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Mapping potential impacts of dams and reservoirs in South America

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We present a continental-scale evaluation of the distribution of dams and reservoirs in South America. This analysis is relevant to estimate potential impacts on water supply and flow alteration. A combined total of 808 of the largest dams across the continent, which can store about 1,003 cubic kilometres of water, were evaluated. We divided the area of study into 27 hydrological regions and for each region we determined necessary inputs to assess the potential impacts of dams and reservoirs such as: total area, mean annual runoff, total storage volume, population, or equipped area for irrigation. Although the storage capacity of the reservoirs represents around 10% of the region's total mean annual runoff, the potential impacts for flow alteration differ considerably between hydrological regions because dams and reservoirs are not evenly distributed in South America. Whilst in some hydrological regions in the north, including the Amazon river, water storage from reservoirs represents less than 5% of their mean annual runoff, some hydrological regions in the south of the continent can store the equivalent of 2 to 3 years of their mean annual runoff. The region with the highest potential for hydrological impacts is the Rio Colorado basin in Argentina, where storage from reservoirs can be almost 3.5 times the region's mean annual runoff. The observed variations in water storage can be explained by the diversity in hydrology and water demands of the different hydrological regions of the continent. For example, water storage for hydropower purposes represents about 85% of the total water storage in the continent. Also, the highest number of dams exclusively allocated for hydropower production are located in the east of the continent in Argentina and Brazil. The hydrological region with the highest ratio of water storage is "La Plata" in the southeast of the continent with approximately 35% of the total water storage of the continent. In addition, almost 70% of dams are located in humid or sub-humid areas. In average, the dams in the continent can store 9,700 m³ of water per person and 161,000 m³ of water per hectare equipped for irrigation. The regions with the highest concentration of dams are Venezuela and the eastern region of Brazil, while the regions with the least number of dams per area are found in the northeast of Brazil and the south of the continent. These ratios may be useful to understand the potential effects of dams and reservoirs on a regional and continental scale, considering that development plans in several countries include many new dams across the continent. With this study, we expect to provide valuable insights to researchers and water resource managers about the current and future potential impacts of dams and reservoirs in South America.

