Groundwater use and climate

The Makutapora Record

For more than half a century, the Ministry of Water, the Dodoma Urban Water Supply and Sewerage Authority (DUWASA) and the Tanzania Meteorological Agency have been monitoring groundwater abstraction, groundwater levels, and rainfall in central Tanzania at the Makutapora Wellfield (Figure 1). These observations comprise the longest published record of groundwater levels in tropics and provide unique insight into the relationships among groundwater abstraction, storage and replenishment by recharge.

First, The Makutapora Record reveals that intensive pumping of groundwater (>30,000 cubic metres per day) to provide a climate-resilient water supply to the national capital of Dodoma, is sustained by recharge that results from exceptionally heavy seasonal rainfall occurring infrequently, on average, during just 1 rainy season in 5. Second, The Makutapora Record reveals that the wellfield is able to store substantial volumes of groundwater, estimated to be 3.8±0.4 million cubic metres for every 1 metre decline in the water table. Using this observed relationship, current abstraction of 1.1 million cubic metres per month over one year, is predicted to lower groundwater levels in the wellfield by 3.5±0.4 metres in the absence of recharge.

The uncertain and irregular patterns of recharge observed in The Makutapora Record complicate sustainable management of the wellfield. Sustained periods of groundwater depletion in the absence of substantial recharge are evident from The Makutapora Record during the 1970s. The Makutapora Record reveals, however, a strong link between heavy seasonal rainfalls associated with the El Niño Southern Oscillation (ENSO) and major recharge events. Because ENSO events tend to take place every 3 to 7 years, this link suggests that recharge may be expected to occur, albeit infrequently, in the future. Climate change is projected to increase the intensity of rainfall in the Dodoma region. Although this shift may lead to longer droughts and more frequent and intense floods, The Makutapora Record indicates that it favours groundwater replenishment by rain-fed recharge.

For more information, please contact: Alloice Kaponda, Groundwater Unit, Ministry of Water (alloicekaponda@yahoo.com). Compilation and analysis of The Makutapora Record was conducted by the Ministry of Water, University College London, University of Sussex and the British Geological Survey with support from the Department for International Development (DFID, UK).

Further details can be found in:

Figure 1. The Makutapora Record of: (a) groundwater-level observations, (b) monthly rainfall, and (c) monthly groundwater abstraction, starting from 1955.
Matumizi ya Maji ya Chini ya Ardhi na Hali ya Hewa
Bonde la Makutapora – Dodoma

Kwa zaidi ya miongo mitano Wizara ya Maji, Mamlaka ya Majisafi na Mamlaka ya Hali ya Hewa Tanzania (TMA) zimekuwa zikifuatilia matumizi ya maji ya ardhi, vina vya maji katika visima na viwango vya mwua katika Bonde la Makutapora. Ufuatiliilia huu ni moja ya uliochukua muda mrefu katika ukanda wa tropiki na unaonyesha uhusuiano wa karibu baina ya matumizi ya maji ya ardhi, hifadhi ya maji ardhini na kiwango cha maji kinachoongeza ardhini kulingana na maji ya mwua.

Kwanza taarifa za ufuatiliilia katika Bonde la Makutapora zinaonyesha kwamba pamoja na matumizi makubwa wa maji (kiasi cha zaidi ya mita 30,000 kwa siku) kwa ajili ya mji wa Dodoma, takini hayajaathiri hifadhi ya maji ardhini. Hali hii inasababisha kuwa mabadiili ya mivyo vya kima vya vyakoo ambazo zitoongeza hifadhi ya maji ardhini kulingana na mwua.

Pili taarifa za ufuatiliilia katika Bonde la Makutapora zinaonyesha kwamba bonde linahifadhi kiasi cha mita za ujazo milioni 3.8±0.4 kwa kila kina cha mita. Hii hiyo kutokana na takwimu hizi inawezekana kutabiri kwamba maji katika kisiwa cha mita 3.5±0.4 kama hakukakuta kwa ongezeko lolote la maji ardhini.

Pili taarifa za ufuatiliilia katika Bonde la Makutapora zinaonyesha kwamba mabadiili ya mivyo vya kima vya vyakoo ambazo zitoongeza hifadhi ya maji ardhini. Hali hii inahadhihirisha kuwa kila baada ya uchukuo wa mwaka mita zitoa hadi 3 hadi 7 hivyo ongezeko la maji.

Bw. Stephen Katanga wa Wizara ya Maji kisima namba 103/78 kilichopo katika Bonde la Makutapora.

Further details can be found in: