Nowcast and forecast of Kp index

P. Wintoft, M. Wik, J. Katkalov

Swedish Institute of Space Physics

S. Walker, H.-L. Wei
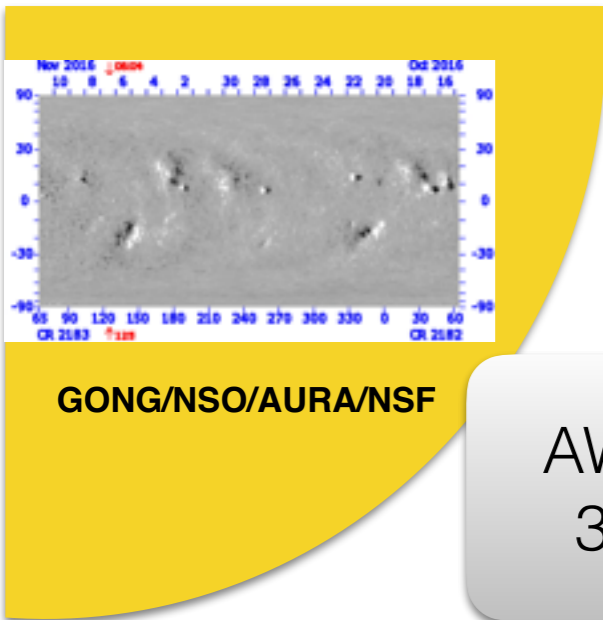
University of Sheffield

J. Matzka

Geoforschungszentrum

