Strong Hydrological Effects on Superconducting Gravimeter Observations in Garhwal Himalaya

Naresh Kumar, Gautam Rawat and Baldev R. Arora,
Wadia Institute of Himalayan Geology,
33 GMS Road, Dehradun 248 001, India
arorabr@wihg.res.in; Fax +91 135 2525200

Continuous gravity measurements are being carried out in the Garhwal Himalaya at MPGO Ghuttu for recording gravity variation produced by continental convergence at μGal level. The only superconducting gravimeter (SG) station in the Himalayan region has a very high accuracy for observing minor changes in gravity. In the Himalayan region heavy rainfall of over 50 mm/h occurs in the rainy season from June to August. Two years gravity observations show a heavy influence of tidal forces, atmospheric pressure and hydrological effect. The recorded data is sufficient to remove the continuous and systematic effects of tidal forces and atmospheric pressure using global model or data adoptive regression analysis. The important theme of detecting changes in near surface water storage using gravity, a specific goal of Gobal Geodynamics Project (GGP), is being fulfilled by recording water level changes in a 60 meter deep borehole at about 200 m away from the SG station. The gravity changes, especially during rainy season, are marked by two class of variations, one steep changes related to intense events of heavy rainfall and second slow changes, which are apparently related to hydrological mass distribution. The short period precipitation-induced gravity change, concurrent with heavy rainfall events, is of the order of 1 μGal. However, the ground water level variation exerts slow change in gravity residual up to 30 μGal with time lag of few days to 30 days. The efficacy of tank model and regression approaches used to quantify precipitation and hydrological mass balance are discussed to illustrate the merit and limitation imposed on the isolation of dynamic and earthquake precursory signals.