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On the combination of VLBI and ring laser data for accurate Earth rotation determination

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The determination of Earth rotation parameters (ERP, i.e. polar motion and universal time/length of day) with sub-diurnal resolution is today mainly done using space geodetic techniques, such as Very Long Baseline Interferometry (VLBI) and Global Navigation Satellite Systems (GNSS). A new interesting technique, sensitive to sub-diurnal variation in the ERP, is ring laser gyroscopes. A ring laser gyroscope is sensitive to the projection of the instantaneous rotation vector of the Earth on the normal of the ring laser, thus one single ring laser is not enough to completely determine the ERP. In this work we investigate the possibilities to combine VLBI measurements of ERP with sub-diurnal resolution with ring laser measurements. For this we use recent data from the Wettzell G ring laser. Different methods for performing the combination are studied, e.g. combining the data at the normal equation level or using a Kalman filter. We investigate how much the accuracy of the ERP determined from the combination is improved relatively to the ERP determined using VLBI only. We also perform simulations to investigate the impact of possible future improvement of the ring laser measurement accuracy, as well as the impact of having data from several globally distributed ring lasers.