The PROGRESS project

GONG/NSO/AURA/NSF

PROGRESS

PRediction Of Geospace Radiation Environment and Solar wind parameterS

AWSoM
30 Rs

SWIFT
L1

Neural Network
NARMAX

Kp
Dst
AU, AL, AE

Statistical
wave
models

VERB
IMPTAM

https://ssg.group.shef.ac.uk/progress/html/
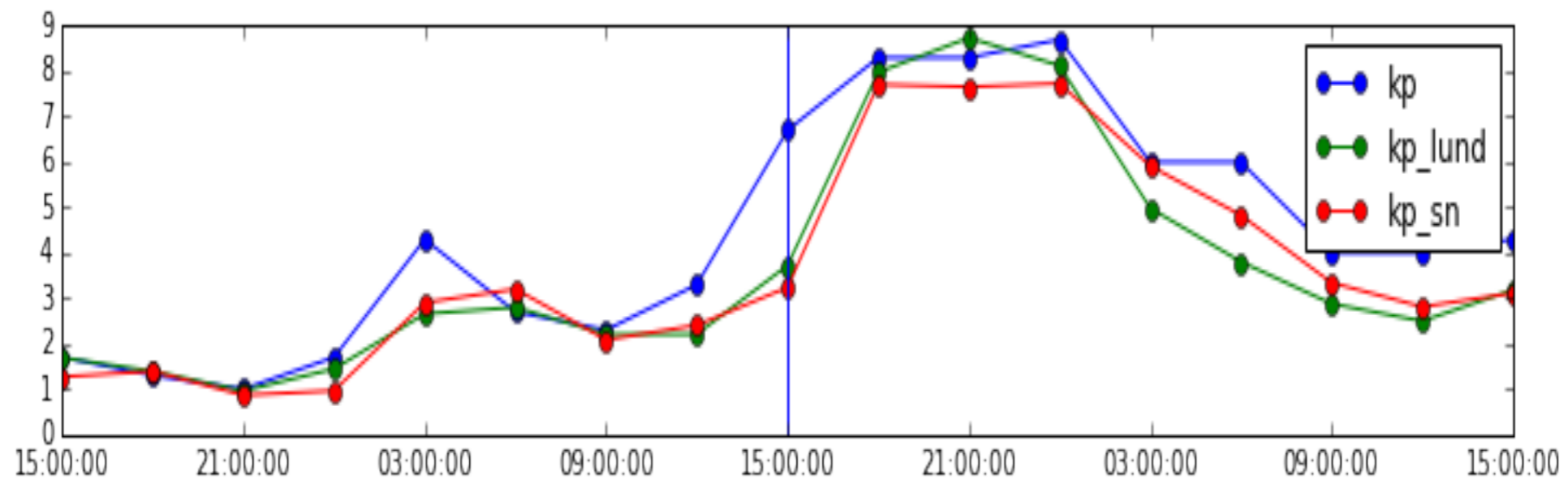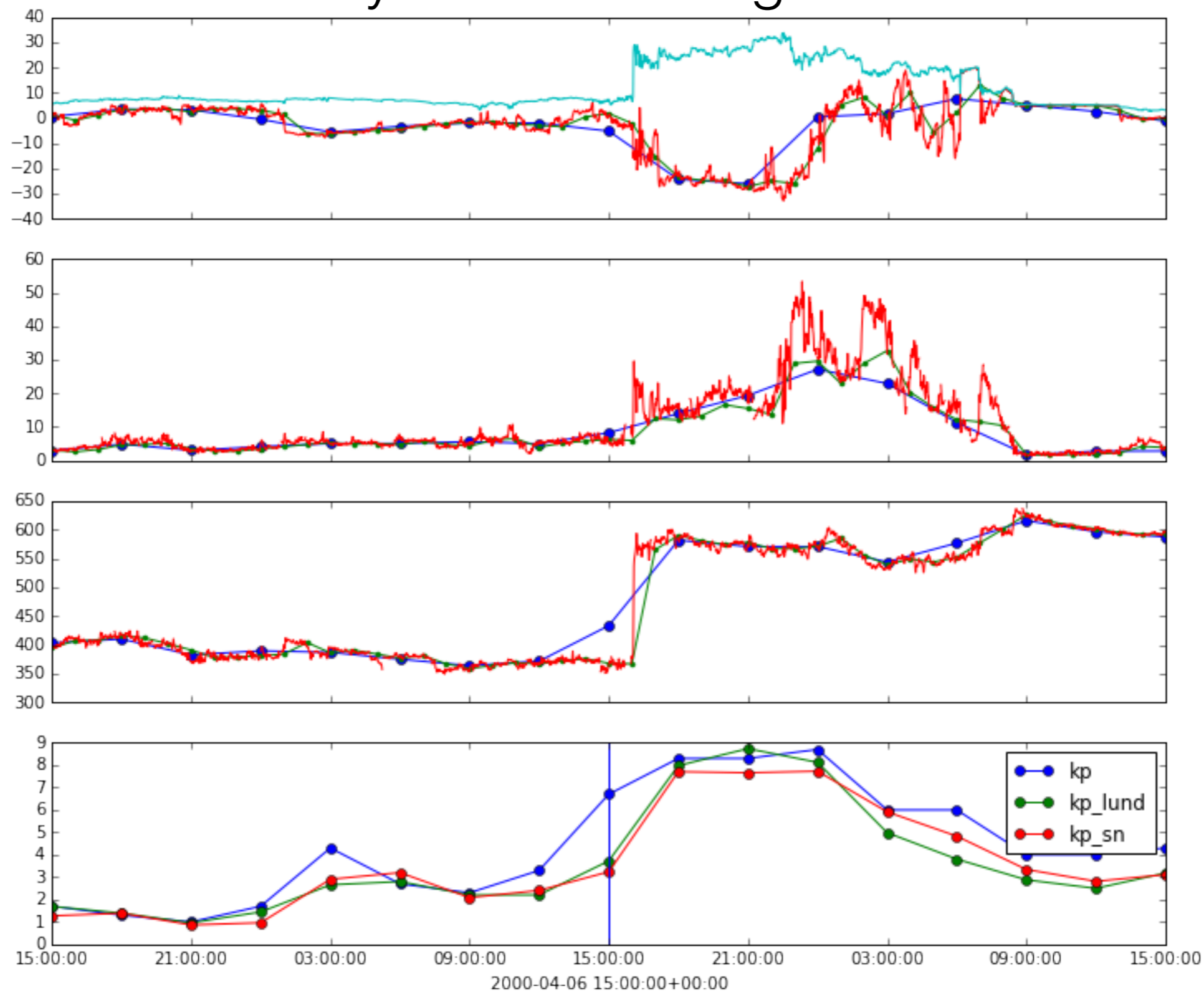
A case with Neural Network and NARMAX
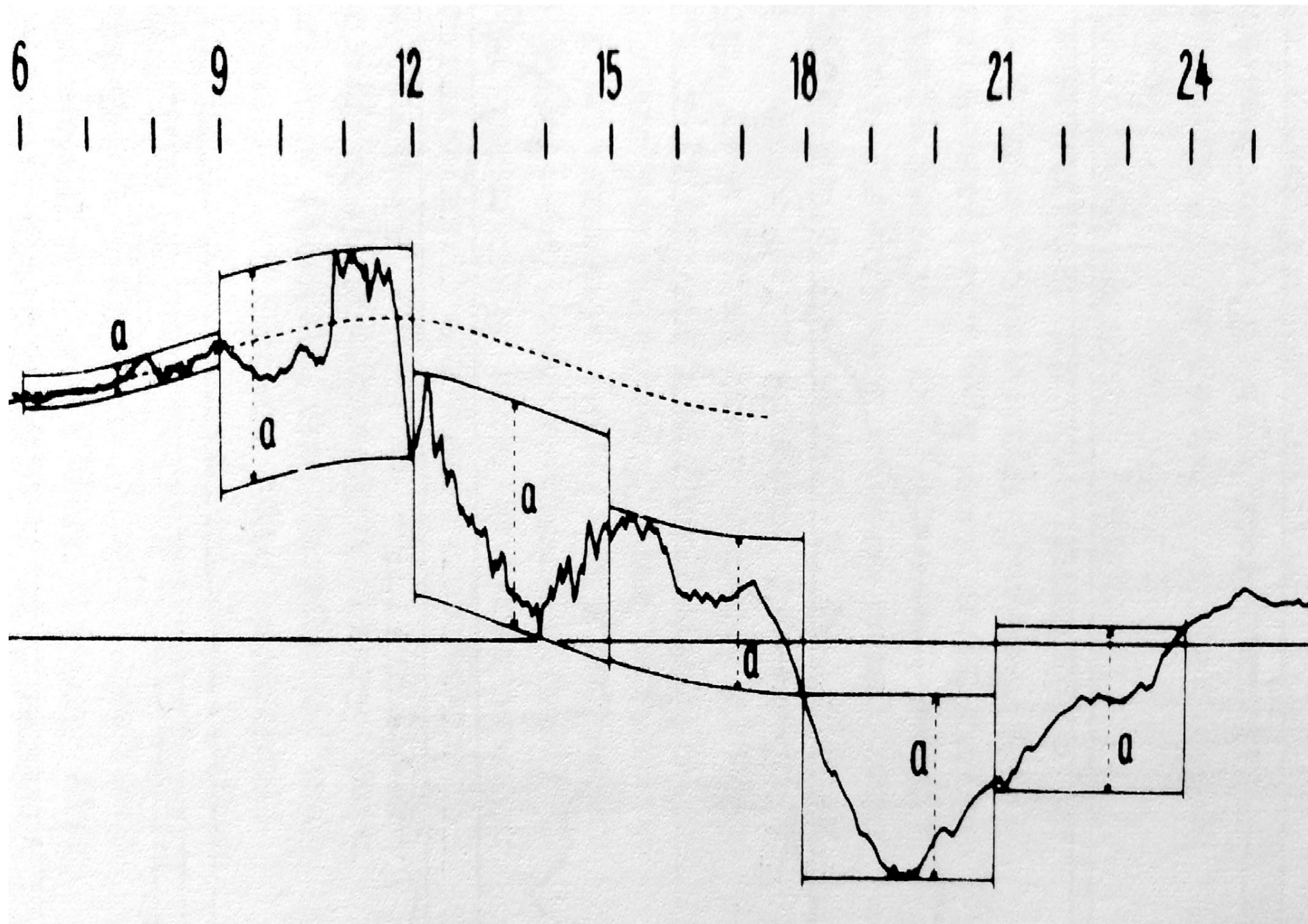## Both driven by 3-hour averages of solar wind

