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On the phenomena disturbing the terrestrial orientation of the Wettzell G-Ring gyroscope

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Ring Laser Gyroscopes (RLGs) are instruments for measuring absolute rotation. They observe the so-called Sagnac effect, i.e. a phase shift of two light beams propagating in opposite directions around a circuit of a rotating gyroscope. Although the two beams travel the same path in the same conditions, due to the sensor rotation they traverse different distances in itertial space. It results in the phase shift which is directly proportional to the dot product of the normal of the gyroscope and the vector of its rotation. Considering a large laser gyroscope firmly tied to the ground, it is quite obvious that the observed Sagnac effect is due to both Earth rotation perturbations and changes in the terrestrial orientation of the normal vector. We have already dealt with the first effect (M. Tercjak and A. Brzeziński (2017), Pure Appl. Geophys, Vol. 174 pp 2719–2731) and now we want to focus on the phenomena disturbing the terrestrial orientation of an instrument. According to (K.U. Schreiber and J. P. Wells (2013), Review of Scientific Instruments 84), the aforementioned phenomena are pressure loading around the sensor site, wind loads, ground water variations, microseismic activity, solid Earth tides and, especially for instruments located near to the seashore, ocean tidal loading. However, some effects are not easily modeled and therefore it is difficult to predict their impact. Within this work we make an overview of the effects affecting direction of the normal vector of the gyroscope G-Ring at the Wettzell Observatory, compare their impact and discuss a possibility of modeling them. We compare different models of non-tidal loading effects (including our own modeling efforts), discuss two ways of modeling the impact of the solid Earth tides and verify required accuracy of the Love numbers used in computations. Moreover, we discuss the impact of the local atmospheric conditions on the observations and a possibility of reducing their impact.