

MONITOR2 AR Meeting

MONITOR2 analysis during reported EGNOS APV-I performance degradation periods

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Reported EGNOS APV-I Performance Degradation events

- EGNOS APV-I Availability is defined as the percentage of epochs in which the Protection Level are below the Alert Limits corresponding to the APV-I service (HPL<40m and VPL<50m) over the total time period.
- The Performance degradation is defined when the 99% APV-I availability map is covering less than 80% of the Service Area.



Table of reported EGNOS APV-I Perf. Deg. Events (17th March to 31st Dec 2015)

#	Starting time	Ending time	Comments
1	17/03/2015, 14:59:59	19/03/2015, 07:14:59	Doys 76-78 (St.Patrick's storm reported at paper ION-Pacific 2015)
2	28/03/2015, 22:59:59	29/03/2015, 22:44:59	Doys 87-88
3	15/04/2015, 20:29:59	16/04/2015, 21:44:59	Doys 105-106
4	22/06/2015, 20:14:59	23/06/2015, 20:29:59	Doys 173-174
5	01/07/2015, 01:14:59	02/07/2015, 01:29:59	Doys 182-183
6	28/08/2015, 05:44:59	28/08/2015, 23:59:59	Doy 240
7	07/10/2015, 19:14:59	08/10/2015, 18:59:59	Doys 280-281
8	20/10/2015, 17:14:59	21/10/2015, 17:14:59	Doys 293-294
9	20/12/2015, 22:14:59	21/12/2015, 22:14:59	Doys 354-355



