Response to Anonymous Referee #2

1. This manuscript entitled "Dataset of Georeferenced Dams in South America (DDSA)" clearly explains the importance of a database of georeferenced dams in South America, along with other variables that describe each local dam scenario. Thus, the purpose of the proposed work is clear and important in order to establish a base line of information for other studies related to dams and reservoirs. I think the idea and work are in concordance with the journal's and I encourage the authors to modify the text and also include guidelines for future database modifications (i.e. updates). I recommend this article for publication upon the following major revisions:

Response: The authors take the opportunity to acknowledge the valuable comments provided by the anonymous referee, as well as the time that has been committed to provide this valuable feedback. All suggestions made have been considered and addressed in a reasoned manner. Revisions have been made to the manuscript and are described below.

2. The relevance of the proposed database for future studies will be directly linked with latest update. Thus, a mechanism for complementing the information should be provided. What should other researchers do in order to update the data on a given region?

Response: Thank you for this suggestion. We have improved section 5 in order to encourage interested researchers to make whatever contributions they deem necessary to keep our database up to date. Likewise, we have described how to access the database through the free access repository ZENODO and also, we have included in the repository access link, the contact information of the authors, in order to receive the contributions from the research community.

References to lines with the suffix 'OM' refer to the original manuscript and the refence to lines with the suffix 'RM' refer to the revised manuscript.

Line 265OM / 339RM:

'5 Data availability

The Database of Georeferenced Dams of South America (DDSA) is a joint effort of researchers from the Department of Civil Engineering: Hydraulics, Energy and Environment of the Universidad Politécnica de Madrid and the Civil Engineering Career of the Universidad Técnica de Ambato. The DDSA database is available for both researchers and the general public through the ZENODO open access repository https://doi.org/10.5281/zenodo.3885280 (Paredes-Beltran et al., 2020), where we have detailed the contact information of the authors, in order to receive any valuable contribution which could allow us to improve our database.'

3. The Data description section is divided in three subsections: 2.1. Study Area. 2.2. Data Sources, and 2.3. Data Processing. Subsections 2.2 and 2.3 repeat a significant portion of the information. I would suggest to the authors to fusion these two into a single subsection "Data sources and assessments methods" maintaining the 7 groups originally indicated in subsection 2.2 and including within each of them the methods used for the respective data assessment.

Response: Thank you for this suggestion. We have reviewed your suggestion and found it appropriate. We have combined the section '2.2 Data Sources' and the section '2.3 Data processing' into a new section '2.2 Data sources and assessment methods'. The relevant information in section 2.3 has been included in each of the groups in section 2.2. Finally, we have revised each of the groups in the new section 2.2 to include only the appropriate content.

Line 91OM / 107RM:

'2.2 Data sources and assessments methods

2.2.1 Compilation of preliminary information

A preliminary compilation of data regarding dams and reservoirs in the continent was first carried out to serve as a basis prior to the creation of this database. For this, two types of bibliographic sources were used: first, dams and reservoirs information from currently published databases, and second, records available about dams, reservoirs and water resources, from governments and other official sources. In the first case, we used two well-known open access databases of dams and reservoirs: the GRaND database (http://globaldamwatch.org/grand/, last access: 23 May 2020) and the AQUASTAT database (http://www.fao.org/aquastat/es/databases/dams/, last access: 23 May 2020). In the second case, we found that many governments keep up-to-date and comprehensive records of their water resources including dams and reservoirs. However, there were cases in which official information is not available. Table 1 details the public sources from which most of the information was obtained for each of the countries.

After an extensive review, we determined that georeferenced information about dams in this continent is limited. This is one of the main reasons why we aimed to develop a new database that includes all the current consistent information available. We proceeded in three stages: first, we collected all the available published information on dams and reservoirs; second, we compared and validated this data with the existing information available from local and national governments; and finally, we determined the geolocation of each point. This information has been processed and we carried out an extensive data validation and error checking, elimination of duplicate or inaccurate entries and completion of information where possible.

