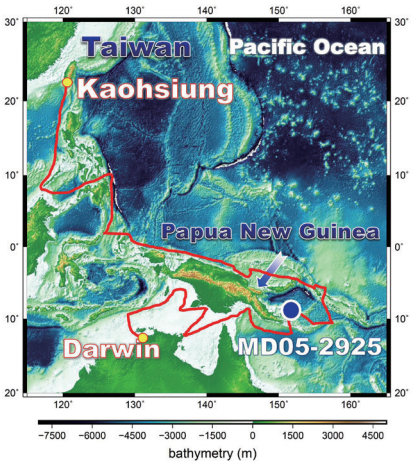

Figure 2. A 15000-km research cruise from Kaohsiung to Darwin during June 1-July 8 2005.

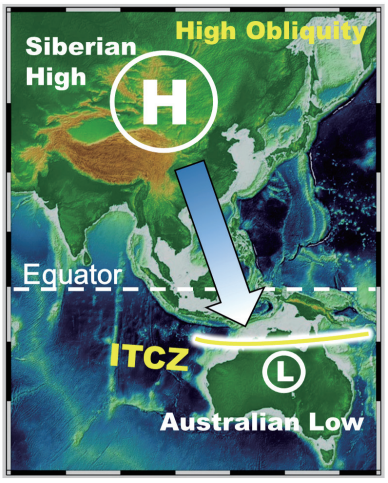

Figure 3. Illustration of the pressure-push mechanism driving the southern branch of the western Pacific ITCZ in the Asia-Pacific realm.

Figure 4. Foraminiferal carbonate shells one of natural archives documenting recent and geological-scale ocean and climate histories.

Their findings suggest that obliquity forcing may play a more important role in global hydroclimate cycles than previously thought. It also provides an in-depth understanding of the past precipitation distribution and dynamics and may offer valuable clues for future climate prediction.

Reference

Yi Liu[#], Li Lo[#], Zhengguo Shi, Kuo-Yen Wei, Chien-Ju Chou, Yi-Chi Chen, Chih-Kai Chuang, Chung-Che Wu, Horng-Sheng Mii, Zicheng Peng, Hiroshi Amakawa, George S. Burr, Shih-Yu Lee, Kristine L. DeLong, Henry Elderfield and Chuan-Chou Shen. (2015). Evolution of the Pacific Intertropical Convergence Zone over the past 282,000 years. *Nature Communications*, 6:10018. DOI: 10.1038/ncomms10018. #These authors contributed equally to this work.

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Influences of rapid and chronic meteorological fluctuations on species elevational range size

The spatial distribution of wildlife is sensitive to climate variabilities. Classic ecological hypotheses have suggested that to adapt and become tolerant to high seasonal climatic variabilities, species in temperate mountains must survive over a greater spatial extent. Therefore, highly diverse organisms that inhabit rugged terrain in tropical and near-tropical areas have been considered more vulnerable to climate change due to the less distinct seasonality in these regions. Additionally, these organisms occupy narrower elevational ranges. However, animals are subjected not only to seasonality but also to diurnal weather fluctuations, and the latter have rarely been studied. A collaborative study conducted by researchers from Academia Sinica, National Cheng Kung University, the University of Connecticut (USA) and National Taiwan University implemented new technologies to analyze a global dataset of species distributions and to assess the

effects of a wide array of physical environmental drivers on the elevational range sizes of species.

The climatic variability hypothesis states that organisms distributed over wider geographic ranges are associated with greater climatic fluctuations. Hence, tropical mountain species are considered more susceptible to climate change than are those in northern regions since tropical species are inhabitants of a stable climate regime and have narrow elevational range sizes. However, this is contradictory to what we, as inhabitants of the region, have observed in tropical and near-tropical mountainous regions where bioclimatic variabilities are actually quite pronounced along elevation gradients. To investigate the comprehensiveness of this hypothesis, an interdisciplinary research team was formed, and it included researchers who specialized in ecology, statistics and spatial analysis. We applied structural equation modeling to investigate the relationships between global-scale climatic factors with fine resolutions and elevational range sizes for 16,000+ species of rodents, bats, birds, lizards, snakes, salamanders and frogs along 180 montane elevation gradients. The results revealed a new macroecological rule: species elevational range sizes are influenced by both diurnal and seasonal climatic variability, but in opposite ways.

Identifying the complex interactions between biotic and abiotic factors and deriving the salient variables governing species range size are critical for understanding not only the adaptation of terrestrial ecosystems in the Anthropocene but also human welfare, including the spatiotemporal dynamics of vector-borne diseases and food security. Therefore, our findings and newly postulated concept should have broad implications in the fields of biology, ecology, meteorology, public health and economics. In the past, research has mainly concentrated on the most direct and detrimental impacts of climate change on organisms, such as species extinction. A shift in the distribution of species has become apparent in the past decade, and global assessments such as the Intergovernmental Panel on Climate Change Assessment Report (Working Group 2) have mainly focused on long-term climatic trends. This study sheds new light on the relationships between animal behaviors and bioclimatic variability and adds crucial information to the current climate change literature.

The unique geographical and biophysical settings of the mountainous regions in tropical and near-tropical areas harbor a wide variety of endemic species. They are global biodiversity hotspots. Global climate change, specifically, elevated temperatures and extreme weather events, may have direct and collateral ramifications on these natural environments (the photograph shows Chilan Mountain and was taken by Cho-ying Huang in November 2015).

Their findings suggest that obliquity forcing may play a more important role in global bioclimate cycles than previously thought. It also provides an in-depth understanding of the past precipitation distribution and dynamics and may offer valuable clues for future climate prediction.

Reference
Wei-Ping Chan, I-Ching Chen, Robert K. Colwell, Wei-Chung Liu, Cho-ying Huang, Sheng-Feng Shen. (2016). Seasonal and daily climate differentially influence species across elevational gradients. *Science*, 351(6280), 1437-1439. DOI: 10.1126/science.aab4119

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