Geophysical Research Abstracts
Vol. 21, EGU2019-12667, 2019
EGU General Assembly 2019

Alexander von Humboldt's legacy in current Earth System Science research in the Andes

Manfred R. Strecker
Univ. Potsdam, Structural Geology, Potsdam, Germany (strecker@geo.uni-potsdam.de)

Alexander von Humboldt was fascinated by the Andes. Through his comparative study of mountain belts and the systematic analysis of latitudinal and vertical zonation of plant communities, Humboldt recognized early on that the mountain ranges of Europe and Asia generally strike east-west, while the mountain ranges of the New World strike north-south. To a certain extent he associated the orientation and height of the New World mountains - in particular the Andes - with their proximity to the Pacific Ocean and volcanic processes; he speculated that the distance between volcanic edifices in the range was determined by linked magmatic systems at depth. Humboldt looked at the Andes in a holistic manner and he thus recognized the importance of vertical and latitudinal temperature gradients with regard to the glacierization of South America, the role of the Andean Cordillera to block moisture and to divert runoff, and the impact of humans on plant cover, microclimate and erosive processes. His approach stimulated efforts by others to improve the cartography of mountain belts by incorporating meteorology, botany and geology, one such example being Pissis' mapping of the snowline in the Chilean Andes in 1875. As such Alexander von Humboldt was a visionary who laid the foundation for today's Earth System Science and its across-discipline approach to investigate and decipher complex phenomena associated with the evolution of mountain belts. In this presentation, the interplay between Andean tectonics, climate and surface processes will be reviewed in light of Humboldt's studies more than 200 years ago.

In our current view the Cenozoic Andes exemplify the influence of protracted tectonism on the long-term evolution of climate. With a north-south length of approximately 7000 km, peak elevations in excess of 6 km, active volcanoes, marked tectonic activity east of the arc and frequent megathrust earthquakes along the forearc, the Andes constitute the type example of a non-collisional mountain belt. In addition, there are strikingly different climatic and erosional regimes across and along the orientation of the mountain belt, because the range intercepts atmospheric circulation and forces rainfall along its flanks in its northern and southern sectors, respectively. The asymmetry in precipitation is clearly reflected in differences in weathering, erosion, and sediment transport on opposite sides of the orogen. The Andes thus constitute a barrier for hydrologic processes and species migration perpendicular to strike; conversely, its north-south orientation has favored the interchange of geographically separated lineages in a narrow latitudinal belt, fostering gene flow. Finally, the Andes force the deviation of humid air masses southward toward the arid Andean Plateau as an integral part of the South American Monsoon System, which supports a dense subtropical vegetation in an inherently dry region. These topics are common knowledge today, but many of these aspects had already been addressed, measured and interpreted by Humboldt's seminal studies in the early 1800's.