First, we researched for the most relevant databases of dams and reservoirs available and found three consistent results: The World Register of Dams from ICOLD, the GRaND database and the AQUASTAT database of dams. After the initial inspection, we discarded the ICOLD database because even though it is widely considered as the largest database on dams with over 57,985 entries worldwide and 1,922 dam entries in South America, it is not georeferenced nor it is an open-access database, which limits later validation of our results. Then, we inspected the AQUASTAT database (which has not been updated since 2015) and collected detailed information of more than 14,000 dams; nonetheless, in the case of South America the list consists of 1,964 dams of which only 344 entries are georeferenced. Finally, we examined the GRaND database which presents 7,320 entries, however, only 343 of those entries correspond to South America.

Once initial information was collected from open-access databases to assemble our preliminary list, we examined public records available from local and national governments in each country. We compiled them in order to compare this data with our preliminary list, data collected from governments and other public sources is available in different formats and in most cases required different types of approximation and treatment to obtain results. Each dam record was compared individually and in the case of correspondence it was accepted, in the case of countries where we did not find available public reports, we compared and verified our preliminary records with information available on the internet, focusing on dams with reservoir capacity greater than one cubic hectometre, although some records with smaller reservoir volume were included as these could be verified in a reliable manner.

Finally, a supplementary search on the internet was performed to exclude gaps, mismatches or errors.

2.2.2 Geolocation of entries

Once we compiled and verified our preliminary list of dams and reservoirs, we proceeded with the geolocation of each individual record. First, we verified and corrected the data of the preliminary list and then we carried out a second geolocation assessment for our final database using public access online map browsers like Google Earth (https://earth.google.com/web/, last access: 23 May 2020), Bing Maps (https://www.bing.com/maps, last access: 23 May 2020) and Open Street Maps (https://www.openstreetmap.org/#map, last access: 23 May 2020).

Although these map browsers do not provide us with the analytical capabilities of Geographic Information Systems (GIS) files and programs, these products are operative when visually searching for geographic locations and landmarks, as well as providing data that is often up to date.

In most cases, it was necessary to carry out extensive examinations for each dam since there were cases in which the names of the dams were not sufficient reference to locate them, thus, it was necessary to use additional references such as the nearby cities or villages, the reservoirs names, rivers names, or secondary or alternative names of the dams.

The coordinates in this database are described in decimal degrees using the WGS84 reference coordinate system.

2.2.3 HydroSHEDS

To perform the analysis of the dam catchments, the HydroSHEDS (Hydrological data and maps based on SHuttle Elevation Derivatives at multiple Scales) (Lehner et al., 2008) dataset was used. This product allows users access to consistent hydrographic information on a regional scale at a resolution of 15 arc seconds and was derived primarily from the Shuttle Radar Topography Mission (SRTM). The dataset information was obtained from the public site (https://www.hydrosheds.org/downloads, last access: 23 May 2020) in raster format and for this project we utilized 3 layers: void-free elevation, drainage direction and flow accumulation.

Once each dam location was verified and accepted, each location point was aligned according to the HydroSHEDS raster dataset (Lehner et al., 2008) in order to determine the dams' catchments. First, flow direction of each of the model raster cells was computed by applying the 'D8' algorithm. Second, the ridge cells between catchments were identified to delineate them. Finally, the catchment areas were calculated by counting the contributing above cells to each dam.

2.2.4 Climatic Research Unit (CRU TS 4.03) time-series dataset

Surface climate variables are commonly used inputs in studies like agriculture, ecology and biodiversity. For this reason, near-surface temperature (NST), precipitation (P) and potential evapotranspiration (PET) mean monthly values from 1901 to 2018 are included for each dam catchment in this database. This data was derived from the Climatic Research Unit (CRU) time-series dataset (Harris et al., 2020), which is hosted by the UK's National Center for Atmospheric Science (NCAS) and it is produced by the University of East Anglia's Climatic Research Unit (CRU). This dataset is a commonly used high-resolution gridded dataset and has been compared favourably with other climatic datasets (Beck et al., 2017; Jacob et al., 2007).

