WCRP Conference for
Latin America and the Caribbean:
Developing, linking and applying climate knowledge

# Climate variability and change estimates of South American riverflow through statistical downscaling

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Water availability presents a considerable uncertainty across several time scales. This notion is a serious problem for various applications, such as agriculture and hydroelectric energy. In this study we obtain estimates and make long-term projections of seasonal river run-off via statistical downscaling. Seasonal-to-interannual (SI) simulations and multi-decadal climate change (CC) projections from a global model are assimilated into statistical models in order to produce estimates of seasonal streamflows for four rivers in subtropical South America, namely Uruguay and Negro in La Plata Basin, and Biobio and Itata in southern-central Chile.. The model used is the conformal-cubic atmospheric model (CCAM). This model is a variable-resolution global atmospheric model developed by CSIRO in Australia. It employs a semi-implicit semi-Lagrangian method to solve the hydrostatic primitive equations. High-resolution reanalysis data from 1979 to 2008 were produced by providing the CCAM at 6-hourly intervals with NCEP reanalysis data; seasonal (3-month) averages of this CCAM-based reanalysis data set were subsequently calculated. For the SI time scale, simulations were performed by forcing the model with simultaneously observed SSTs for the period from 1979 to 2005, producing an ensemble of 6 members. For CC projections the CCAM was configured to produce multi-decadal simulations of regional climate for the period 1961 to 2100 at the same horizontal resolution as the reanalysis set. These simulations were performed by forcing the CCAM with the bias-corrected SST and sea-ice output of a number of different coupled global climate models used in AR4 of the IPCC (CSIRO, GFDL20, GFDL21, MIROC, MPI and UKMO). All six of these projections were for the A2 SRES emission scenario. Statistical downscaling to South American rivers was subsequently performed by using the various CCAM-based output fields described above as predictors in a principal component regression model. . For SI simulations model output statistics (MOS) was performed on the large-scale circulation output of the CCAM simulationdata (e.g. 850, 500 and 200 hPa geopotential height fields, 200 hPa u-winds, etc.) and tested retro-actively. The SI system's ability to simulate seasonal flows was tested through discriminations as well as reliability. Although some of the extremely high-flow seasons were underestimated by the MOS, skill has been found to be encouraging especially for those rivers with strong ENSO links (e.g. Negro River). For CC projections the same predictors found to be useful in the SI experiment were used in a perfect prognosis approach, but this time the predictors are obtained from the CCAM-reanalysis. The perfect prognosis equations are subsequently used to simulate seasonal flows over the 140 CC years and for each of the six CCAM projections. Initial results suggest an upward decadal trend for the Negro River during summer.