Auroral activity of the polar boundary arc and the equatorial part of an oval during substorms

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Dynamics of polar aurora recorded in Finland and on the Kola Peninsula was investigated. During a local growth phase and on transition to a phase of expansion, on a boundary of the auroral oval with a polar cap periodically became active a polar boundary arc. Along with this stationary arc in the same area new auroral arcs arise and begin to drift to the equator. The activity in the main, equatorial part of an oval is not directly synchronized with the activity in a boundary arc. The idea of quasi-independent substorm development at the near-tail and trapping regions is discussed. According to this idea, the boundary arc is a projection of braking area of the fast flows of particles arriving from a near-tail reconnection region. Diffuse arcs drifting to the south may be regarded as signature of an action of the enhanced convective electrical field, or as a projection of a compression wave. As a result, on the inner boundary of the plasma sheet, which is located in the trapping region, the conditions favorable for development of explosive instability of a substorm are gradually growing. The onset can be both spontaneous or initiated by the sudden decrease of convective electric field. Similarly, the following substorm activations during poleward expansion are developing independently from a sources in the magetotail. The assumption of the quasi-independent development of processes in the magnetotail and the trapping region seems to be in agreement with experimental data and allows to reconcile the contradictions in existing substorm models.

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