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Combined optical and incoherent scatter specification of high latitude electron flux and conductance

S. R. Kaeppler, SRI International

D. Hampton, University of Alaska-Fairbanks

M. J. Nicolls, SRI International/LeoLabs

A. Stromme, SRI International

J.H. Hecht, The Aerospace Corporation

S. Solomon, NCAR

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Motivation

- How is energy transferred from the magnetosphere into the ionosphere in the high latitude ionosphere?
  - Can conductance be determine using combined incoherent scatter radar and all sky imager techniques in a localized 2-D sense or conductivity in a 3-D sense?
  - Given a large amount of ISR data, is there a better parameterization of empirical conductance relations? Does this parameterization include variations in the neutral atmosphere?
  - What role does rapid temporal and spatial variability have on characterizing conductivity?

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Ionospheric conductivity is a quantity not directly measured, and thus remains an uncertain quantity in high latitude electrodynamics

Relations by Robinson et al., JGR, 1987, based on the model by Vickrey et al., JGR, 1982, have been used extensively to characterize conductance and these formula have been validated on a limited data set.

$$\Sigma_P = \frac{40\langle E_0\rangle}{16 + \langle E_0\rangle^2} Q_0^{0.5} \qquad \frac{\Sigma_H}{\Sigma_P} = 0.45\langle E_0\rangle^{0.85}$$

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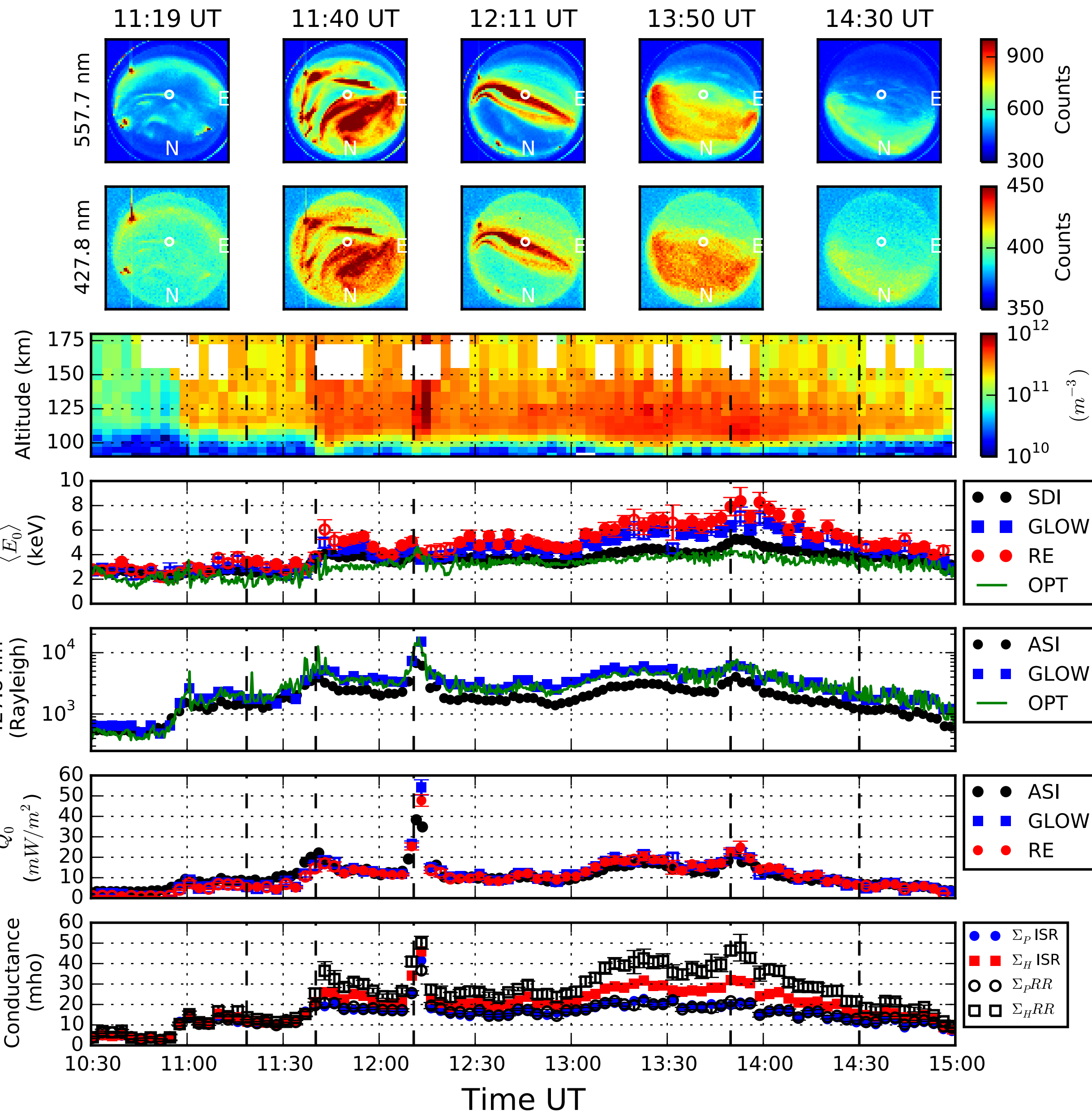
Validating ISR and SDI

