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Climatic controls on drainage basin topography – The Andean margin (15˚30'S 41˚30'S)

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The analysis of drainage basins has become a powerful and widely applied tool to derive information about active tectonics. However, it is a challenging task isolating tectonic from climatic signals in the landscape. In fact, it still remains elusive how an increase in precipitation might influence erosion and topography in mountain ranges. In addition, it is an open question to what extent river profiles and drainage basins from different climatic settings can be compared with respect to tectonic processes. The Andean margin spans nearly all climatic zones while providing a tectonically active environment. This region is thus a unique natural laboratory for investigating the relationship between range topography, tectonics, and climate.

Here, we present an empirical study of drainage basins, spanning the western flank of the Andean cordillera and its various climatic zones from Arequipa/Peru in the north to Chiloe Island/Chile in the south. We analyzed a total of 126 basins including a subset of 56 equally-sized subbasins along the western Andean watershed to exclude scale and size effects. For all basins, we extracted 20 variables describing geometry, relief, lithology, and climate. Furthermore, we calculated hypsometric integrals and profile concavity indeces for each basin. Finally, we regressed all variables in order to test the influence of geometry, relief, lithology, and climate on hypsometric integral and profile concavity.

Our preliminary results document that basin mean elevation, hypsometric integral, and profile concavity are strongly controlled by mean annual precipitation. An erosion index calculated as the product of slope and the square root of precipitation highly cor-

relates with these parameters as well. Interestingly, the data does not show an increase in relief at higher precipitation rates. This suggests that precipitation effectively decreases basin mean elevation, and eventually basin relief. Thus, together with tectonics precipitation is a first order control of mountain range topography.