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Deducing spatial properties of auroral primary particle distributions from ground-based optical imaging.

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The distribution of particles impinging on the upper atmosphere constitutes the most important link between magnetospheric processes and the optical aurora. Particle measurements from satellites and sounding rockets give the most exact information about the primary particle distribution, but they are only able to provide snapshots and statistical results. With ground-based imaging, on the other hand, it is possible to record the aurora over a large area for an extended period of time, and it is therefore of great interest to be able to deduce properties of primary particle distributions from optical data. So far, the most successful methods have relied on different emission intensity ratios, but these methods only work well for field-aligned measurements. This is obviously a severe limitation. In this paper we discuss ways to obtain information on primary particles away from magnetic zenith. In a recent study we have used images of the auroral red and green line emissions obtained from different ALIS stations to estimate the maximum deviation from magnetic zenith of the measurement direction for which the results are reliable. Taking the altitude difference between the red and green line emission peaks (about 100 km) into account we find that the green to red intensity can be used to reconstruct auroral electron parameters for directions up to 30 degrees from magnetic zenith. Implications for magnetospheric processes in selected cases, as well as interpretation problems, will be discussed.