Hydrological Variability in Atacama Altiplano Lakes During The Last Millennia

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Abstract

Paleohydrological reconstructions from the Chilean Altiplano document abrupt moisture fluctuations during the last millennia. Although the end of the mid Holocene aridity and the onset of more humid conditions between 6–4 ka has been identified in numerous regional marine and terrestrial sites, the timing of late Holocene dry and humid phases shows large regional variability. Laguna Miscanti and Laguna Miñiques (23° 43'S – 67° 46'W, 4140 m asl) are topographically closed, but connected by surface outflow from Miscanti. Sedimentological and geochemical indicators from two new cores show large facies changes, i.e. higher carbonate and evaporite deposition during more arid periods and increased organic productivity (both algal and macrophyte) during more humid phases. As in most Andean lakes located in volcanic settings, large 14C reservoir effects occur complicating 14C dating, so the age models include 210Pb and U/Th dating. In spite of dating uncertainties, both lakes show similar patterns during the last millennium. A humid phase in Laguna Miscanti prior to ca 1200 CE is coherent with rodent middens and geomorphological features indicative of a major pluvial/recharge event at lower altitudes (Atacama Desert) during the Medieval Climate Anomaly (ca 800 - 1300 CE). The LIA (1300 – 1850 CE) is characterized by several arid/humid cycles and the last century by a productivity increase. The hydrological changes observed during the last millennium illustrate the complex dynamics of recent climate evolution over the high altitude Andean plateau. Discrepancies between the northern and southern Altiplano records and with intermediate latitudes (Central Chile) records may reflect contrasting responses to external forcing (Westerlies versus South American Monsoon dynamics) along different climatic zones.

Methods

We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study.

Participants

Material

Procedure

Data analysis

We used R [1] and the R-packages *bookdown* [2], *citr* [3], *dplyr* [4], *forcats* [5], *gamlss* [6–8], *gamlss.data* [7], *gamlss.dist* [8], *ggplot2* [9], *ggpubr* [10], *ggthemes* [11], *gridExtra* [12], *kableExtra* [13], *knitr* [14], *lattice* [15], *MASS* [16], *nlme* [17], *papaja* [18], *parallel* [19], *plyr* [4,20], *png* [21], *purrr* [22], *readr* [23], *rmarkdown* [24,25], *Rmisc* [26], *rticles* [27], *splines* [28], *stringr* [29], *tibble* [30], *tidyr* [31], and *tidyverse* [32] for all our analyses.

Results

Discussion

References

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