method described by Baumgarten et al. (2010). Samples were collected at a maximum 2-hr interval before or after the Landsat8/OLI overpass. In the three final campaigns, however, samples were carried out for a full day.

Scotta (2018) also developed an empirical regression model using Landsat8/OLI the red band (667 nm) and the in situ sampled SPM (Equation 1).

$$ \text{SPM} = 3.49 e^{0.0021 R_{rs}(667)}, $$  \hspace{1cm} (1)

where $R_{rs}(667)$ stands for Remote Sensing Reflectance at 667 nm in sr$^{-1}$ units.

Two sources of information are therefore available from Scotta (2018) study: (1) field sampled SPM; and (2)
the empirical model developed for Landsat8/OLI level-2 scenes (Equation 1) which can be further used for SPM estimates.

3 | DATA ACCESS

The Patos Lagoon SPM Compendium has been made publicly available at PANGAEA, https://doi.org/10.1594/PANGAEA.920924 (Tavora et al., 2020).

4 | POTENTIAL DATA SET USE AND REUSE

In this compilation, multiple SPM data sets were homogenized and checked for consistency to be made available for overall use. All daily observations were processed in such a way that they can be directly compared. The table consists of 11–12 columns taking the form described in Table 1. The way the table is organized allows further manipulation of information for different purposes (e.g. satellite ocean colour comparison, inputs in coastal models). A summary of the number of data points available for every year is provided in Figure 2. The resulting total number of SPM samples is 54,978 for all years, including measurements at different depths and stations (counting MODIS of SPM samples is 54,978 for all years, including measurements at different depths and stations (counting MODIS (2003–2019) only once). It is clear that SPM sampling efforts at different depths and stations (counting MODIS (2003–2019) only once). It is clear that SPM sampling efforts increased significantly from 2003-2004 to date.

It is important to note that some of the data sets (e.g. Espinha de Peixe (1986), Jung (1988–1990), Pró-Mar de Dentro (1999–2000)) did not present a specific day but indicated the interval of days during which the sampling was executed. Data with partially missing day and/or range of days were not removed because it can still be useful for monthly or yearly comparison in specific studies. The spatial distribution of the final group of data is presented in Figure 3, for each data set.

The geographic distribution of observations (Figure 3) shows a higher number of observations in the estuarine region (Figure 3c). The northernmost region of Patos Lagoon (Figure 3a) also shows good spatial coverage. Central regions of the lagoon show a smaller number of observations, with Camaquã River having the lower sampling density in relation to other river mouths (Figure 3b). Best geographic coverage is provided by the ‘Lagoa dos Patos’ project (1987–1988) data set. Porto do Rio Grande data set has the best coverage of the estuarine region of the lagoon. In terms of sampling at different depths, both LOCOSE (2012–2019) and Porto do Rio Grande (2000–2018) data sets measured vertical profiles of the parameters (refer to Figure 6). The data sampled at rivers mouth and lagoon inlet were classified in five groups, to facilitate data comparison from the northernmost station (i.e. POA) to the southernmost station (i.e. Patos Lagoon Inlet). Figure 4 presents the variability of SPM in magnitude for each of the five groups.

SPM presented relatively large variability in most tributaries, with exception of Camaquã River. There is an interesting almost constant mean SPM concentration for all stations in Figure 4 and a slightly decrease from North to South on SPM concentrations demonstrated by the median, percentiles and average values. Such a decrease (also observable in Figure 5a–b) could demonstrate the characteristic nature of coastal lagoons acting as an accumulative basin. The Inlet area presented the highest SPM concentrations as outliers. Such outliers could represent the re-suspension at which the inlet of Patos Lagoon is under during SW winds, when the water flow reverses landwards favouring the entrance of oceanic waters into the system. However, one must be careful, as this analysis is just an overall big picture of the system’s SPM and further analysis on the spatial and temporal variability of SPM data set is required. The reader can refer to Bitencourt et al. (2020) and Távora et al. (2019, 2020) to further evaluate the SPM variability in Patos Lagoon based on numerical model and remote sensing techniques, respectively.

