



# **PRediction Of Geospace Radiation Environment and Solar wind parameters**

Work Package 6

Forecast of the radiation belt environment

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# Overview

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- Overview
- Deliverables/Milestones
- T6.3 Highlights
- Summary of current position

# Overview

Work package number	6	Title	Forecast of the radiation belt environment
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Lead Beneficiary	USFD	Participants	GFZ
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Start month	1	End month	30
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# Objectives

1. To extend of SNB<sup>3</sup>GEO model to various to lower energy electrons (down to lowest range of GOES 15 data 30-50 keV) and to increase rate of prediction from 1 day at present to 2 hours, maintaining the same prediction lead of time 24 hours.
2. To enhance the performance of VERB model by employing the tensors of diffusion coefficients from WP4 and incorporating real time data assimilation methodology into VERB forecast.
3. To develop the VERB-NARMAX Coupled (VNC) model that will integrate forecasts of SNB<sup>3</sup>GEO model at GEO as boundary conditions for VERB model.

# Deliverables list

	Title	Due
D6.1	NARMAX models of electron fluxes sat GEO	2015-06-30
D6.2	Use of data assimilation technique within VERB code mode	2017-02-28
D6.3	Results of the VNC model and two methods of model couplings	2018-02-28

## Task 6.3 – Development of the coupled VERB-NARMAX model

(VNC) Month 7-30 (USFD, GFZ)

### VERB

- Simulates the evolution of high energy electron fluxes within the inner magnetosphere
- Driven by Kp and boundary electron flux estimates

### SNB<sup>3</sup>GEO

Most accurate models for forecasting electron fluxes at GEO

Task is to use NARMAX fluxes to drive VERB

## Task 6.3 – Development of the coupled VERB-NARMAX model

(VNC) Month 7-30 (USFD, GFZ)

In the GA two methods of coupling between VERB and SNB3GEO are to be investigated

- adaption the VERB code to use a boundary with variable L-shell that corresponds to GEO, and development of the interface between SNB<sup>3</sup>GEO and VERB
- The output from SNB<sup>3</sup>GEO will be propagated and scaled to the surface of constant L\*.

## Current version

- Kp from OMNIweb
- Sheffield daily NARMAX flux forecasts

Only usable for past casts

## In order to forecast require forecasts of Kp and electron fluxes

- Current and past values from GFZ, Potsdam
- In process of incorporating forecasts of Wing model (4 hour)
- PROGRESS related models once online

## Source of electron fluxes

- GOES 13 observations
- Sheffield NARMAX models (daily and hourly)



