The potential impact of climate variability on siltation of Andean reservoirs.

Case of study: Cañete river, Peru.

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Climate variability and Peruvian economy

Rainfall pattern in Peruvian western Andes presents a high variability.
Cañete basin as a case study

Cañete basin (6000 km²) is located in the Coastal range of the Andes.

Natural hazards: gully erosion, flash floods and landslides

High geomorphic activity within the basin, controlled by climatic variability and vegetation cover.
Evaluate the impact of climate variability on the volume of transported sediments and therefore on the storage of hydroelectric reservoirs.

What is the plan??

Hydrological model → Sediment transport model → Cañete river model (historical data 2010 – 2015) → Proposed hydrological scenarios (10) → Proposed sediment scenarios (10) → Trapped sediments in Capillucas dam
Scarcity of meteorological data

The basin is monitored by 11 rainfall stations, 7 temperature stations and 13 flow measurement stations.

Sub-optimal spatial distribution of weather and gauging stations

The data collected after the year 2010 was used to built the hydrological model.

The sediment transport model describes suspended sediments and bed load

- Transport function: Ackers&White
  \[ X = \frac{SD}{h} \left( \frac{V}{V^*} \right)^n \]
  
  - X: sediment flux
  - D: particle diameter
  - h, V: flow depth and velocity
  - \( V^* \): friction velocity
  - \( G_{gr} \): parameter of transport

- Sorting Method: Thomas (Eq5)

Main input: 24,65 suspended sediments samples collected (1998 to 2001)
Ten rainfall scenarios were proposed

Scenarios correspond to increasing and decreasing rainfall intensities in the region.

- Proposed rainfall changes:
  
  [ + 5% ] [ + 8% ]
  [ + 10% ] [ + 15% ]
  [ - 17% ]

- Proposed rainfall patterns:

  **Pattern A:**
  Uniform increase/decrease of rainfall amounts

  **Pattern B:**
  Increase/decrease of rainfall intensity (peaks).

Hydroelectric reservoirs could be silting up more rapidly than anticipated

The amount of sediments trapped shows an exponential performance related to the rainfall variation. The impact on reservoir lifespan is strong with a 10% increase in rainfall intensity during storm events.

Scenario B+15%:
Capillucas dam can reach its total storage **10 years** before expected life span.
Questions ... Comments ... Suggestions ...?