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In the Radio Occultation (RO), the refractivity is generally obtained from the inverse Abel transform of measured bending angle, often called Abel inversion (AI). While concise and straightforward to apply, AI is susceptible to the error present in the bending angle. Aiming at reducing the adverse effects of the measurement error, this study proposes a new method for determining the refractivity through a variational regularization (VR). The method approximates the inversion of the forward Abel transform by an optimization problem in which the regularized solution describes the measurement as closely as possible within the measurement's considered accuracy. The optimal problem is then solved iteratively by means of the adjoint technique. VR incorporates the prior information about measurement characteristics and desired behaviour of the solution into the regularization via error covariance matrices. In contrast to variational data assimilations, VR holds the control variable in the measurement space. This makes VR particularly effective by allowing the method to benefit from the posterior height determination and to deal with model's error in the impact parameter. The advantages are elaborated using a purposely corrupted synthetic sounding and with known true solution. The competency of VR relative to AI is validated with a large number of actual RO soundings. The comparison with nearby radiosonde observations shows that VR is considerably smaller than AI in both random and systematic errors. It is concluded based on the results presented in this study that VR offers a definite advantage over AI in the quality of refractivity.
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