A case with Neural Network and NARMAX
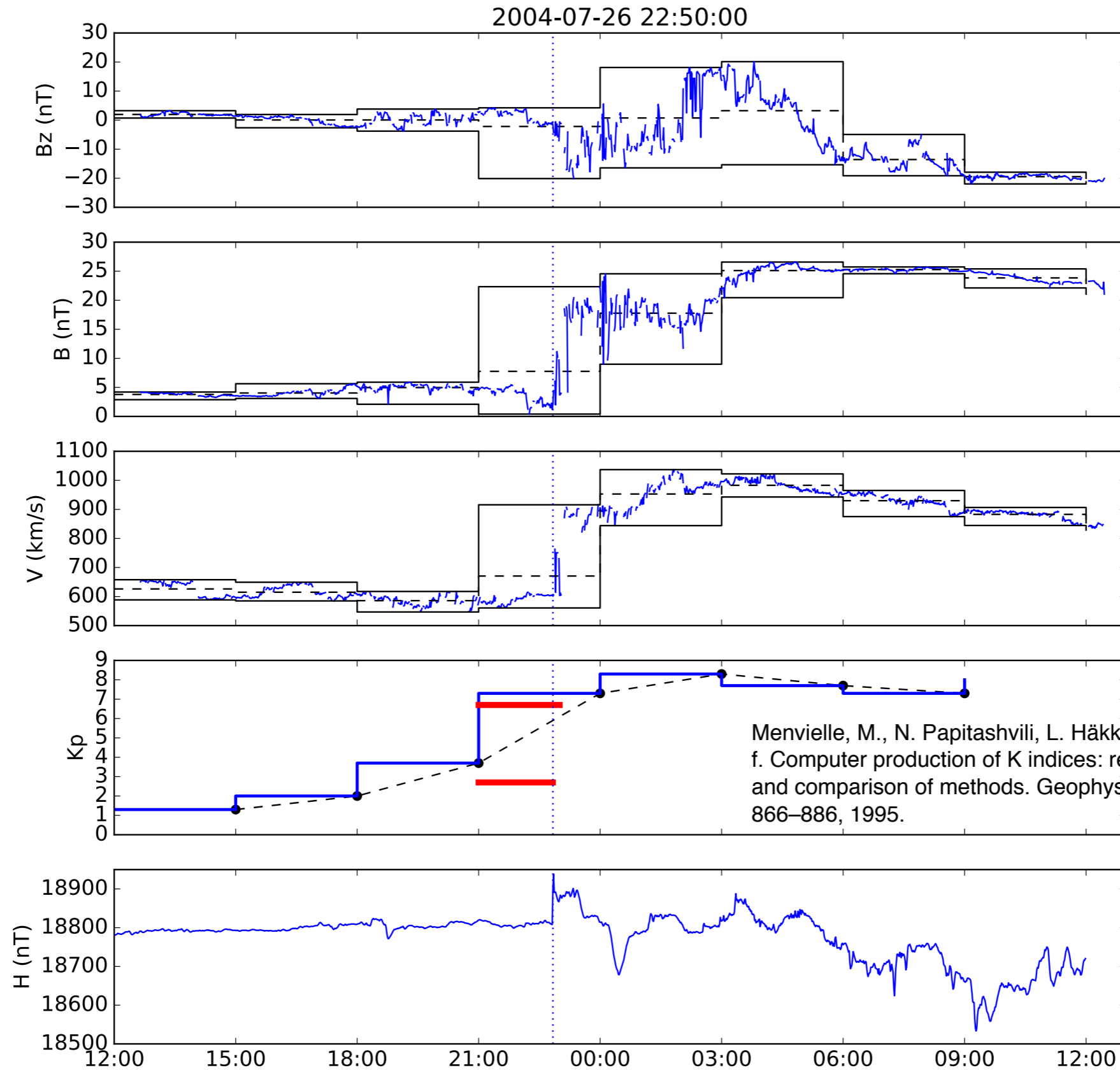## Both driven by 3-hour averages of solar wind