Reported EGNOS APV-I Performance

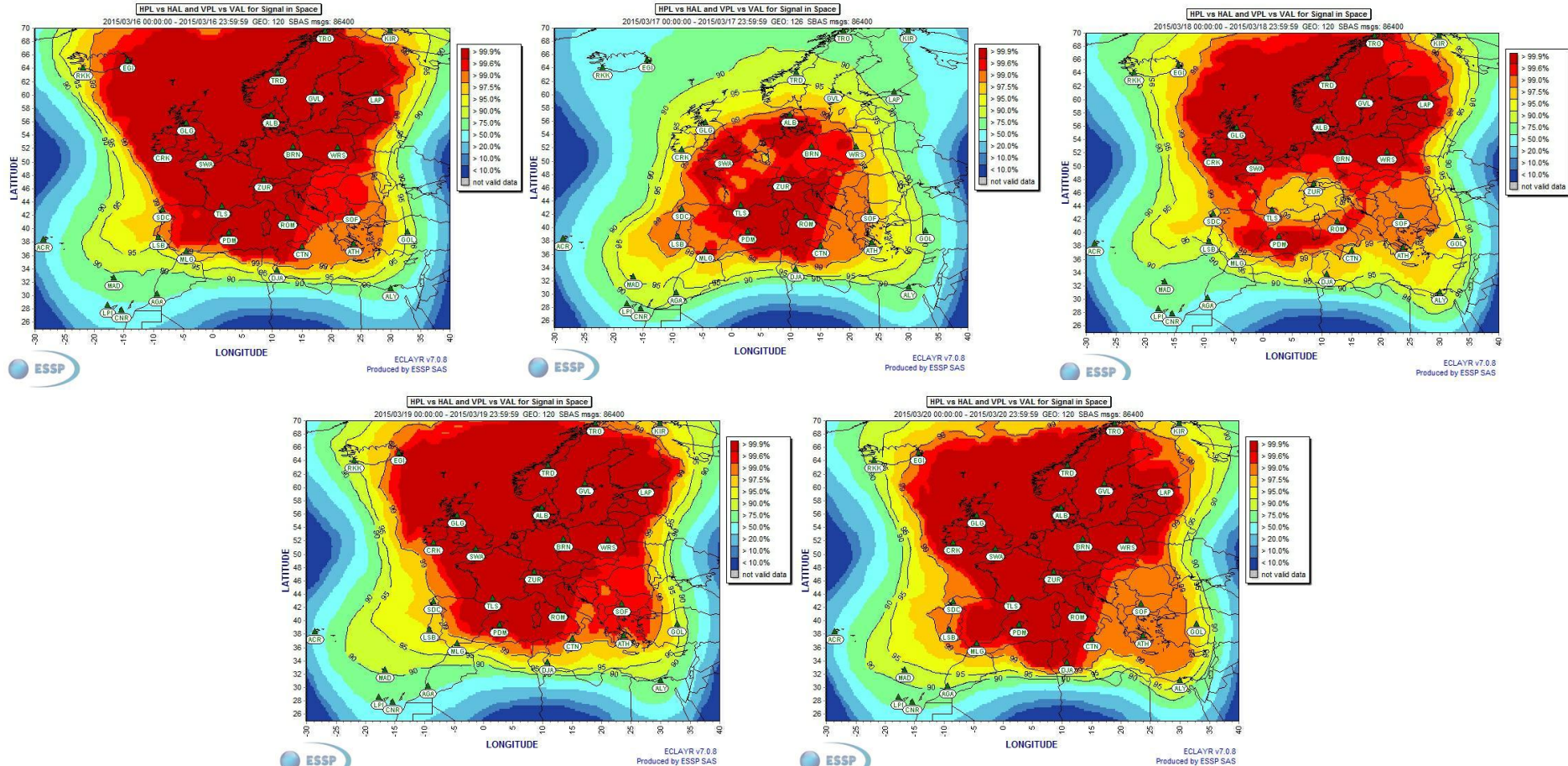
Degradation events

- We present a selection of the ionospheric information provided within MONITOR2 during the target events.
- NRT (< 30 min) and RAPID (< 2 days) latency products, which are automatically made available at the MIR or UPC server, have been considered.
- A part of the periods were not covered by NRT scripts due to problems in the gathering / processing of the GPS datastreams (in case of interest these periods may be revisited by adapting the NRT scripts to work in postprocessing too).



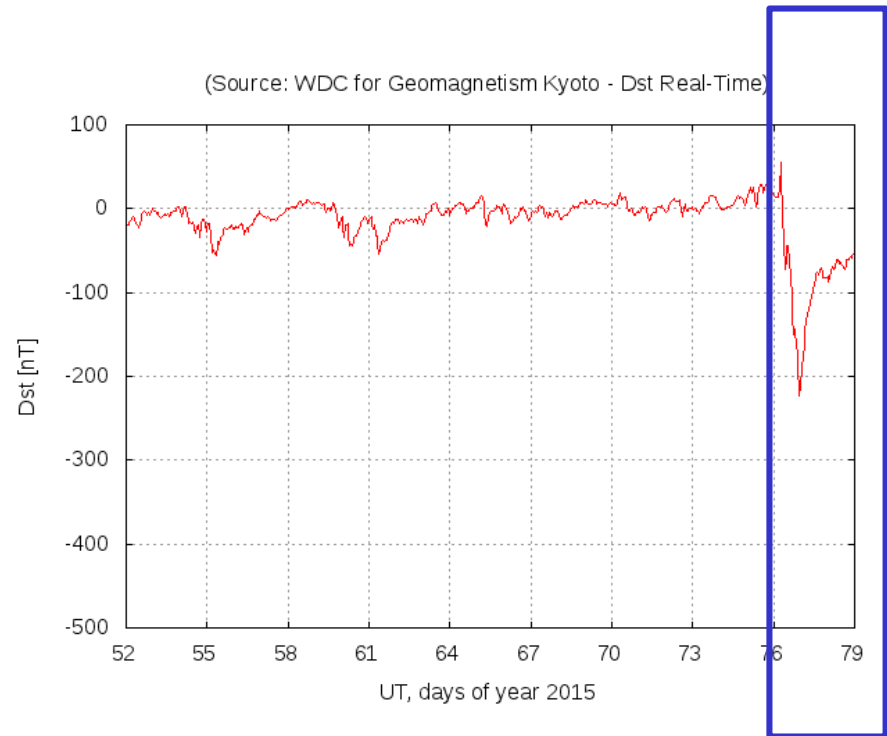
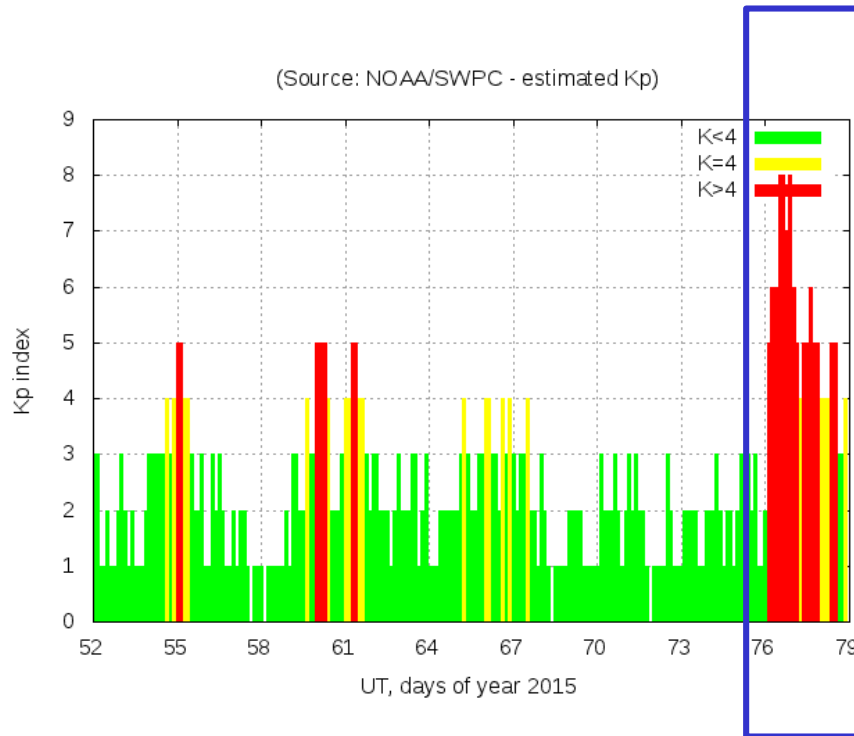
Period #1, 17/03/2015 (doy 76), 14:59:59 to 19/03/2015 (doy 78), 07:14:59: Availability maps

