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Salt intrusion in the Pungue estuary, Mozambique: effects of sand banks and temporary closing of tidal channels

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This paper presents a salt intrusion model for the Pungwe estuary with the aim to determine the minimum discharge required to prevent the salt intrusion from reaching the water intake situated 82 km from the estuary mouth. The Pungue river is shared between Zimbabwe and Mozambique and has a large variation in precipitation and runoff. The mean monthly discharge can be as low as 4 m^3/s and as high as 1450 m^3/s. The second largest city of Mozambique, Beira, relies on the Pungue for its water supply. In the dry season it frequently occurs that the water intake of water has to be ceased because the salinity of the Pungue water is too high.

The salt intrusion model used is based on a fully analytical and predictive theory which is confronted with measurements of salt intrusion and estuary topography. The paper presents the collection of estuary characteristics and the salt water intrusion measurements that were obtained by field measurements in 1993 and 2002. Using these data the salt intrusion model has successfully been applied.

During salinity intrusion measurements in the dry season of 1993 it was observed that sand banks in the middle zone prevented the salt water from intruding further upstream, resulting in lower salinity levels upstream than the theoretical salt water intrusion predicts. This effect takes place when the high water level at Beira is lower than 6.5 meters and can reduce the maximum salt water intrusion length by 10 km.

The model indicates that a minimum discharge of 20 m^3/s is required to maintain acceptable salinity levels during high water and average spring tide near the water intake. The actual water discharge upstream of the water intake may have to be higher, since this minimum discharge does not take into account the water abstracted for irrigation and urban water supply.