Work is preceding as expected to couple VERB and NARMAX flux forecasts

Initial results are promising

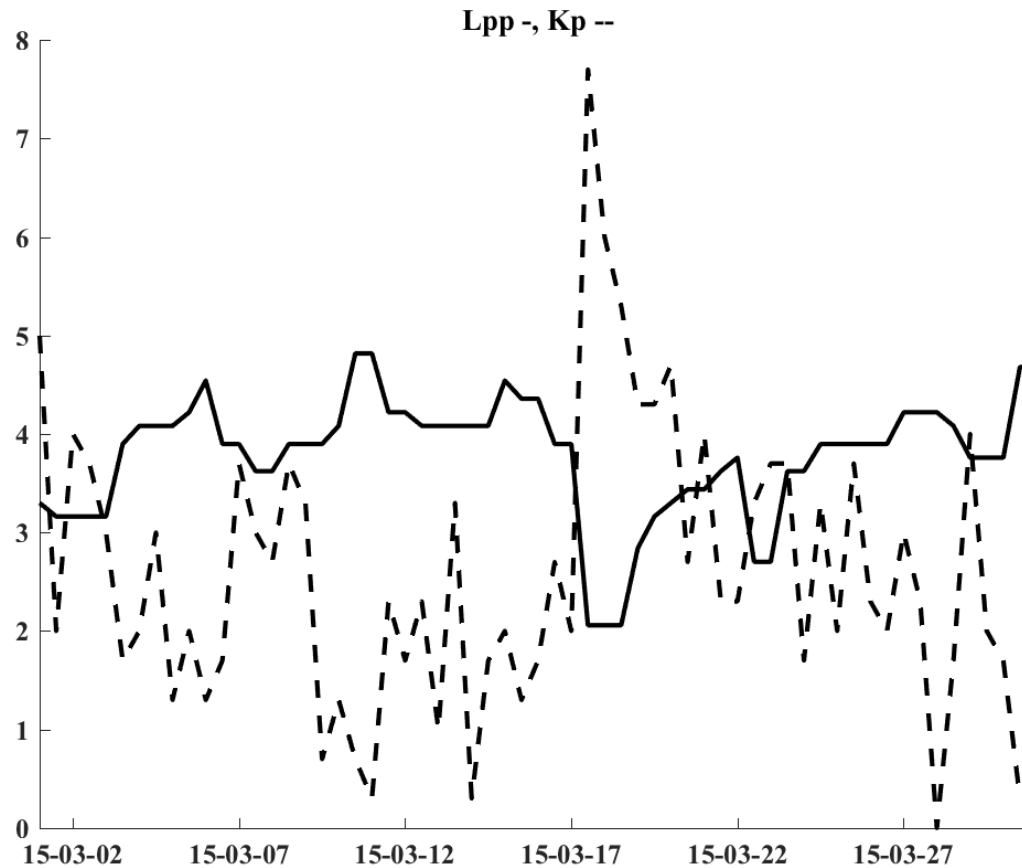
Currently

- Validating output
- Incorporating Kp predicted values
- Comparison of results with van Allen Probe measurements

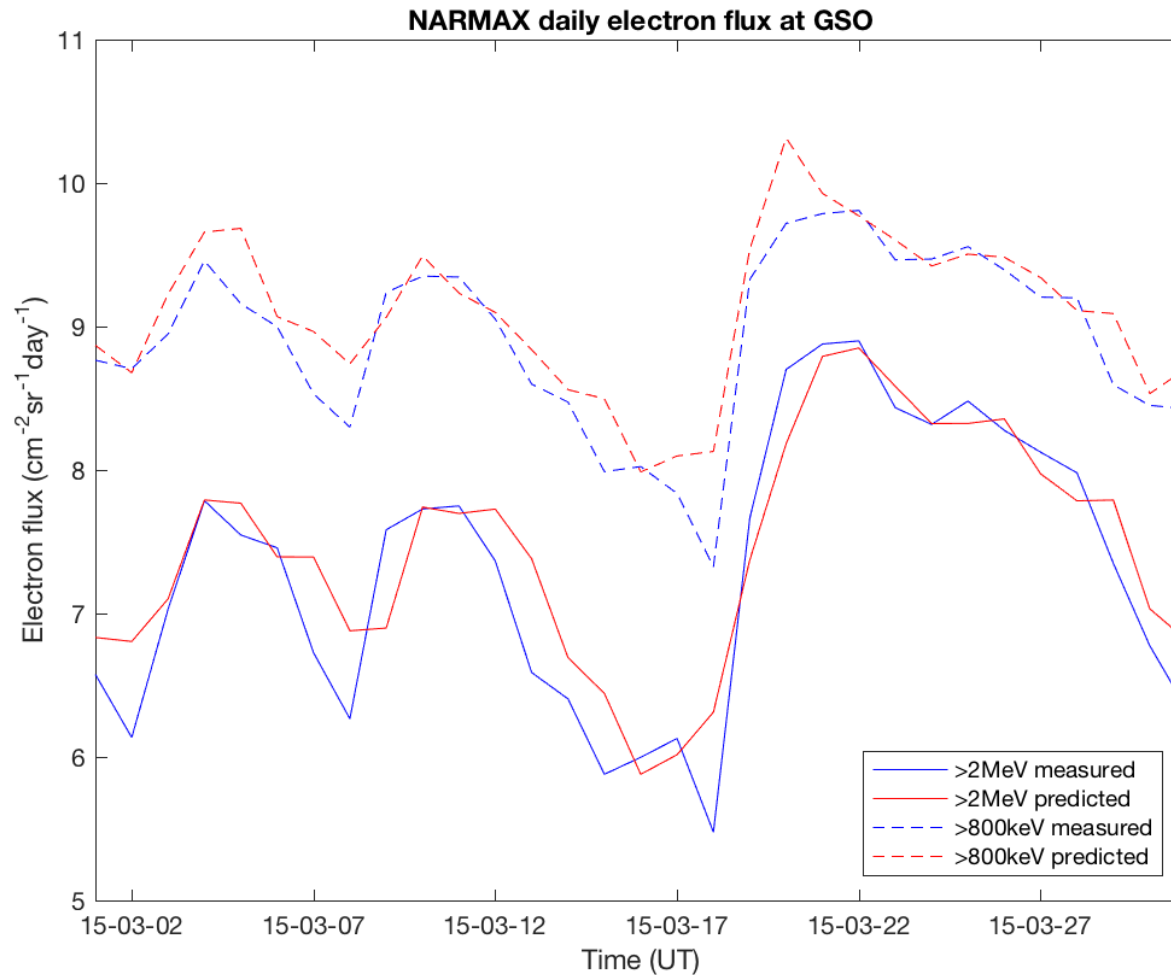
GFZ are requesting an extension to the deliverable submission date (currently Feb 2018) to enable them to complete the job satisfactorily.