For a more detailed comparison between data sets, Figure 6 introduces time-depth SPM sampling efforts. This information is useful because while surface SPM measurements are very helpful in studies of sediment transport and water quality, vertical SPM distributions not only complement surface estimates but contribute to the understanding of processes happening in the water column (e.g. turbidity maximum zones, flocs formation or sinking/resuspension of particles). A few data sets executed vertical sampling of SPM in the estuarine region of Patos Lagoon. For each of the five groups described above, the time-depth overview depicts a more comprehensive study of vertical particulate matter distribution for the past 40+ years over both SGC (Figure 6d) and Patos Lagoon inlet (Figure 6e). The particular interest in the area might be explained by their direct relationship with the estuary and with safe navigation in the Port of Rio Grande.

Finally, efforts to assess weaknesses and strengths of the data sets for a trustful use and reuse of this SPM compendium were carried out (see Figure 5b where standard deviation for all data sets is shown in percentage). Individually, the field acquired SPM data unfortunately does not always present the uncertainties in data acquisition which would be estimated by the standard deviation of water sample triplicates, for example. The reasons for the lack of such data could be unawareness of importance of such information, lack of funds and/or personnel to carry on extra analysis. Concerning the use of remote sensing techniques as
a source for SPM information in this compendium, Távora et al. (2020) assessed overall uncertainties when the authors compared their SPM estimates based on three different state-of-the-art algorithms against two of the data sets presented here: DMAE (2003–2013) and LOCOSTE (2012–2019). Uncertainties were reported to be within a maximum ±50%. Another source of SPM data presented here, the rating curve approach (i.e. Jung (1988–1990) data set),

**FIGURE 2** Yearly frequency distribution of SPM information for Patos Lagoon

**FIGURE 3** Distribution of SPM per data set in the final table. Data sources are identified with different colours and/or symbols. For acronyms, see Figure 1
was reported with a maximum bias of 16.1% by Jung et al. (2020) and regression analysis for turbidity and SPM measurements used in DMAE (2003–2013), LOCOSTE (2012–2019) field campaigns carried out in 2014, 2015, 2018 and 2019 report respectively a coefficient of determination of 0.98 (and maximum 4.7% uncertainty on the calibration curve) and 0.9 (uncertainty not reported).

5 | CONCLUSIONS

A compilation of multiple sources of SPM data with temporal coverage from 1978 to 2019 was presented. SPM was acquired based in four different techniques: traditional water sampling using good practices protocols published by Aminot and Chaussepied (1983); Loring and Rantala

![Figure 4](image-url) Statistical distributions of SPM from north to south of Patos Lagoon: Porto Alegre City (POA), Guaiaba River, Camaquã River, São Gonçalo Channel (SGC) and Patos Lagoon Inlet (Inlet). Each SPM box plot represents the following features: the bottom and top of each blue box represents the 25th and 75th percentile, the horizontal red line represents the median sample, and the red plus (i.e. ‘+’) sign represents the outliers

![Figure 5](image-url) Availability of surface SPM from all sites within the data sets. Values are monthly mean SPM (top panel) and monthly standard deviation in percentage (bottom panel). SPM samples are plotted from north (POA-Porto Alegre City) to south of the lagoon (Inlet)
TÁVORA et al. (1992); Baumgarten et al. (1996); Baumgarten et al. (2010); by comparison with turbidity (applying regression analysis; e.g. de Andrade Neto et al. (2012) and Ávila (2013)); using remote sensing data (e.g. Tavora et al. (2019, 2020)); and applying the SPM rating curve approach (e.g. Jung (2017); Jung et al. (2020)). Data were minimally changed with the exception of those necessary after quality control (e.g. acquisition, cleaning and homogenization). The compendium presents the first large data set of SPM measurements in Patos Lagoon, and no other multi-decadal data set of SPM is known to be publicly available in Brazil. This document has detailed the steps taken in order to create a data set suitable for numerical modelling and satellite comparison for SPM assessment, and also for the definition of monitoring strategies. It is hoped that not only will the Patos Lagoon SPM compendium be useful to the coastal oceanography modelling community, but also that the need for consistency within SPM data sets has been demonstrated.