(from https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=apv1_availability)

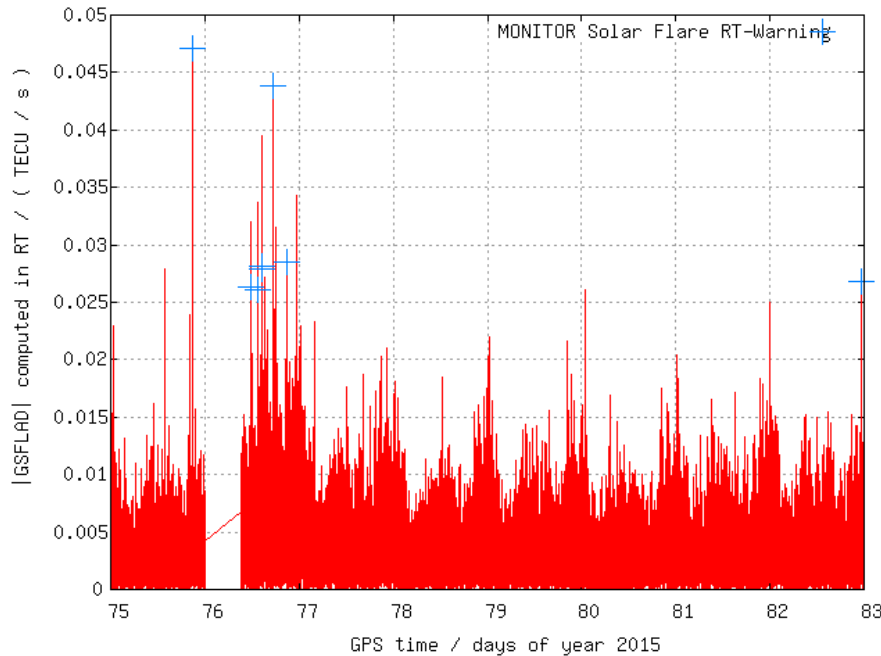


FMI

Period #1, 17/03/2015 (doy 76), 14:59:59 to 19/03/2015 (doy 78), 07:14:59: Kp, Dst & GEC

