Equivalent and Physical Currents from Magnetometer Meridian Chains

http://sarahgoodreau.com/2011/12/30/ghost-current/
Techniques can be based on equivalent currents (SECS):

rotationsfreies Elementarstromsystem (mit zugehörigen FACs)

divergenzfreies Elementarstromsystem

Olaf Amm, Dissertation, 1998
Automated Forward Modeling proposes a physical model and optimizes its parameters
Can inversion in a meridian be the same for both approaches?

Title: Inverting magnetic meridian data using nonlinear optimization

Authors: Connors, Martin; Rostoker, Gordon

Affiliation: AA(Athabasca University Observatories), AB(Department of Physics, University of Alberta)

Publication: Earth, Planets and Space, Volume 67, article id. #155, 20 pp.
If the FAC are far away, then their effect is small in AFM.

Inversion with online 1-d SECS at FMI and with AFM gives essentially the same result.

Is this result real?
AMPERE for this event spans IMAGE Array

Use FAC Integration Technique of:

Electric Currents of a Substorm Current Wedge on 24 February 2010
*Geophys. Res. Lett.* **41**, 4449-4455

and assume that any imbalanced FAC flows across the IMAGE meridian
The net down FAC in the morning sector is equal to the cross-meridian current from AFM.

The net up FAC in the evening sector is equal to the cross-meridian current from AFM.
Conclusions

• We showed that SECS 1-d and AFM (AMM) gave similar magnitude for current across the IMAGE meridian, SECS says it is “equivalent” current, AFM that it is “physical”

• We showed that AMPERE net FAC was the same in magnitude as the AFM cross-meridian current

• If FAC is far enough away (easily verified with Y component) then physical current and equivalent current are shown to be identical, as might be expected