First, the datasets for each variable were downloaded in netCDF formats for monthly periods from 1901 to 2018. Then, these files were converted, resampled and aligned into raster formats in order *to match the dams' catchments model. Finally, we computed the long-term mean monthly values for precipitation, near-surface temperature and potential evapotranspiration for the complete time period (1901 to 2018) and for each of the dams' catchments.*

This dataset is provided in a resolution of 0.5 degrees by 0.5 degrees grid, it covers the South America continent from 1901 to 2018 and is derived from a periodic interpolation of data from a network of meteorological stations. The NST units are expressed in degrees Celsius (◦C), the PRE units are in expressed in millimetres per month (mm/month) and the PET units are expressed in millimetres per month (mm/month).

For this database we used the version 4.03, which is provided by the Center for Environmental Data Analysis (CEDA) website (https://crudata.uea.ac.uk/cru/data/hrg/#current, last access: 23 May 2020), in a NetCDF format.

2.2.5 University of New Hampshire Global Runoff Data Centre (GRDC) composite runoff field

A basic requirement in the assessment of water resource systems is monthly runoff data. For this, the mean monthly runoff data for each dam was also included in this database. We used the University of New Hampshire and Global Runoff Data Centre (UNH/GRDC) Composite Runoff field v1.0 (Fekete et al., 2002), which is often regarded as the best available runoff dataset for large scale models (Gonzàlez-Zeas et al., 2012; Lv et al., 2018). The GRDC dataset combines observed river discharge information with climate-driven water balance models in order to develop consistent composite runoff fields. The method applied in this product uses selected gauging stations data archives to a simulated topological network and compares them with outputs from water balance model (WBM) simulation performed by the authors.

The runoff dataset for South America was downloaded from the data product site in ASCII-grid formats in a resolution of 0.5 degrees by 0.5 degrees. Then, the file was converted, resampled and aligned in order to match the dams' catchments model. Finally, the mean monthly runoff data for each dam catchment was derived. The units of runoff are expressed in millimetres per month (mm/month).

The dataset was obtained from the product public site (http://www.compositerunoff.sr.unh.edu/, last access: 23 May 2020).

2.2.6 Population data from the Global Rural-urban Mapping Project (GRUMP)

Demographic data is usually a necessary input for studies that include urban or rural information on water resources assessments. Population for each of the dams' catchments is included on this database and was derived from the Global Rural-urban Mapping Project (GRUMP) (Center for International Earth Science Information Network CIESIN et al., 2011). The GRUMP dataset is provided by the Socioeconomic Data and Applications Center (SEDAC) and offers different georeferenced population datasets at continental, regional and national scale. This dataset is often used as baseline for studies that require large-scale maps of urban or rural areas (Florczyk et al., 2020; Mcdonald et al., 2011) and is based on polygons defined by the extent of the night-time light imagery and approximated urban extents from ground-based settlement points.

The dataset was downloaded from the data product public site (https://sedac.ciesin.columbia.edu/data/collection/grump-v1, last access: 23 May 2020) in ASCII format in a 30 arc second resolution. The files were converted, resampled and aligned in order to match the dam's catchment model, and then the population was computed for each dam catchment. The units of population per dam catchment are expressed in number of people.

2.2.7 Equipped Area for Irrigation from the Global Map of Irrigated Area dataset

The equipped area for irrigation (EIA) for each of the dams' catchments were extracted from the Global Map of Irrigated Areas dataset provided by the Food and Agriculture Organization of the United Nations (Siebert et al., 2005) which is often used to provide valuable information about irrigation in hydrological models (Wisser et al., 2008). This dataset is a global scale dataset of irrigated areas based on cartographic information and FAO statistics and it was developed by combining sub-national irrigation statistics with geospatial information.

The EIA data was downloaded from the data product public site (http://www.fao.org/aquastat/en/geospatial-information/global-maps-irrigated-areas/, last access: 23 May 2020) in ASCII-grid formats, then, the file was converted, resampled and aligned in order to match the dams catchment model, and then the equipped area for irrigation for each dam catchment was computed. This dataset is presented in a resolution of 0.5 degrees and it is presented in ASCII-grid formats. The units of EIA are expressed in hectares (ha).'