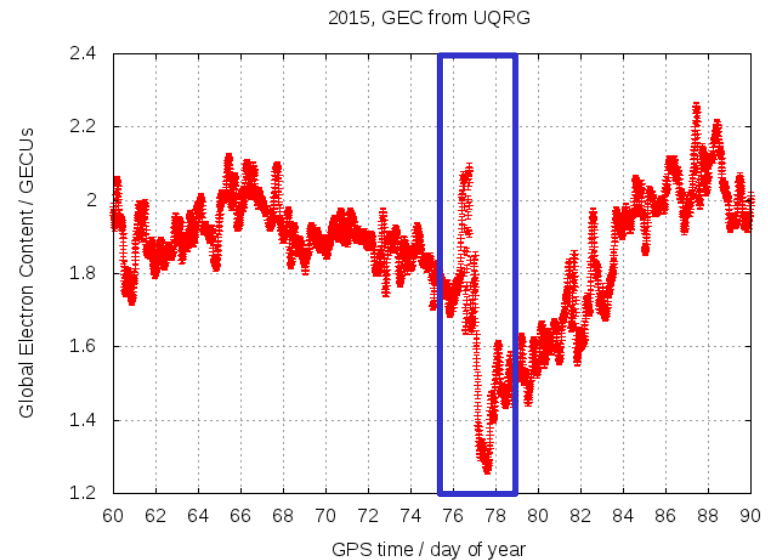
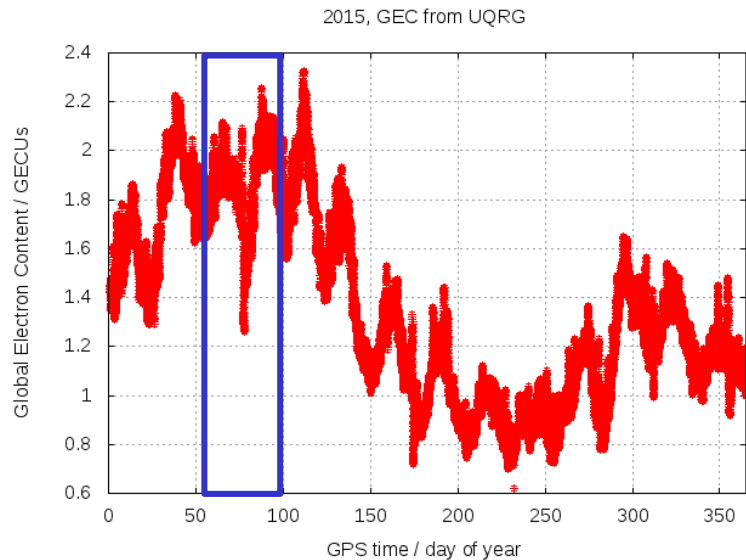


Period #1, 17/03/2015 (doy 76), 14:59:59 to 19/03/2015 (doy 78), 07:14:59: GSFLAI, SISTED