# Example run

## St. Patrick's Day storm – March 17, 2015



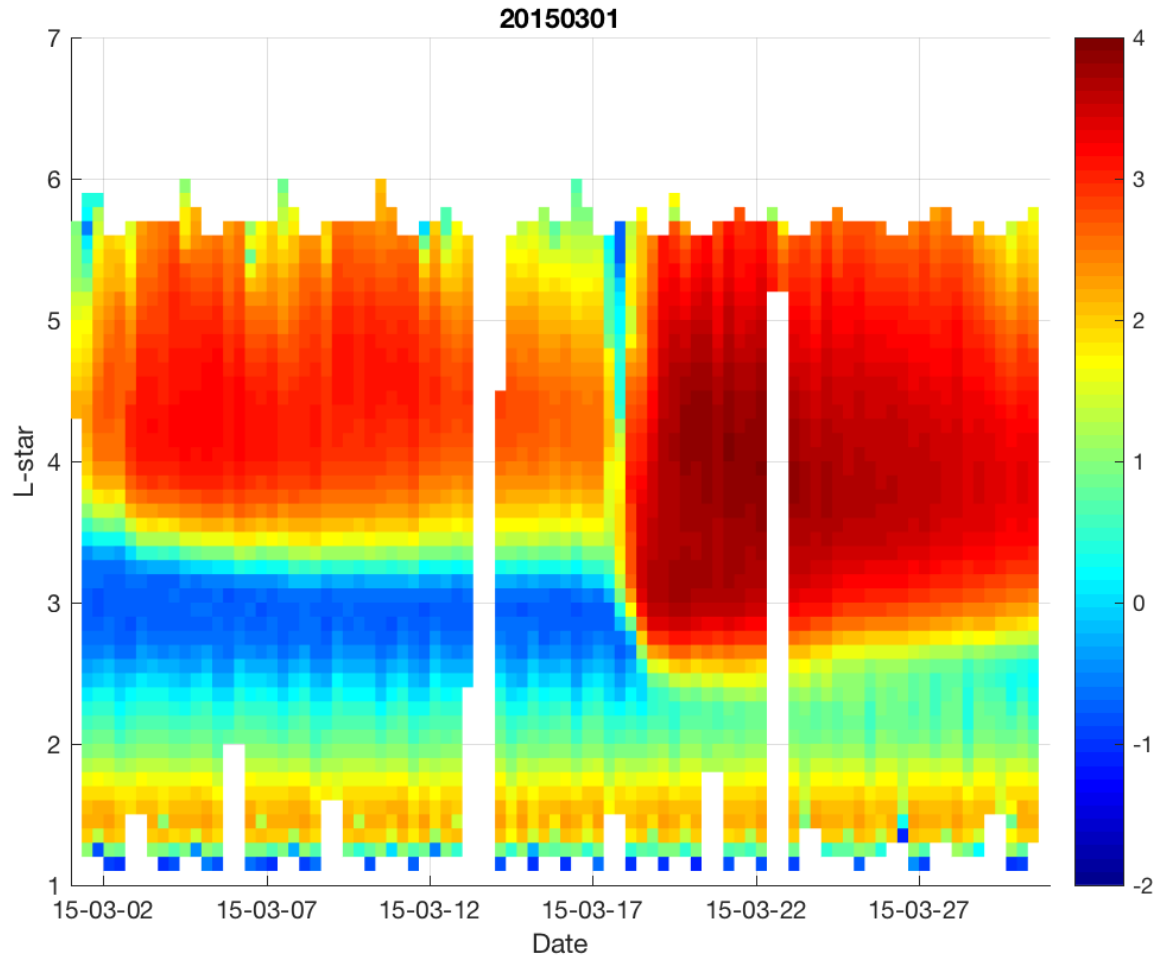
# SNB<sup>3</sup>GEO fluxes



