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Abril 2023

Determining the geodetic mass balance of the Znosko glacier (King George Island, Antarctica) using an unmanned aerial vehicle

Bello, Cinthya; **Suarez, Wilson**; Brondi, Fabian (2023).

Remote Sensing Letters, *14*(02). 148-156.
https://doi.org/10.1080/2150704X.2023.2165419

Abstract
In the last decade, unmanned aerial vehicles (UAVs) have been used for scientific research specially for glaciological applications in Antarctica. In the study an UAV was used to detect changes in Znosko glacier surface, map the glacier contour, snow line and estimate the geodetic mass balance. Znosko glacier (ZG) located in King George Island (KGI), Antarctic Peninsula has an estimated total area of 1.77 km2 (January 2020), a length of 1.9 km and maximum elevation of 300 metres above sea level (m a.s.l.). The aerial photogrammetric survey was carried out in two field campaigns (austral summer 2019 and 2020) during the XXVI and XXVII Peruvian Antarctic Operation using a Quadcopter for image acquisition. Our findings reveal a negative geodetic mass balance for the periods 2019–2012, 2020–2019 and 2020–2012 with −15.25, −2.76 and −17.97 metre water equivalent (m w.e.) respectively. Analysis of these datasets confirm a mass loss with a heterogeneous pattern between accumulation and ablation zone. Furthermore, glacier outlines reveal that ZG front has lost approximately 3% of its area between 2012 and 2020 by calving effect.

Access: https://hdl.handle.net/20.500.12542/2608

Hydrological impacts of dam regulation for hydropower production: The case of Lake Sibinacocha, Southern Peru

Bello, Cinthya, **Suarez, Wilson**, Drenkhan, Fabian, Vega-Jácome, Fiorella. (2023).

Journal of Hydrology, 46.
https://doi.org/10.1016/j.ejrh.2023.101319

Abstract

Study focus: Hydraulic infrastructure plays a fundamental role for energy production, drinking and irrigation water storage and flood control in regions with seasonal river flow. The highAndean Lake Sibinacocha has been regulated since 1988 to increase energy production of the Machupicchu hydropower plant. In this study, river streamflow changes are evaluated by analyzing precipitation and discharge trends using indicators of hydrologic alteration and ecoflow for natural (1965–1987) and altered (1988–2016) flow regimes. New hydrological insights for the region: For the altered flow regime, an ecodeficit of about 20% (compared to natural river flow) and an ecosurplus > 30% were found during the wet season (December-February) and dry season (June-August), respectively. These changes have reduced the risk of water shortage (dry season) and flood (wet season) and contribute to increasing water use including hydropower production, irrigation and drinking water. However, river alteration might lead to considerable impacts on riverine ecosystems. Despite major limitations related to data scarcity and complex environmental processes in the basin, our results highlight the usefulness of combined methods of hydrological alteration and ecoflow to effectively evaluate water regime changes in regulated basins. An integrated scientific approach is necessary to address uncertainties and develop meaningful future water availability scenarios that guide hydropower projects with improved water and energy security considering minimal impacts on human and natural systems.

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The rainy season in the Southern Peruvian Andes: A climatological analysis based on the new Climandes index

Sedlmeier, Katrin, Imfeld, Noemí, Gubler, Stefanie, Spirig, Christoph, **Quevedo, Karim, Escajadillo Fernandez, Yury,** Rohrer, Mario, Schwierz, Cornelia (2023)

International Journal of Climatology, 1-18.
https://doi.org/10.1002/joc.8013

Abstract
The rainy season is of high importance for livelihoods in the Southern Peruvian Andes (SPA), especially for agriculture, which is mainly rain fed and one of the main income sources in the region. Therefore, knowledge and predictions of the rainy season such as its onset and ending are crucial for planning purposes. However, such information is currently not readily available for the local population. Moreover, an evaluation of existing rainy season indices shows that they are not optimally suited for the SPA and may not be directly applicable in a forecasting context. Therefore, we develop a new index, named Climandes index, which is tailored to the SPA and designed to be of use for operational monitoring and forecasting purposes. Using this index, we analyse the climatology and trends of the rainy season in the SPA. We find that the rainy season starts roughly between September and January with durations between 3 and 8 months. Both onset and duration show a pronounced northeast-southwest gradient, regions closer to the Amazon Basin have a considerably longer rainy season. The inter-annual variability of the onset is very high, that is, 2–5 months depending on the station, while the end of the rainy season shows a much lower variability (i.e., 1.5–3 months). The spatial patterns of total precipitation amount and dry spells within the rainy season are only weakly related to its timing. Trends in rainy season characteristics since 1965 are mostly weak and not significant, but generally indicate a tendency towards a shortening of the rainy season in the whole study area due to a later onset and an increase in precipitation sums during the rainy season in the northwestern study area.
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Comparison between the Operational and Statistical Daily Maximum and Minimum Temperature Forecasts in The Central Coast of Peru

Aliaga Nestares, Vannia; De La Cruz, Gustavo; Takahashi, Ken (2023).

Weather and Forecasting,38(4), 555–570.
https://doi.org/10.1175/WAF-D-21-0094.1

Abstract
Multiple linear regression models were developed for 1-3-day lead forecasts of maximum and minimum temperature for two locations in the city of Lima, in the central coast of Peru (12°S), and contrasted with the operational forecasts issued by the National Meteorological and Hydrological Service - SENAMHI and the output of a regional numerical atmospheric model. We developed empirical models, fitted to data from the 2000-2013 period, and verified their skill for the 2014-2019 period. Since El Niño produces a strong low-frequency signal, the models focus on the high-frequency weather and subseasonal variability (60-day cutoff). The empirical models outperformed the operational forecasts and the numerical model. For instance, the high-frequency annual correlation coefficient and root mean square error (RMSE) for the 1-day lead forecasts were 0.37-0.53 and 0.74-1.76°C for the empirical model, respectively, but around −0.05-0.24 and 0.88-4.21°C in the operational case. Only three predictors were considered for the models, including persistence and large-scale atmospheric indices. Contrary to our belief, the model skill was lowest for the austral winter (June-August), when the extratropical influence is largest, suggesting an enhanced role of local effects. Including local specific humidity as a predictor for minimum temperature at the inland location substantially increased the skill and reduced its seasonality. There were cases in which both the operational and empirical forecast had similar strong errors and we suggest mesoscale circulations, such as the Low-Level Cyclonic Vortex over the ocean, as the culprit. Incorporating such information could be valuable for improving the forecasts.

Access: https://hdl.handle.net/20.500.12542/2665

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