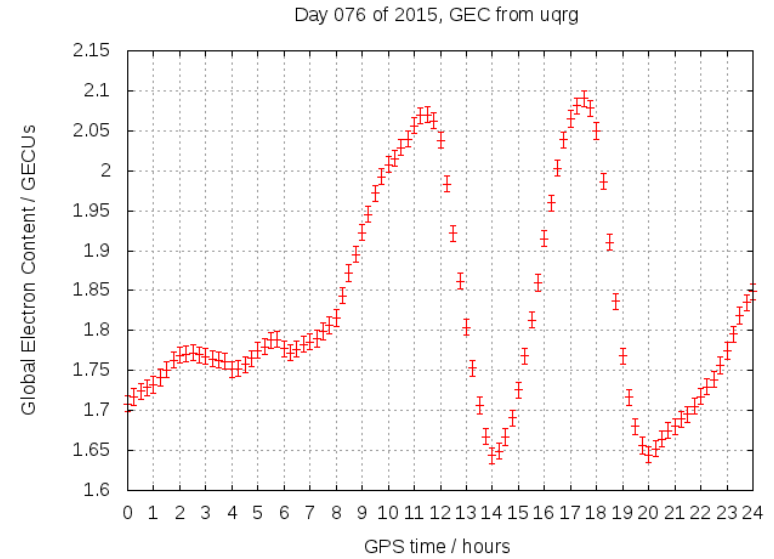
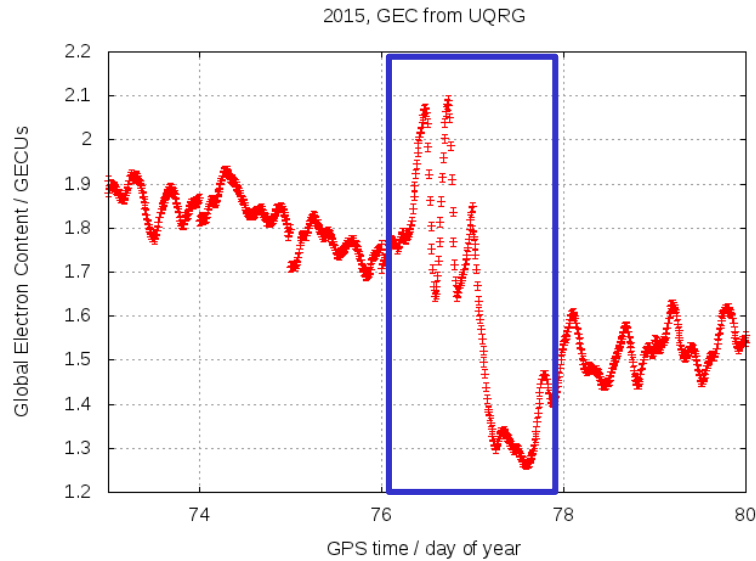
Clear solar flare activity on doy 76 and previous days

Period #1, 17/03/2015 (doy 76), 14:59:59 to 19/03/2015 (doy 78), 07:14:59: GEC

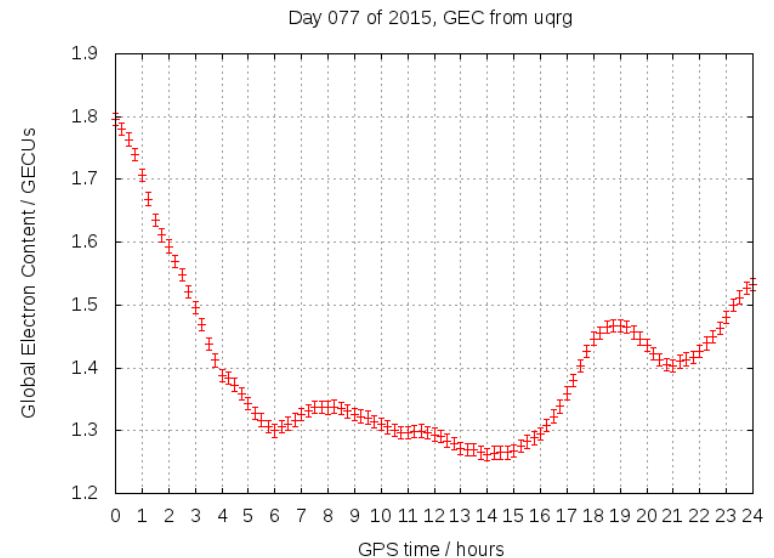


Clear impact on Global Electron Content trend (a positive phase, followed by a negative phase)