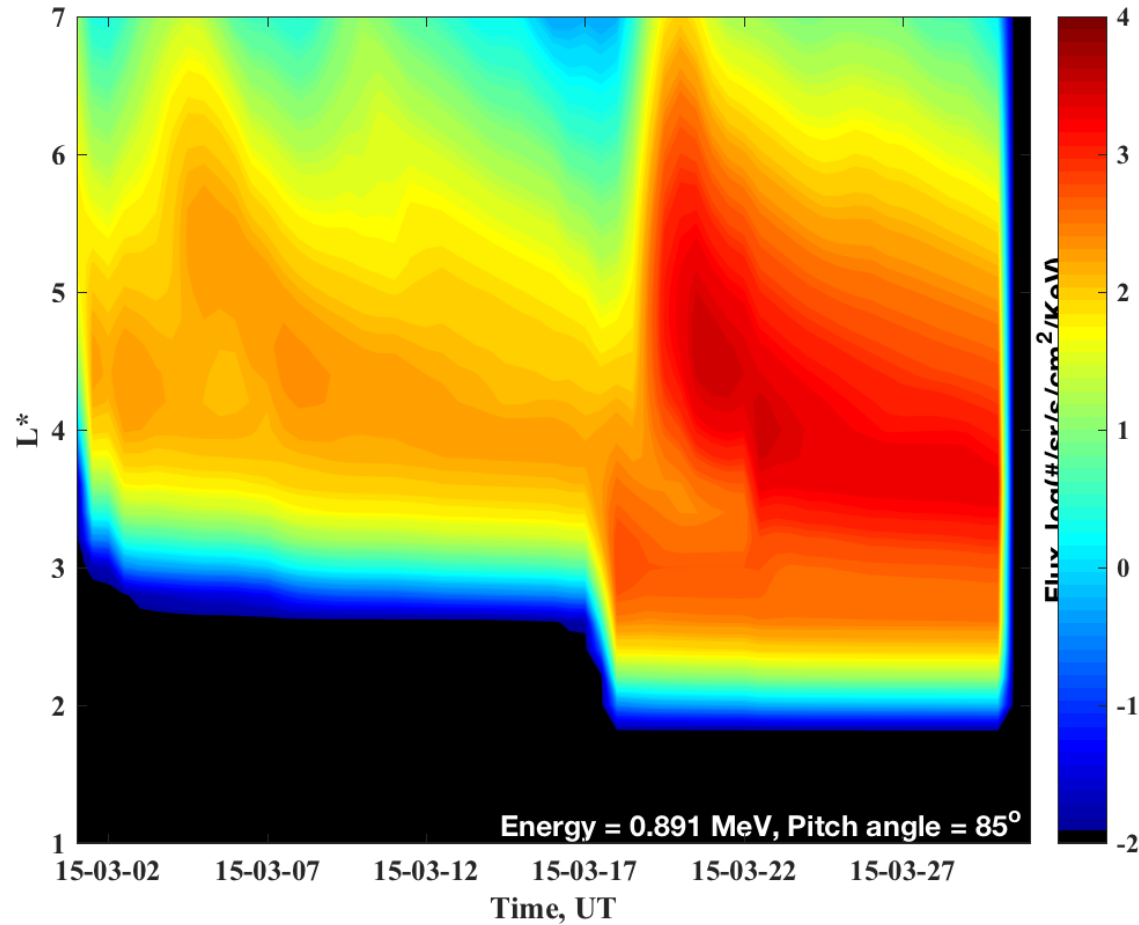
$>800\text{keV}$   
PE 0.76, Corr 0.93

$>2\text{MeV}$   
PE 0.83, Corr 0.93

# VAP MagEIS



# VERB results



# Comparison

