Geophysical Research Abstracts,
Vol. 11, EGU2009-3537-1, 2009
EGU General Assembly 2009

Novel method for water vapour monitoring using wireless communication networks measurements

N. David (1), P. Alpert (2), and H. Messer (3)

(1) The Department of Geophysics and Planetary Sciences, Tel Aviv University, Tel Aviv, Israel (noamda@post.tau.ac.il), (2) The Porter School of Environmental Studies, Tel Aviv University, Tel Aviv, Israel (pinhas@post.tau.ac.il), (3) The School of Electrical Engineering, Tel-Aviv University, Tel-Aviv, Israel (messer@eng.tau.ac.il)

We propose a new technique for monitoring near-surface water vapour, by estimating humidity from data collected through existing wireless communication networks.

Water vapour plays a crucial part in a variety of atmospheric processes. As the most influential of greenhouse gases, it absorbs long-wave terrestrial radiation. The water vapour cycle of evaporation and recondensation is a major energy redistributing mechanism transferring heat energy from the Earth's surface to the atmosphere. Additionally, humidity has an important role in weather forecasting as a key variable required for initialization of atmospheric models and hazard warning techniques. However, current methods of monitoring humidity suffer from low spatial resolution, high cost or a lack of precision when measuring near ground levels.

Weather conditions and atmospheric phenomena affect the electromagnetic channel, causing attenuations to the radio signals. Thus, wireless communication networks are in effect built-in environmental monitoring facilities. The wireless microwave links, used in these networks, are widely deployed by cellular providers for backhaul communication between base stations, a few tens of meters above ground level. As a result, the proposed method can provide moisture observations at high temporal and spatial resolution. Further, the implementation cost is minimal, since the data used is already collected and saved by the cellular operators. In addition – many of these links are installed in areas where access is difficult such as orographic terrain and complex topography. As such, our method enables measurements in places that have been hard to measure in the past, or have never been measured before. The technique is restricted to weather conditions which include absence of rain, fog or clouds along the propagation path.

We present results from real-data measurements taken from microwave links used in a backhaul cellular network that show very good agreement with surface station humidity measurements.