11/24/2012 Event PFISR and ASI



Kaeppler et al., 2015, JGR analyzed 2 nights from PFISR and 1 night from Sondrestrom and estimated energy flux, average energy, and conductance from best fit of GLOW to AC ISR data and compared estimates to SDI (PFISR).

Average energy (keV)

427.8 nm optical emission

Energy Flux

Hall and Pedersen Conductance

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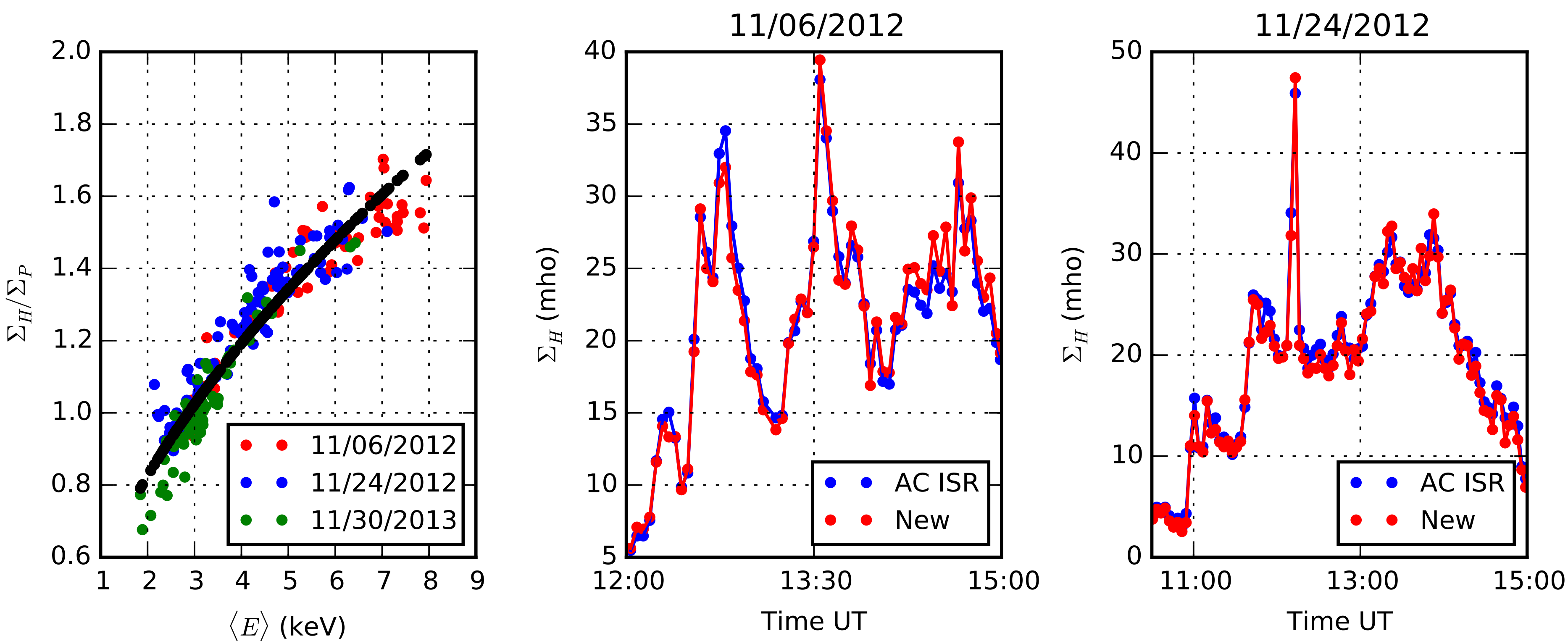

Robinson et al., JGR, 1987

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Updated Hall Conductance using three case studies (limited to auroral cases)

$$\frac{\Sigma_H}{\Sigma_P} = 0.57\langle E_0 \rangle^{0.53}$$

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Future Work

- How can we couple local measurements of conductivity to the more global picture?
- What is the contribution of local variation in conductivity with the meso- and global-scales?
- Can combined optical and incoherent scatter radar be used to assess precipitation and conductivity in a 2-D sense?

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