

## Groundwater level fluctuations and land use changes in the basaltic aquifer of Narmada basin (Central India)

\*Sakshi Ramesh Shiradhonkar<sup>1</sup>, Tomochika Tokunaga<sup>1</sup>

1. Department of Environment Systems, University of Tokyo

In an extremely populated country like India, with agriculture as its economic backbone and nearly 90% of water has been utilized for agriculture and related activities, a strategic water management approach is necessary to avoid unsustainable exploitation of fresh water resources. Understanding the drivers behind the changing trends and their magnitude with respect to the water resources can provide information to support managing and developing water resources in a better way. During 2003-2016, an apparent increase of TWS (terrestrial water storage) was evident from GRACE (Gravity Recovery and Climate Experiment) satellite data in the central west of India where the Narmada river basin is situated whereas TWS trends were declining in north and south of India. In this study, the part of the Narmada river basin was chosen as the study site to discuss the possible reasons for the observed increase of TWS in the area. In this area, between 2003 and 2016, two major dams (Indira Sagar dam (2005) and Omkareshwar dam (2008)) were constructed, and the canal systems were developed in the area. Moreover, several water bodies were developed in the non-canal command areas (non-CCA). The objectives of this study were set to (1) understand the possible effects of the canal system on groundwater level behaviour in the Indira Sagar canal command area (CCA) and in the non-CCA within the basaltic aquifer domain, and (2) analyse the land use change, especially the surface water bodies. The groundwater levels were analysed based on two timelines, i.e., before and after canal construction in dry pre-monsoon and rainy monsoon seasons. The canal construction began by around 2007, from Indira Sagar dam towards the west until 2012-2013. The area to the south of the Narmada river is divided as CCA and Non-CCA based on the canal irrigation scheme. After the canal construction, on an average, about 2 m rise was observed in the well water levels during pre-monsoon while 1.1 m in monsoon seasons. Mann-Kendall's statistic test was performed on the groundwater well levels situated in non-CCA during dry pre-monsoon, rainy monsoon seasons and annually. Out of the 20 studied wells, only the ones situated near local water bodies showed significant/insignificant increasing trends while all the others which were spatially located far from any surface water body indicated declining trends. The changes in land use land cover (LULC) pattern were studied using Landsat 5, Landsat 7 ETM+, and Landsat 8 OLI/TIRS imageries in the region. The area used for surface water storage increased from about 1% to about 12% in between 2003 and 2013. The water from rainfall and Narmada river are perhaps the major sources for developing these water bodies, since both the major dams are built across the Narmada river. Based on the statistics and the interpretations, groundwater storage has been increased after the canal operation than before, likewise the area of surface water body expanded during 2003-2016, this may at least partly explain the reason why GRACE demonstrates increasing TWS trends in central west region of India.

Keywords: Groundwater, TWS (Terrestrial Water Storage)