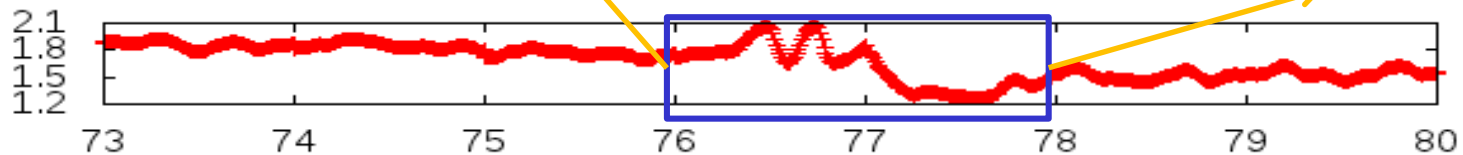
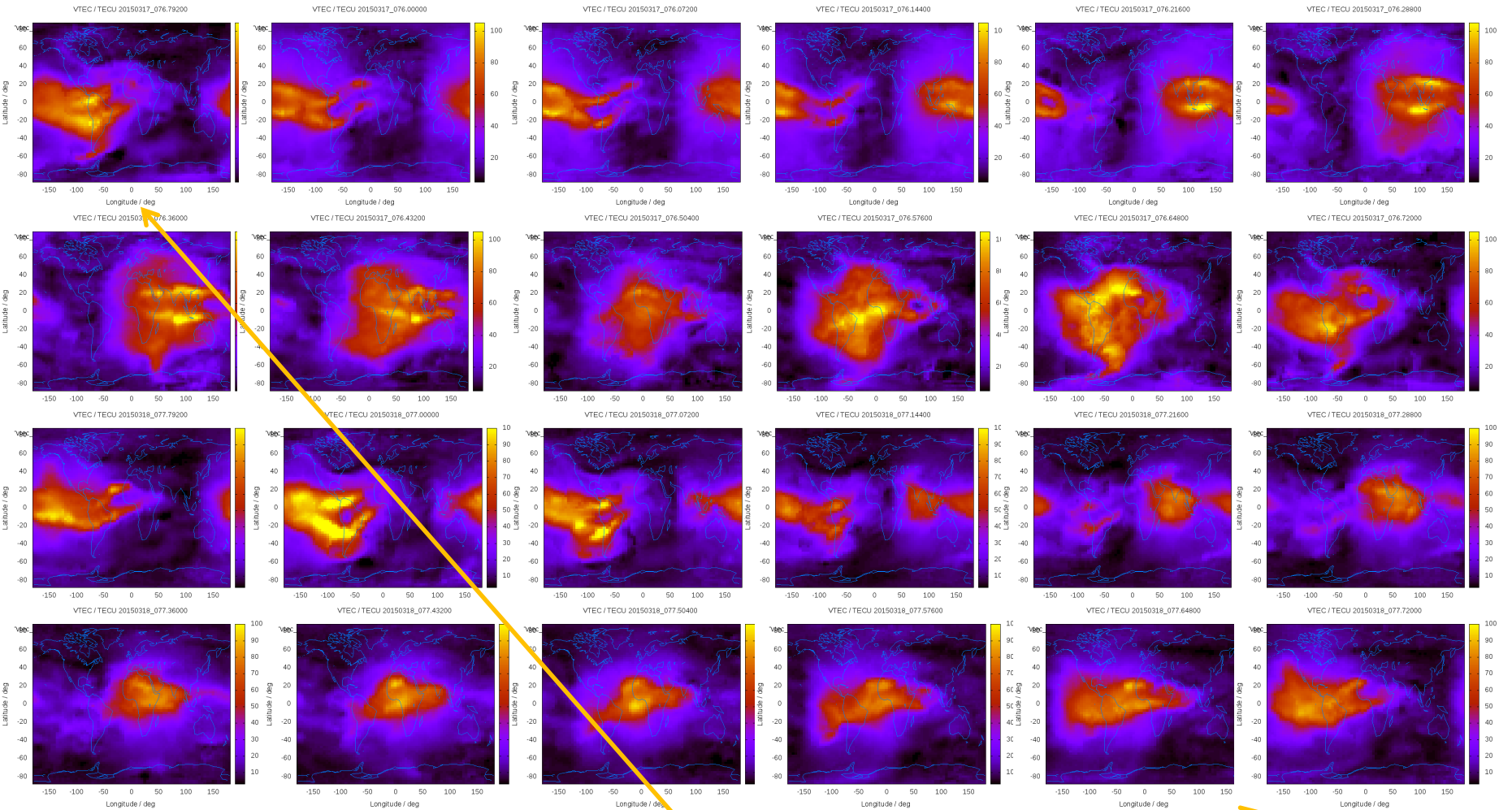
Period #1, 17/03/2015 (doy 76), 14:59:59 to 19/03/2015 (doy 78), 07:14:59: GEC



