Effect of adjacent frequency signal on geodetic GNSS observations

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We found a possible radio interference of 1.5 GHz LTE signals from cell-phone base stations to nearby geodetic GNSS receivers installed at 14 GEONET stations of the Geospatial Information Authority of Japan as of February 2016. At these stations, the SN ratio of observed L1 and L2 frequency GPS signals dropped suddenly on the same days when the nearby cell-phone base stations began the transmission of 1.5GHz LTE signals. The height components of GEONET final solutions (F3) of these stations are contaminated with fake periodic variations of up to 5 cm amplitudes and from 2 week to 3 month periods. There are no corresponding horizontal periodic variations. All the 14 stations are equipped with the same type of modern geodetic GNSS receivers and choke ring antennas for multi-GNSS. We suspect that the relatively high power of 1.5GHz LTE signal adjacent to L1 GPS frequency (1.57542 GHz) from the nearby cell-phone base station saturates the antenna and receiver amplifiers, and lowers the received L1 and L2 GPS signals by the receiver. However, the mechanism of the fake height variations of relatively long periods is not easy to identify. Test observations at 2 GNSS stations with notch filters provided by the receiver manufacturer to remove the 1.5 GHz LTE signal show moderate recovery of SN ratio and almost no indication of periodic height variations. The insertion of attenuator of about 5 to 10 dB has the similar effect. As interim measures, we plan to deploy optimal level attenuators to the remaining stations affected by the possible adjacent frequency channel interference.

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