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A comparison of different approaches for the determination of the Earth's pole tide Love number from polar motion observations

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The Earth orientation parameters (EOP) are available for a time frame of several decades with a high accuracy. Commonly analytical or numerical forward models are applied to interpret the EOP series and their variations in terms of underlying geophysical processes in the Earth system. Naturally, models are dependent on geometrical, rheological and physical Earth parameters, some of them are weakly determined from observations or models. The pole tide Love number is the most critical parameter. It has a strong influence on period and damping of the model's Chandler oscillation.

In this contribution we apply the precise polar motion observations in an inverse dynamical model approach in order to improve the pole tide Love number. There are different possible approaches (e.g. a Gauss-Helmert approach, an adaptive Kalman filter), which are applied on the Euler-Liouville equation. The different approaches are tested against each other with respect to their stability and their numerical results. The external geophysical forcing (e.g. atmospheric, oceanic angular momentum variations) and the precise observation time series are constraints for the inverse dynamic model. Due to the high accuracy of the observations an improvement of the pole tide Love number is expected. Finally the improved pole tide Love number will be used in the forward model. The paper presents the procedure and numerical results of each approach, the comparison of the approaches and the improved model results for the polar motion

Our investigations are integrated in a project performed in the frame of the German research unit on Earth Rotation and Global Dynamic Processes.