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Reply to comment by S. Haaland et al. on "Minimum variance analysis-based propagation of the solar wind observations: Application to real-time global magnetohydrodynamic simulations"

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[1] The authors welcome the comments made by *Haaland et al.* [2010, hereafter HA10] on the work by *Pulkkinen and Rastätter* [2009, hereafter PR09]. Indeed, the forward modeling technique introduced in the work by PR09 to damp (or low-pass filter) the fluctuations in the determined phase planes can cause violation of the original constraint $\langle \mathbf{B} \rangle \cdot \mathbf{n} = 0$. In fact, the violation of the constraint has to occur also in the method by *Weimer and King* [2008], who carry out nonconstrained interpolation of the phase plane orientations to "patch" the poorly determined phase planes between the well-determined ones. Also, as pointed out both by HA10 and PR09, the damping does prevent sharp and possibly real changes in the phase plane orientations.

[2] HA10 argue that the violation of the constraint $\langle \mathbf{B} \rangle \cdot \mathbf{n} = 0$ and preventing the sharp changes in the phase plane orientations are possibly unphysical features and should thus be avoided. While this may be true, it is emphasized that the sole purpose of the work by PR09 was to develop a technique applicable to solar wind propagation in a real-time space weather modeling setting. The authors did not attempt to create a physics-based model for the solar wind discontinuities or to extract physical information about the solar wind properties for detailed physics-based analysis. Although physically as accurate as possible approaches are certainly desirable, in the applications-oriented context the true validity of the technique is determined in terms of comparisons between predicted and observed geospace parameters. PR09 carried out such comparisons using global magnetohydrodynamic simulations and the observed ground magnetic field perturbations. Further, as was argued by PR09, the small number of free parameters in the new method is an appealing feature that at least partially balances the deviation from a strictly physical approach. The small number of free parameters may be important for robust application of the method to a great variety of different interplanetary conditions.

[3] The new technique proposed by HA10 is very interesting and the ability to hold the constraint $\langle \mathbf{B} \rangle \cdot \mathbf{n} = 0$ while allowing for sharp changes in the phase plane orientations is appealing. As indicated by HA10, it would be interesting to study if the free parameters of the method such as the wavelet threshold and the data segment length can be chosen optimally in a way suitable to a variety of different interplanetary conditions. Also, comparisons between observed and predicted geospace parameters obtained by applying the technique introduced by HA10 to a real-time setting is needed (for a recent example of such comparisons, see *Pulkkinen et al.* [2010]). Only rigorous comparisons between predictions and observations can give unambiguous indications about solar wind propagation techniques' applicability to space weather modeling.

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