Kp measures range in H

Mayaud, Derivation, meaning, and use of geomagnetic indices, AGU Monograph, 1980.
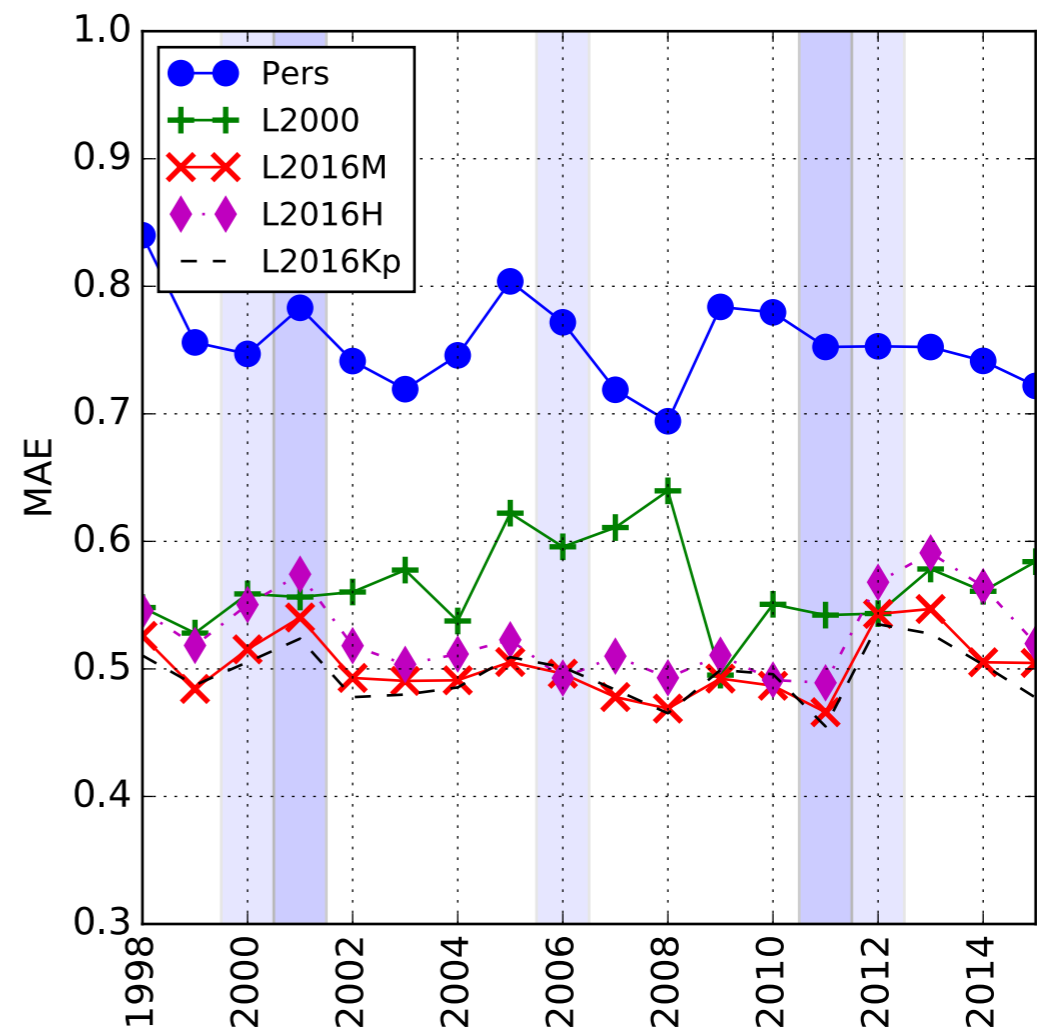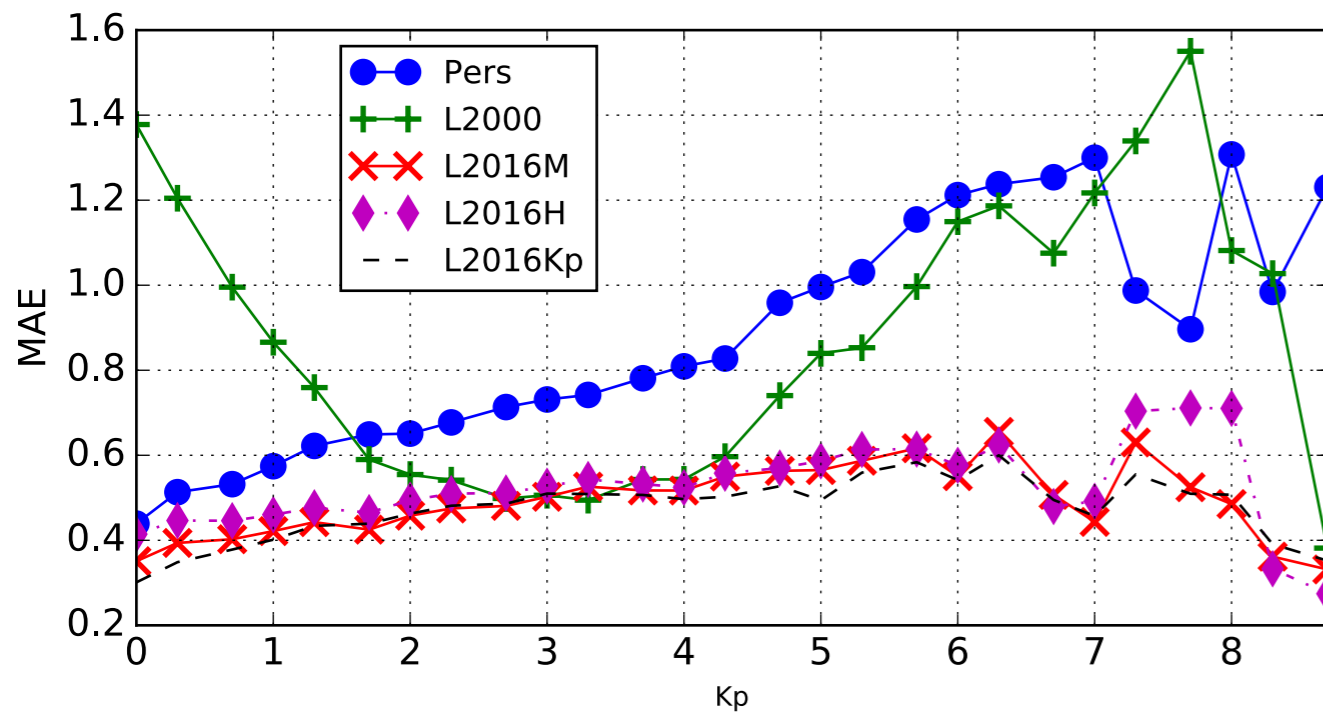
SSC and effect on real-time Kp

