

Streamflow data in Arequipa, Peru

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Discovery Park

INTRODUCTION

River discharge provides a measure of the volume of water passing a point in the river every day. Discharge monitoring is needed to determine the total quantity of water resources available, in order to make decisions about water allocations for human and ecosystem needs and provide daily flow required to complement water quality monitoring. Long term monitoring is also important to determine how changing climatic conditions affect water availability, floods and droughts. Flow in many rivers in Arequipa is regulated by dams and reservoirs, and as a result flow is less variable than it would be under natural conditions.

MONITORING LOCATIONS AND AGENCIES

River discharge has been monitored in 40 unique locations in seven watersheds that overlap with the Arequipa department (Figure 1). It is measured by several regional and local agencies which make up the National Water Resources Information System (Sistema Nacional de Información de Recursos Hídricos – SNIRH) who distributes the data.

ANA reports data from two types of stations:

1) Daily stations report average volumetric flow rate (in m^3/s) that is estimated from an established rating curve that related flow rate to water level, and

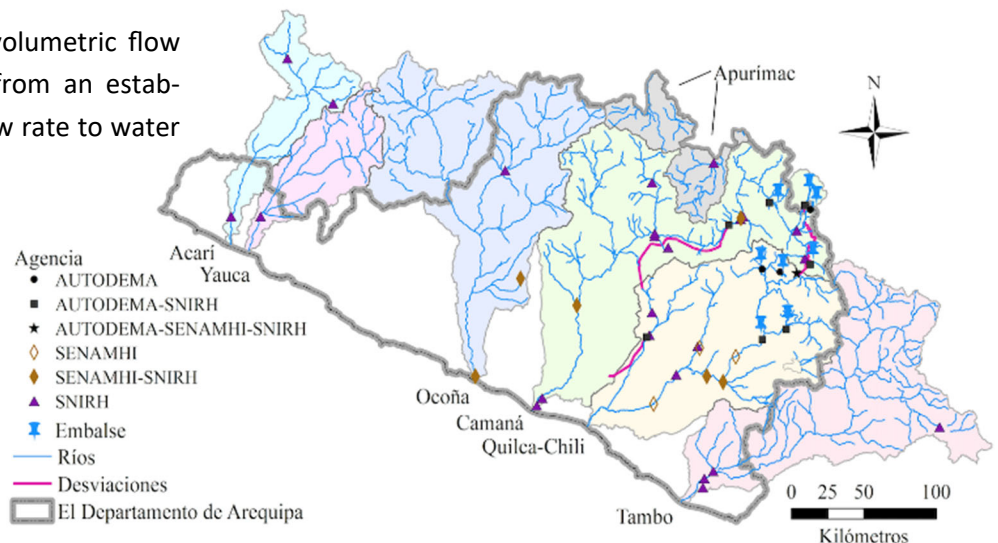
2) Hourly water-level stations water level is reported every four hours from some daily stations that are operated by SENAMHI. The hourly stations were installed in nine locations in 2015, but flow rate is not currently being reported.

Additionally, the Autoridad Autónoma de Majes (AUTODEMA) reports daily reservoir outflow, inflow and water withdrawals from 12 locations in the system that has supplied water to Majes Irrigation District since 2009.

ACCESSING STREAMFLOW DATA

- Daily streamflow measurements that include some historical stations as well as newly installed stations are available from SNIRH through a new database: <http://snirh.ana.gob.pe/visors2/>
- SENAMHI provides 4-hourly water level for HYDRO stations that measure precipitation and river level (water level is also available through SNIRH): <https://www.senamhi.gob.pe/?&p=estaciones>
- Daily measurements of water movement throughout the managed Chili and Colca systems monitored by AUTODEMA are available from: <https://autodema.gob.pe/reportesom/>

Figure 1. Locations of river discharge monitoring stations in the Arequipa Department, Peru. These locations are differentiated based on frequency and the type of measurement taken (daily or hourly flow). Rivers, large diversions, and dams are also identified in the map.



DISCUSSION OF DISCHARGE INFORMATION

Stream discharge monitoring in Arequipa started with one station in 1923; more consistent streamflow data collection started in the 1960's (Figure 2). Many stations were established to quantify resources in rivers that have since been regulated; these early stations have been discontinued over time. Currently, daily stream discharge is actively being monitored in 22 locations in Arequipa. Six of these stations are part of water management infrastructure controlled by AUTODEMA and represent regulated discharge from reservoirs. Nine hourly monitoring stations (three represent new locations, six coincide with existing stations) were installed in 2014 and 2015 but are currently only reporting river stage and cannot be used for hydrologic analysis until a rating curve is established.