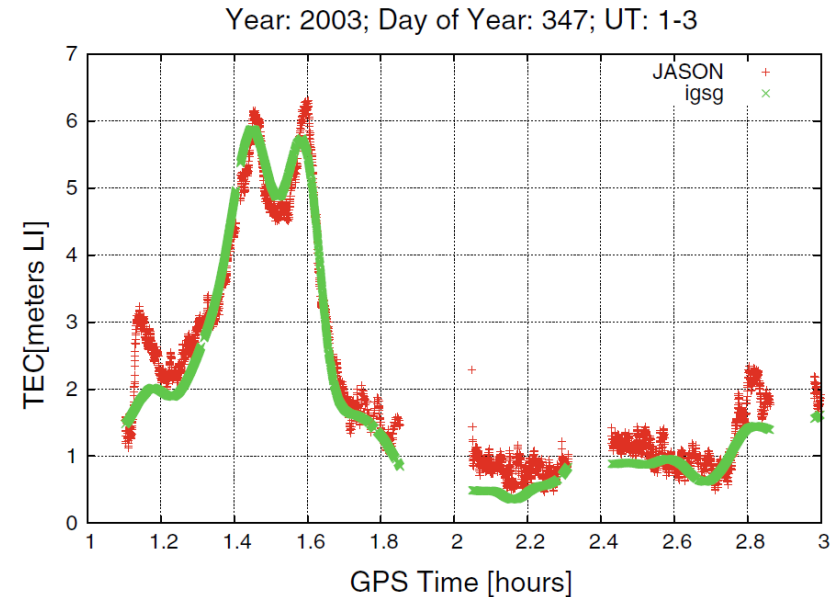
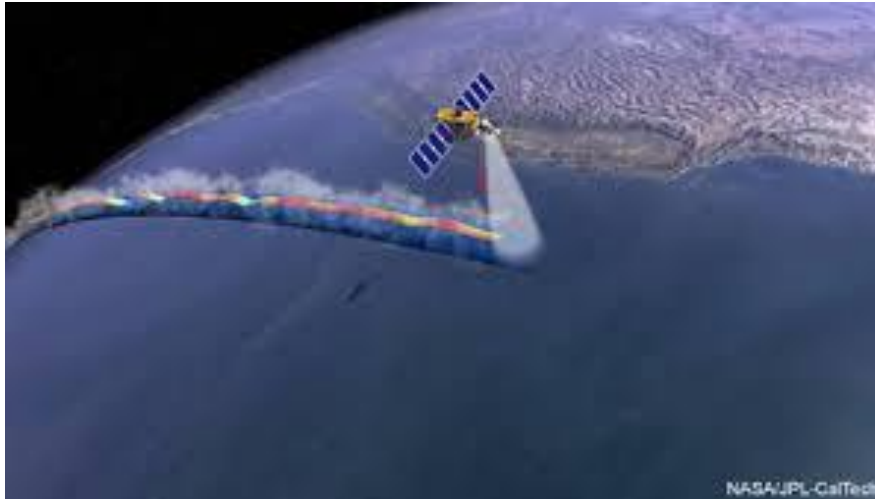
The detailed view shows two important GEC increases (+20%), separated by 6 hours, followed by a deep negative phase (almost -25%) ~18 hours later



Period #1, UQRG VTEC snapshots @ 2h from 17/03/2015 (doy 76) 00h to 19/03/2015 (doy 77) 22h



VTEC directly observed from dual-frequency altimeters: a GNSS-independent ionospheric truth



✓ **Dual-frequency altimeter measurements provides an excellent and independent source for assessing GNSS-based VTEC models** in difficult conditions (over seas & far from rec.).