2004-07-26 22:50:00

Menvielle, M., N. Papitashvili, L. Häkkinen, and C. Sucksdor f. Computer production of K indices: review and comparison of methods. Geophysical Journal International, 123, 866–886, 1995.

Updated Kp neural network

- 3-hour averages, and maxima and minima solar wind

- Two modes:

  - Driven by measured (ACE/DSCOVR) 1-minute data

  - Driven by predicted 1-hour resolution data

- Trained on data from 1998–2015 excluding

  - validation set (2000, 2006, 2012) and

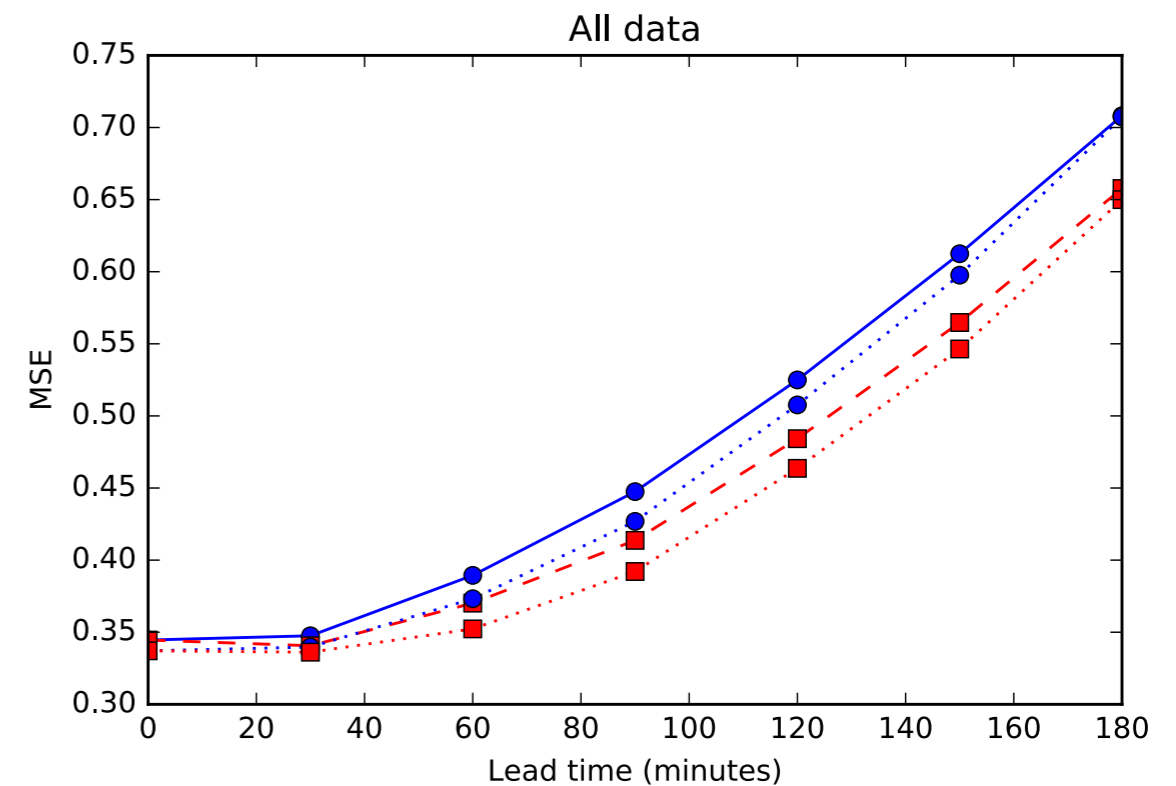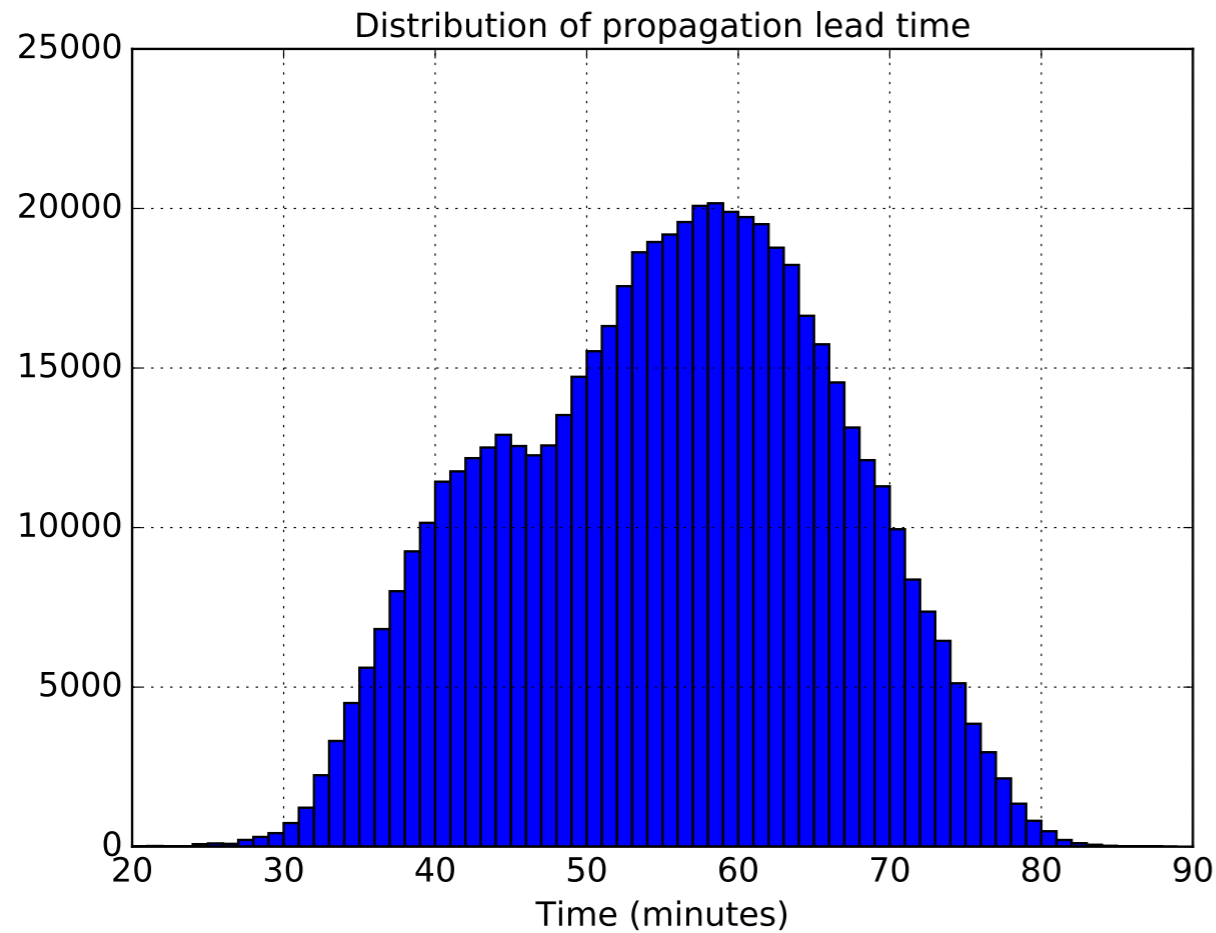 - test set (2001, 2011)