Adequacy: The overall station density shown in Figure 1 is reasonable, but stations were either installed to estimate flow potential for later reservoir construction, or to monitor current water transfer through the system. No active stations were identified with a drainage area less than 1000 km². Small natural upland gauged catchments are needed in order to distinguish climate-driven changes in the frequency and magnitude of floods or droughts from those due to more immediate and direct anthropogenic causes. In addition, flash floods are a concern in many areas around Arequipa, but there have been no gauging stations historically that can help to quantify flood hazard in these small watersheds. The short span of data collection and high percentages of missing data, and flow alterations caused by upstream regulations, limit the potential for long-term hydrological analysis in Arequipa. Only three of the stations identified have record lengths greater than 20 years and are still active.

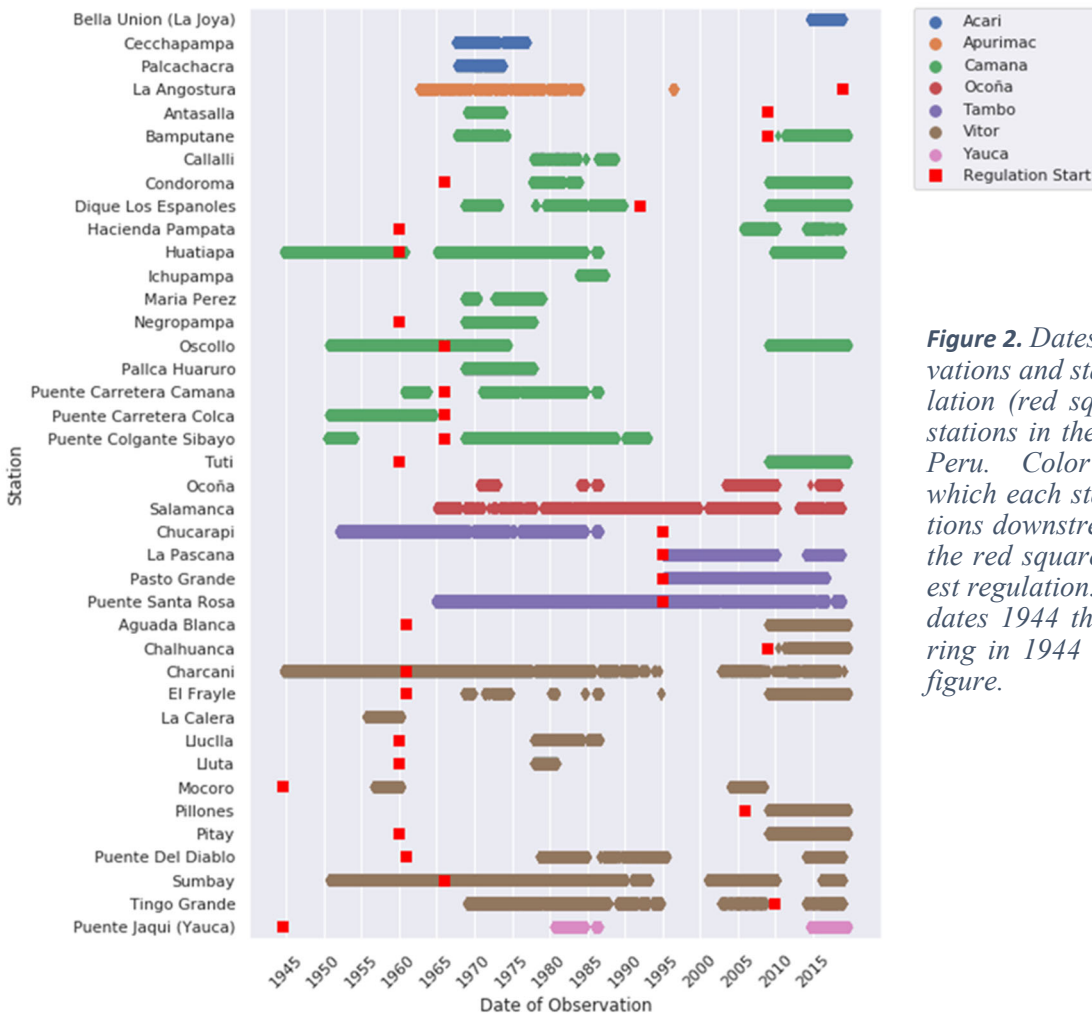


Figure 2. Dates of river discharge observations and start of upstream flow regulation (red square), for all streamflow stations in the Arequipa Department of Peru. Color indicates river basin in which each station is located. For stations downstream of multiple structures the red square shows the date of earliest regulation. If start of regulation pre-dates 1944 then it is plotted as occurring in 1944 so that it appears on the figure.

CONTACT

For more information on our developers, this factsheet, and other resources developed by the SWM team of the Arequipa Nexus Institute, contact us at nexus-swm@purdue.edu