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# Optical flow analysis applied to high resolution auroral imagery: a new approach to auroral classification

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Studies of fine structure in the optical aurora have, historically, focused on the size and drift-speed of individual features. Optical flow techniques, on the other hand, provide a framework for analyzing the velocity field as a whole. In particular, we study three events of very dynamic aurora, which is rich in small scale details and motions, but which at the same time is very different from rayed aurora and curls (also exhibiting fast moving structures at small scales).

The optical flow is gained through a robust estimation framework. Traditionally, optical flow fields are deduced by assuming that only a single motion is present in a small finite region of the image, and that either the image data or the spatial coherence is conserved. In reality, optical flow consists of multiple motions, and is only piecewise smooth. By using robust estimation, violations of the above assumptions are treated as outliers, thus reducing the sensitivity to ill-formed assumptions, and we can resolve multiple motions and discontinuities in the flow field. The optical flow fields obtained for the three events are presented and compared to that of other types of aurora, and their potential use for identifying unique properties of the aurora is discussed.

Deficiencies in current observational methods, which leads to inadequate measures, are discussed along with possible solutions.