The location of the substorm initial brightening in the auroral oval

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An auroral initial brightening in substorm is related to the onset of substorm, and is an important phenomenon to understand its physical processes.

As reported by, e.g., Akasofu [1964] and Lyons et al. [2002], an initial brightening arc often appears equatorward of quiet arcs near midnight, and it then develops to breakup auroras.

On the other hand, satellite observations imply that the onset of substroms occurs somewhere in the inner magnetosphere rather than around the plasma sheet boundary layer, but we have not yet had an enough knowledge of the onset place. It is hence an outstanding question where the initial brightening happens to occur in the auroral oval, which connects to the plasma sheet through magnetic field lines.

The present study is based on an analysis of isolated substorm events using multi-wave lengths image data obtained from the Polar satellite and simultaneous data from magnetometer and radar networks.

We identify an initial brightening aurora and spatial and temporal developments of the aurora into the expansion and recovery phases of substorm.