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Modeling of ionospheric signatures of an auroral streamer during a double oval situation

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During the late evening and night of September 14, 2004, the nightside auroral oval shows a distinct double oval configuration for several hours after a substorm onset at $\sim$ 1845 UT. During this configuration, an auroral streamer is observed around 2117 UT in the recovery phase of the substorm by the IMAGE satellite optical instruments, by the MIRACLE ground-based instrument network in Scandinavia, and by the EISCAT mainland radar. In the magnetospheric plasma sheet conjugate to the streamer, the four Cluster satellites record a bursty bulk flow event, which is the known magnetospheric source of ionospheric streamers. The ionospheric equivalent current maps during this streamer event show a clear signature, which is however different from the one which has been observed many times earlier for streamers that occur in a situation without a double oval configuration. Introducing a conceptual model of the ionospheric electrodynamics of an auroral streamer with and without a double oval configuration, we are able to reproduce the main signatures of the observed ionospheric equivalent current maps for both situations. The difference between the two situations can be explained by a poleward pointing polarisation electric field which is set up in the double oval case only, due to the density and conductance gradients at the equatorward edge of the poleward part of the oval, and at the poleward edge of the equatorward part of the oval, respectively.