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with a decrease in precipitation or a change in seasonality. Through the lack of spatial coverage of climatological measurements it is not possible to verify this assumption in a differentiated manner. Hence, the German- Chilean joint project "Responses of Glaciers, Biosphere and hydrology to climate Variability and climate change across the Southern Andes (GABY-VASA)" determines the influence of long and short term climate variabilities El Niño-Southern Oscillation (ENSO), Southern Hemisphere Annular Mode (SAM) on the cryo- and biosphere. The combination of atmospheric, dendrochronological, glaciological and modern remote sensing techniques provides the unique opportunity to analyse and cross validate climate variabilities and to interpret environmental changes. Along three cross-sections in the Chilean Andes (Southern Patagonian Ice Sheet, Gran Campo Nevado and Cordillera Darwin) glacier mass balances derived from geodetic measurements (DInSAR) and ice flow dynamics are connected with precipitation models. Precipitation variability reflected by $\delta^{18}\text{O}$ in tree-rings is a promising approach to obtain detailed information of small-scaled hydro climatic conditions. Furthermore the use of $\delta^{18}\text{O}$ as a proxy afford the opportunity of meteorological back trajectories and the derivation of air masses since the Little Ice Age. It thus interlinks past and present climate and allows to draw conclusions about the driving forces of glacial change.

Dendroecology of *Drimys brasiliensis* Miers (Winteraceae) in two Atlantic cloud forests in Paraná State, Southern Brazil

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Dendroecology: ECO-P-21 - Main Hall

The subtropical montane forests in the Southern Brazilian Atlantic Forest constitute a distinct and unique phytogeographic unit, where the soil and climate conditions may impose a rigorous and/or limited control on the plant development. In this context, this study aimed to conduct a dendroecological analysis of *Drimys brasiliensis* Miers (Winteraceae) - a typical tree species naturally growing in these environments, in two upper portions of the Atlantic Forest, in Paraná state. Of a total of 20 selected and georeferenced trees in two study areas of the Serra do Mar (Anhangava Hill - 1,430 m.a.s.l. and Caratua Peak - 1,850 m.a.s.l.), respectively; 80 wood samples containing tree-ring time series were collected by using increment borers (\varnothing 5mm), which were later processed in the laboratory. It was preceded with the macroscopic identification and marking of tree-ring boundaries under a stereomicroscope system, and the scanning and measuring by an imaging software. All tree ring measurements and data analysis were controlled by using Cofecha software. A Principal Coordinates Analysis (PCoA) was used with environmental and climate data to correlate the tree growth in both areas. The obtained results demonstrated that the tree ages ranged from 29 to 134 years. A first tree ring chronology for this species in these upper montane environments (for a period of

1884 to 2013), with 19 individuals and 55 radial samples) is presented. The intercorrelation values obtained for the two sites were 0.37 and 0.30, respectively. Some parameters as altitude and minimum and maximum temperatures seems to be determining factors to the growth of this species. The environmental conditions in these montane forests that often are influenced by cloud coverage and orographic rains and/or fogs can probably affect the solar radiation reaching the forest and therefore play an important role on tree growth.

Tree mortality and summer droughts in *Nothofagus pumilio* forests in the southern Patagonian Andes, Argentina

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Dendroecology: ECO-P-22 - Main Hall

Increase in the frequency, duration and severity of droughts associated with climate change are modifying the composition, structure and biogeographic distribution of forests in many regions of the world. The occurrence of a recent and extensive tree mortality event in the *Nothofagus pumilio* forests, southern Patagonia, Argentina, provides an opportunity to advance in the study of the relationships between tree mortality events, episodic droughts and regional climate variability. At a *N. pumilio* stand affected by the 2011-2012 drought, health conditions of each individual in the canopy was recorded. A tree ring chronology (AD 1818-2014) developed from 40 trees in the stand was used to establish the death date of trees using visual and statistical (COFECHA program) cross-dating techniques. Our results indicate that from 40 trees sampled on the plot, 25 individuals (63%) presented total canopy mortality, whereas the remaining 15 trees (37%) were alive or with varying degrees of mortality. Based on morphological characteristics, the 25 dead trees were classified into three categories: recently dead trees (2 trees with bark and well-preserved small branches); long-time ago dead trees (4 trees without bark and no small branches) and composite dead trees (19 trees with bark showing part of the canopy simultaneously with and without small branches). From the 15 alive trees, 10 trees (67%) show healthy crowns, whereas the 5 remaining trees (33%) show partial dead crowns (previous concurrent with composite mortality). Tree-ring dating of recent and composite mortalities indicates that more than 90% of trees died in 2011. Some of these individuals had over 150 years. These results suggest the occurrence of an unprecedented *N. pumilio* mortality episode related to the severe spring-summer drought during the 2011-2012 in Santa Cruz, Argentina.

Multi-century lake area changes in the Southern Altiplano: a tree-ring-based reconstruction

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