

# Magnetosphere-Ionosphere coupling process produced by Ampere force forcing from the magnetosphere

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The way of M-I coupling process through Ampere force forcing from the magnetosphere to the ionosphere is discussed. There are many kinds of electromagnetic coupling ways between magnetosphere and ionosphere, e.g.,

1. FAC forcing: map the FAC distribution from the magnetosphere to the ionosphere and calculate ionospheric electrostatic electric field (production of FAC-free polarization field),
2. Electric field forcing: map the electric field distribution from the magnetosphere to the ionosphere and calculate the FAC distribution at the ionosphere (production of polarization-free FAC distribution).

However, as discussed by Yoshikawa et al., [2010], both of above ways cannot simultaneously satisfy energy and current conservation. Alternatively the way of M-I coupling through shear Alfvén wave can do that in local coupling. On the other hand, Alfvénic-coupling with electrostatic approximation cannot provide physical mechanism how a localized Alfvénic coupling phenomenon drives global ionospheric current system.

In this study, we propose a new way of M-I coupling theory that formulating the M-I coupling process as subsequent process of ion dynamics produced by the Ampere force forcing from the magnetosphere, that is, 3. Ampere force forcing: map the Ampere force from the magnetosphere to the ionosphere and calculate ionospheric flow through the force balance equation, induced electric field through the generalized Ohm's law, a new magnetic field perturbation through Faraday's induction law, new current density through Ampere's law, and new Ampere's force as a result of this coupling process can feed back to the magnetosphere.

Some example of M-I coupling process, aurora streamer, WTS evolution during substorm process, and dynamical Cowling channel formation will be discussed.

Keywords: Magnetosphere-Ionosphere Coupling, Ampere force forcing, dynamical polarization process