Signal of atmospheric pressure loading in satellite laser ranging data (2)

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Variation of a vertical component due to atmospheric loading effect has been researched throughout the last decades, and is typically 1 cm peak-to-peak or less. Compared to other microwave-based geodetic techniques, satellite laser ranging has an advantage in accurate model of propagation delay, which must result in accurate determination of a vertical component of station coordinates.

The effect was already seen in GPS and VLBI data, and we found it also possible to detect the vertical variation as a function of atmospheric pressure from recent laser ranging data. In our orbit analysis software 'concerto', a new adjusting parameter, height per pressure, was implemented. We used LAGEOS-1 and LAGEOS-2 normal point data taken during 1999 to 2002. The new parameter was estimated simultaneously with other parameters such as orbits and station coordinates. The post-fit weighted rms of normal point data was 1.2 to 1.5 cm, and we obtained the parameter at -0.1 to -0.5 mm/hPa for major 12 laser ranging stations in the world. This result indicates that the station height gets lower when the local atmospheric pressure is high, and is close to -0.35 mm/hPa given by Rabbel and Zschau (1985) and also to the results from VLBI and GPS.