Model performance

	pre	post	average
Pers	0.84	2.70	1.77
L2000	0.82	1.25	1.03
L2016M	0.67	0.76	0.72
L2016H	0.88	0.78	0.83
L2016Kp	0.66	0.81	0.74

ΔKp > 2

Wintoft et al., To be submitted, 2016.

Lead time

Only L1–Earth propagation time when
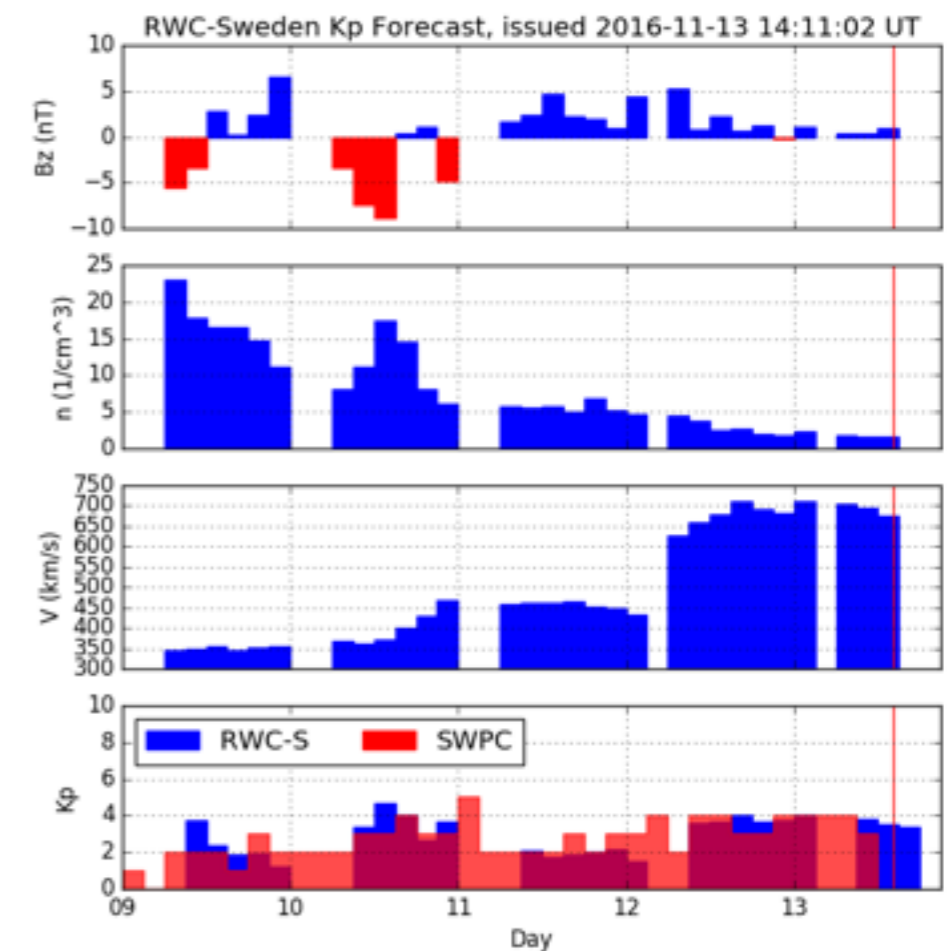   driven by measured solar wind

However, with weak SSC extra
lead time of about 30 minutes.

Summary

- Models developed and tested on all ACE data (1998-)

- Driven by minute or hour resolution solar wind data

- Stable performance over years and Kp level

- Lead time limited to L1-Earth propagation time

- Storms with weak SSC another 30-60 min lead time

- Will be implemented as current Kp forecasts

Current RWC-Sweden
Kp forecast

Acknowledgement