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Tectonic induced growth of lake Beseka (Main Ethiopian Rift)?

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Lake Beseka is situated in the tectonically active Main Ethiopian Rift. Since 1976 a lake level increase of Beseka has been observed by the Ethiopian Water Ministry in Addis Ababa, in a region known for severe droughts and decreasing precipitations for the last decades. During this period its surface area quadrupled and the lake rose up from 946.7 m asl to 955 m asl. Meanwhile, a sugar plantation and major traffic routes from Addis Ababa to Djibouti are threatened by inundation.

In this paper we discuss several hypotheses concerning this sharp rise. The favored assumption before this study incriminated the irrigation of the Abadir Farm Southeast of Beseka. On the other hand, recent tectonic activity might have induced or changed the inflow from hot springs located southwest of Beseka. In addition, a tectonically triggered modification of the underground water system could be the cause of increased discharge into the lake. We use a combined remote sensing/in situ measurements approach to analyse the basin system. Multi-source and multi-date data allow us to quantify the lake growth and several parameters such as temperature and turbidity, and locate the main active faults. Hydrochemical parameters such as conductivity and pH measurements have been collected during a field season in fall 2004. Differences of electrical conductivity up to 4.9 mS/cm have been measured. Nearby the hot springs conductivity values reached their minimum of 1.5 mS/cm compared to 6.47 mS/cm in the centre of the lake. These data and lake surface temperatures measured from processed satellite data indicate no significant changes in proximity to the sugar plantation. These preliminary results suggest that the irrigation system of the farm does not have an influence on the increasing lake level. However, the hot springs in the southwestern part clearly influence pH and conductivity of Beseka.

Using echo sounder data and stereoscopic data acquired before flooding we have gen-

erated a Digital Terrain Model of the floor of Lake Beseka in order to model the water volume increase. Drilling data provided by the local Metehara Sugar Plantation were used to model the lithological bodies. Moreover the groundwater flow direction conditioned by water table and permeability has been simulated. Finally, a meteorological database covering the last 39 years, collected at two different nearby stations has been taken into account in order to study any climatic influence on the lake level. We propose that recent tectonic activity has modified the shallow structure of the basin, modified the hydrogeological system and thus triggered the generation of the lake Beseka.