4. Line 25. Mentions that dams are, in many cases, controversial due to "some associated negative impacts…" and the following sentence indicates that "these structures cause major impacts and changes wherever these are implemented"- this is ambiguous. Please refer to the impacts complementing line 40 in which a list of them is considered and complement it with other topics such as, morphology, water quality and habitat. Please classify them as acute and chronic impacts (time related impacts) since it will add value to the continuous monitoring efforts.

Response: Thank you for this suggestion. We have improved the two paragraphs mentioned in order to avoid ambiguity. Also, we have supplemented these sections with information on the impacts caused by dams and reservoirs.

Line 25OM / 25RM:

*'**1 Introduction***

Dams and their reservoirs provide continuous water supply for different anthropogenic necessities such as electricity generation, water supply, irrigation, flood control, livestock feed or recreation. This becomes crucial in areas where water resources are scarce either by seasonality or due to the increasing effects of climate change. However, in many cases dams and their reservoirs are controversial because they can cause acute and chronic impacts in the environment and also in the nearby human settlements. These impacts are generally well known and include the modification of aquatic and terrestrial ecosystems, reduction of biodiversity, changes in the morphology of river systems, degradation of water quality and characteristics, alterations in sediments and nutrients discharge, changes in seasonal hydrological regimes, the migration of human settlements or changes in land-use patterns (Barbarossa et al., 2020; Bednarek, 2001; Nilsson et al., 2005; Pekel et al., 2016; Stoate et al., 2009).

Due to the obvious importance of dams and their reservoirs, continuous monitoring and resources needs to be dedicated on these structures. The importance of dams and reservoirs also makes them relevant for research. For example, there are studies that assess or propose improvements on construction methods for dams (Ladd, 1992; Noorzaei et al., 2006; Xu et al., 2012), examine improvements on monitoring the structural health or safety of the dam (Gabriel-Martin et al., 2017; Li et al., 2004; Sjödahl et al., 2008) or evaluate their behaviour during seismic or failure events (Alonso et al., 2005; Zabala and Alonso, 2011). Reservoirs associated with dams are also relevant, for instance, by examining the effects, impacts and management alternatives of sediments fluxes (Dai and

Liu, 2013; Kondolf et al., 2014). Usually, these studies require knowing a minimum set of characteristics of the dam, including their location and in most of the cases, need to be included into hydrological models.'

5. Line 65. Please explain which "fields" the authors are referring to.

Response: Thank you for this suggestion. We have improved this section in order to better describe the research fields where we think our database could be used.

Line 65OM / 68RM:

'This database has been developed to provide researchers additional information on dams, reservoirs and dams' catchments in South America, with the expectation to further promote research on dams, hydrology, water resources, ecology environmental science, geography or sociology either on a local, regional or global scale.'

6. Line 70 and 75 mention the Amazon, Parana-Rio de la Plata, and the Orinoco rivers as the largest systems in the region. Please revise to consider mentioning these fluvial systems only once when describing the study area.

Response: Thank you for this suggestion. We have improved these paragraphs in order to avoid repeated sentences.

Line 70OM / 74RM:

'2.1 Study Area

The study area is the continent of South America and includes Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, French Guiana, Paraguay, Peru, Suriname, Uruguay and Venezuela. A total of 1,010 catchments were considered which drain an area of approximately 5,283,000 km2 and discharge their waters to both the Pacific Ocean and the Atlantic Ocean. Within each of this catchments, necessary observations were made to accurately locate dams with their respective reservoirs.

The study area is diverse and full of contrasts due to its unique geography; for example, the Andes mountains are a continuously seismic region that covers the entire west coast of the continent, the Amazon rainforest in the central part of the continent, large semiarid plains in the southeast and also the Atacama desert, which is a region of extreme aridity in the southwest. In the Andes we have the presence of large glaciers that mostly drain east to form several rivers, including some of the largest in the world such as the Amazon, the Paraná - Rio de la Plata and the Orinoco river. On the east coast of the continent, there exist humid mountain formations that extend from Venezuela to northern Brazil.'

