VACS Research Agenda for Eastern Africa: The VACS Great Lakes Project

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Introduction

The Great Lakes research project is one of the flagship projects for the East Africa research component of VACS. Equatorial East Africa has two distinct rainy seasons during the course of the annual cycle, unlike most of the rest of the continent, which has only the one. This distinguishing feature is further complicated by the large proportion of the regional surface area covered by lakes compared to the other regions of Africa. Lake Malawi, Tanganyika, and Victoria (hereafter, MTV) rank among the 10 largest lakes in the World. Their influence extends up to 300km way from the lake coastline. Collectively, the Great Lakes of East Africa impact a vast area. However, their coupling with the regional climate is not well understood. The Great Lake basins are among the most economically productive regions in East Africa and they are home for over 60 million inhabitants. Significant variations in the timing and intensity of rainfall/temperature and the lake conditions could have significant impacts on agriculture, fisheries, hydroelectric power generation, municipality-water supply, river flow, transportation, industrial water pollution, and other social-economic factors in the region.

Research goals:

The primary goal of the VACS Great Lakes project is to understand the variability and predictability of the Great Lake-regional climate coupled system, its modulation by the continental/global climate, and its impact on regional hydrology. This research builds on previous research that has demonstrated that the hydrodynamics of Lake Victoria play a critical role in determining the coupled variability of the lake and the climate of the region (Song et al 2004). Adopting the traditional approach in which the dynamical processes of the lake are neglected and the formulation is entirely based on thermodynamics is not fully satisfactory for these large bodies of water. Such a strategy precludes realistic transportation of heat energy within the lake and thereby results in degraded model simulation of the climate downstream over the large lake and the surrounding lake basin region (Anyah et al 2006a).

Fig.1 illustrates the three-scale problem and VACS research strategy. It focuses on quantifying the relationships among continental/global-scale climate variability (reanalysis or Global Climate Model), East Africa regional climate variability (RegCM3-POM coupled model), and the catchment-scale climate variability of Lake Victoria levels/outflow (Nicholson et al 2000; Tate et al 2004; water balance models), which in turn is closely related to hydropower generation in the region.

In addition to better understanding the role of ENSO and the Indian Ocean Zonal Mode (IOZM) on East African climate, VACS is also investigating so called decadal climate variability modes (see article by Aming'o and Ogallo). Recently, Schreck and Semazzi (2004) and Bowden et al (2006) have isolated a regional decadal mode characterized by increasing/decreasing rainfall over the northern/southern part of eastern Africa, and its temporal behaviour appears to be consistent with the increasing global/hemispherical average surface temperatures. It is hypothesized that this mode could, in part, explain the observed decline in the levels of Lake Victoria and the

melting of the glacier over Mount Kilimanjaro in Tanzania documented by Kaser et al (2003), and many others.

The climate change component of this research (not described here) will examine how this three-scale problem manifests itself under the projected IPCC climate change scenario conditions. The project also involves a major initiative to promote, design, and implement a special observational campaign for the lake basin coupled climate system for validating the models. In future, the intention is to extend this effort to the other major large lakes and ecosystems in the region.

Summary:

VACS research on East Africa is helping to clarify the contribution of climate variability to the recent drop in levels of the Great Lakes which has important implications for the economy of the region. The strong social-economic regional relevance of this research is helping to mobilize and strengthen 'National CLIVAR' research groups in the region. By linking VACS research to specific applications, further motivation for improving the prediction skill of regional climate models for East Africa is evident.

Other aspects of VACS research for East Africa, not discussed here, include an investigation of the Somali and Turkana jets, case studies of the impacts of recent ENSO events over East Africa, examining the relative roles of the Indian and the Atlantic Oceans on East African climate, and producing an inter-comparison of regional climate model outputs downscaled to specific regions of interest.

References

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