The authors here intended to provide a compendium of SPM data to improve the findability, accessibility, interoperability and reuse of SPM data in Patos Lagoon. This concept is particularly important in areas where funding for data acquisition is limited. In addition to the information shared here, other sources of data in the period covered in this compendium were, unfortunately, not made available. Inaccessible data sharing policies and or long-lost information were the biggest limiters. It is our hope that the understanding of the importance of fair data to allow access to the community and the awareness of good data storage will increase among peers. Sharing data is fundamental.

FIGURE 6 Time-depth distribution of SPM from North to South of the lagoon at: (a) POA (Porto Alegre City), (b) Guaíba River, (c) Camaquã River, (d) SGC (São Gonçalo Channel) and (e) the lagoon inlet, by data set. For graphical purposes, both DMAE (2003–2013) and MODIS-aqua (2003–2019) data sets are displayed as quarterly SPM averages. Dot size represents approximate SPM concentration.
6 | ADDITIONAL REMARKS

SPM in the Patos Lagoon was studied by several authors using field sampled data (e.g. Toldo (1989); Vilas Boas (1990); Baisch (1994); Niencheski and Windom (1994); Hartmann and Schettini (1996); Niencheski et al. (1999); Toldo et al. (2006); Niencheski and Baumgarten (2007); Calliari et al. (2009); Marques et al. (2009); de Andrade Neto et al. (2012); Ávila et al. (2014); Vieira et al. (2020)), modelling tools (e.g. Fernandes (2001), Marques et al. (2006, 2009, 2010), Calliari et al. (2009), Nicolodi et al. (2010), Silva et al. (2014), Lisboa and Fernandes, (2015), Bitencourt et al. (2020)); and remote sensing techniques (e.g. Pagot et al. (2007); Moraes (2008); Fassoni-Andrade et al. (2015); Costi et al. (2017); Scotta (2018); Tavora et al. (2019, 2020)).

Studies aiming a more effective assessment of SPM using remote sensing were developed in the past decade. The study by Scotta (2018) developed an empirical algorithm for Landsat8/OLI data to be applied in the Guaiaba River region. Following a similar approach, the study by Costi et al. (2017) developed an empirical algorithm using MODIS-aqua data to estimate sediment plumes in the inlet region of Patos Lagoon. More recently, the study by (Távora et al., 2019, 2020) uses daily information from the MODIS-aqua sensor to estimate SPM covering the whole lagoon extension (i.e. MODIS (2003–2019) data set). The latter compares different SPM algorithms applied to MODIS-aqua scenes over seventeen years of daily data.

While the estuary of Patos Lagoon has been well studied for decades (e.g. PELD-ELPA, https://peld.furg.br), the extension of Patos Lagoon has extensive gaps in data coverage, especially for SPM. With the purpose to fill these gaps, the LOAD project (Long-term analysis of suspended particulate matter concentrations Affecting port areas in Developing countries) was granted by the Office of Naval Research, ONR (N62909-19-1-2145), in 2019. The project aims to associate remote sensing, in situ sampling, acoustics and modelling techniques to assess Patos Lagoon suspended sediment dynamics in different temporal and spatial scales. This SPM Compendium is the first step forward in defining sampling and monitoring strategies and validating remote sensing products within the LOAD Project.

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CONFLICT OF INTEREST

Authors declare no competing interests.

AUTHOR CONTRIBUTIONS

Juliana Távora: Conceptualization (lead); data curation (lead); formal analysis (lead); investigation (lead); methodology (equal); project administration (equal); resources (equal); software (lead); supervision (equal); validation (equal); visualization (lead); writing–original draft (equal); writing–review and editing (lead).

Elisa Helena Fernandes: Data curation (equal); formal analysis (equal); funding acquisition (lead); methodology (equal); project administration (equal); resources (lead); supervision (equal); writing–original draft (equal); writing–review and editing (equal).

Osmar Olinto Möller: Data curation (equal); investigation (equal); writing–original draft (supporting); writing–review and editing (supporting).

OPEN PRACTICES

This article has earned an Open Data badge for making publicly available the digitally shareable data necessary to reproduce the reported results. The datasets are published on https://doi.org/10.1594/PANGA EA.920899; https://doi.org/10.1594/PANGA EA.920917; https://doi.org/10.1594/PANGA EA.920900; https://doi.org/10.1594/PANGA EA.920907; https://doi.org/10.1594/PANGA EA.920906; https://
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