7. Line 85 refers to "El Niño" however there is no mention to "La Niña" that also brings changes to the precipitation patterns and it should be considered.

Response: Thank you for this suggestion. We have improved these paragraphs in order to improve the description of climate events in South America. We have included a description of the ENSO, as well as we have made mention of other relevant climatological events in the region.

Line 85OM / 93RM:

'Climate diversity in South America is also due to the occurrence of several interannual and interdecadal large-scale climate events. For example, the "El Niño Southern Oscillation" (ENSO) which is a Pacific Ocean sea-surface temperature (SST) event that fluctuates from warm ("El Niño") and cold ("La Niña") phases, and occurs in periods of between two to seven years. The ENSO causes disruptions of precipitation and temperature in the continent and is often considered as the major source of interannual climate variability in most of South America.

In general, the "El Niño" causes low precipitation over tropical South America, high precipitation over the south east of the region and high temperatures over tropical and subtropical areas. Also, the "El Niño" is often associated to regionally diverse events like droughts in the Amazon rainforest and the north-east of South America, but also to flooding events in the tropical west coast and the south-east of the continent (Cai et al., 2020; Hao et al., 2020). On the other hand, "La Niña" generally causes the opposite precipitation and temperature events for the same areas (Garreaud et al., 2009).

Other regional climate events in South America like the sea-surface temperature (SST) anomalies in the tropical Atlantic (Garreaud et al., 2009; Jiménez-Muñoz et al., 2016), the Pacific Decadal Oscillation (PDO) (Nathan and Steven, 2002), or the Antarctic Oscillation (AAO) and the North Atlantic Oscillation (NAO) (Garreaud et al., 2009) also play an important role in the variability of South America climate.'

8. Line 100 cites Table 1 regarding the government's available information. Please include the respective links to the information. This is important in order to replicate efforts in the future.

Response: Thank you for this suggestion. We have improved the description of Table 1 in order to include an additional column with the reference's information at the end of the table. We have also included the link to each source in the references section. This was due to the fact that we considered that several of the links were too long, so we preferred to mention the links in the references section to improve the visualization of the table.

Table 1: Available public data records of dams per country

COUNTRY	AVAILABLE PUBLIC INFORMATION	NUMBER OF ENTRIES	GEOREFERENCED INFORMATION	REFERENCE*
ARGENTINA	Inventario de Presas y Centrales Hidroeléctricas de la República Argentina	31	No	(Subsecretaría de Recursos Hídricos, 2010)
BOLIVIA	Inventario Nacional de Presas Bolivia	287	Yes	(Programa de Desarrollo Agropecuario Sustentable (PROAGRO), 2010)
BRAZIL	Mapa Interativo das Barragens Cadastradas	18,880	Yes	(Agencia Nacional de Aguas, 2019)
CHILE	Directorio de Presas	107	No	(Comite Nacional Chileno de Grandes Presas, 2019)
COLOMBIA	ISAGEN	-	No	(ISAGEN, 2020)
ECUADOR	Various web pages	-	No	(ElecAustro, 2020; Hidroabanico, 2019; Instituto Nacional de Pesca, 2020)
FRENCH GUIANA	Not available	-	-	
GUYANA	Not available	-	-	
PARAGUAY	Not available	-	-	
PERÚ	Inventario de Presas en el Perú	743	Yes	(Autoridad Nacional del Agua, 2016)
SURINAME	Not available	-	-	
URUGUAY	Not available	-	-	
VENEZUELA	Other	-	No	(Instituto Nacional de Estadistica, 2020)

* The data records of each country website links are detailed in the reference section

Line 257OM / 398RM:

Agencia Nacional de Aguas (2019) Mapa Interativo das Barragens Cadastradas no Sistema, Sistema Nacional de Informações sobre Segurança de Barragens SNISB. Available at: http://www.snisb.gov.br/portal/snisb/mapas-tematicos-e-relatorios/mapa-interativo-das-barragens-cadastradas (Accessed: 11 November 2020).

Line 302OM / 407RM:

Autoridad Nacional del Agua (2016) Inventario de Presas en el Peru. Lima. Available at: https://www.ana.gob.pe/etiquetas/inventario-de-presas.

Line 328OM / 442RM:

Comite Nacional Chileno de Grandes Presas (2019) Icold Chile - Directorio de Presas. Available at: http://www.icoldchile.cl/directorio/ (Accessed: 21 November 2019).

Line 334OM / 453RM:

ElecAustro (2020) Represa El Labrado. Available at: https://www.elecaustro.gob.ec/ (Accessed: 9 February 2020).

Line 361OM / 486RM:

Hidroabanico (2019) Hidroabanico. Available at: http://www.hidroabanico.com.ec/portal/web/hidroabanico/descripcion (Accessed: 9 February 2020).

Line 367OM / 492RM:

Instituto Nacional de Estadistica (2020) Principales Indicadores Ambientales. Available at: http://www.ine.gov.ve/index.php?option=com_content&view=category&id=68:princ-indicadores# (Accessed: 9 February 2020).

Line 370OM / 493RM:

Instituto Nacional de Pesca (2020) Embalse Chongón. Available at: http://www.institutopesca.gob.ec/embalse-chongon/ (Accessed: 9 February 2020).

Line 372OM / 497RM:

ISAGEN (2020) Generacion de Energia. Available at: https://www.isagen.com.co/es/nuestro-negocio/generamos-energia (Accessed: 9 February 2020).

Line 409OM / 546RM:

Programa de Desarrollo Agropecuario Sustentable (PROAGRO) (2010) Inventario Nacional de Presas. Edited by Viceministerio de Recursos Hídricos y Riego (VRHR). Cochabamba. Available at: https://www.bivica.org/file/view/id/2334 (Accessed: 11 November 2020).

Line 420OM / 561RM:

Subsecretaría de Recursos Hídricos (2010) Inventario de Presas y Centrales Hidroeléctricas de la República Argentina. Edited by Ministerio de Planificación Federal Inversión Pública y Servicios. Buenos Aires. Available at: http://datos.minem.gob.ar/dataset/inventario-de-presas (Accessed: 11 November 2020).

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Autoridad Nacional del Agua: Inventario de Presas en el Peru, Lima. [online] Available from: https://www.ana.gob.pe/etiquetas/inventario-de-presas, 2016.

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Center for International Earth Science Information Network CIESIN, Columbia University, The World Bank and Centro Internacional de Agricultura Tropical CIAT: Global Rural-Urban Mapping Project, Version 1 (GRUMPv1): Population Count Grid, [online] Available from: https://doi.org/10.7927/H4VT1Q1H, 2011.

Comite Nacional Chileno de Grandes Presas: Icold Chile - Directorio de Presas, [online] Available from: http://www.icoldchile.cl/directorio/ (Accessed 21 November 2019), 2019.

Dai, Z. and Liu, J. T.: Impacts of large dams on downstream fluvial sedimentation: An example of the Three Gorges Dam (TGD) on the Changjiang (Yangtze River), J. Hydrol., 480, 10–18, doi:10.1016/j.jhydrol.2012.12.003, 2013.

ElecAustro: Represa El Labrado, [online] Available from: https://www.elecaustro.gob.ec/ (Accessed 9 February 2020), 2020.

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Hao, Z., Zhang, X., Singh, V. P. and Hao, F.: Joint modeling of precipitation and temperature under influences of El Niño Southern Oscillation for compound event evaluation and prediction, Atmos. Res., 245(19), 105090, doi:10.1016/j.atmosres.2020.105090, 2020.

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Hidroabanico: Hidroabanico, [online] Available from: http://www.hidroabanico.com.ec/portal/web/hidroabanico/descripcion (Accessed 9 February 2020), 2019.

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