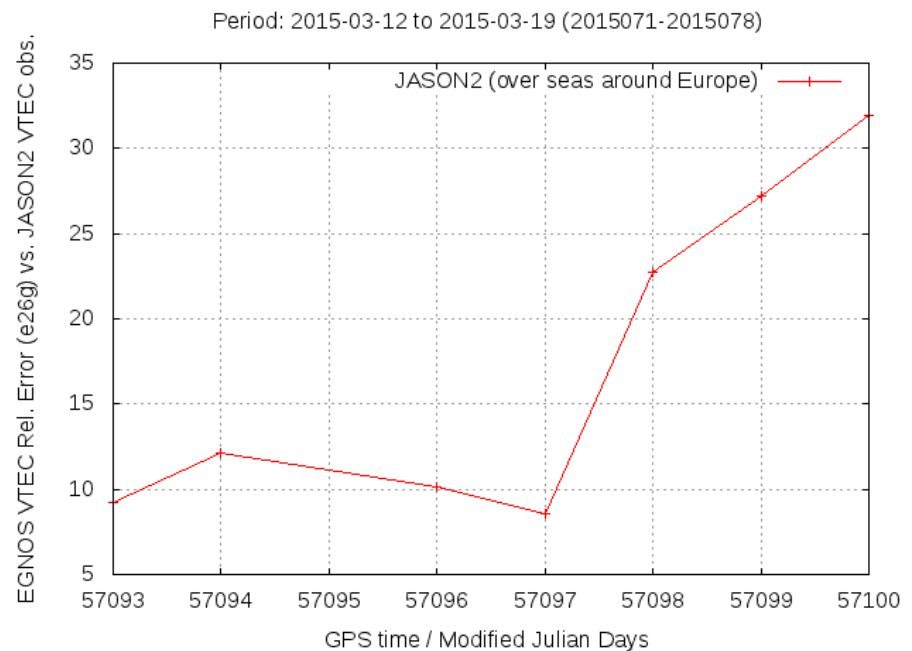
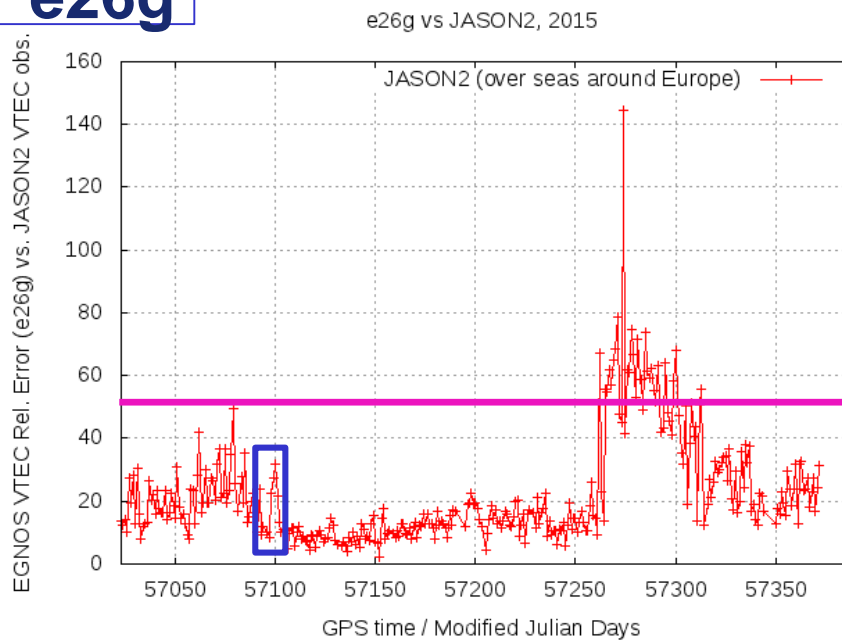
✓ In spite of the noise of the altimeter measurements (reduced by an sliding window of ~16 sec. in right-hand figure, compared vs. final IGS VTEC), the missing altimeter-topside electron content (typically up to few TECUs only) and the well known altimeter bias excess (few TECUs only), it still **allows a very clear assessment and comparison of the errors of the different ionospheric models (considering for instance daily statistics)**, typically much larger and sistematic.

(see for instance Hernández-Pajares, M., Juan, J. M., Sanz, J., Orus, R., Garcia-Rigo, A., Feltens, J., A. Komjathy, S.C. Schaer & Krankowski, A. (2009). *The IGS VTEC maps: a reliable source of ionospheric information since 1998*. Journal of Geodesy, 83(3-4), 263-275).

Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: VTEC error vs. JASON2

EGNOS VTEC Rel. Error (e26g) vs JASON2 VTEC obs.

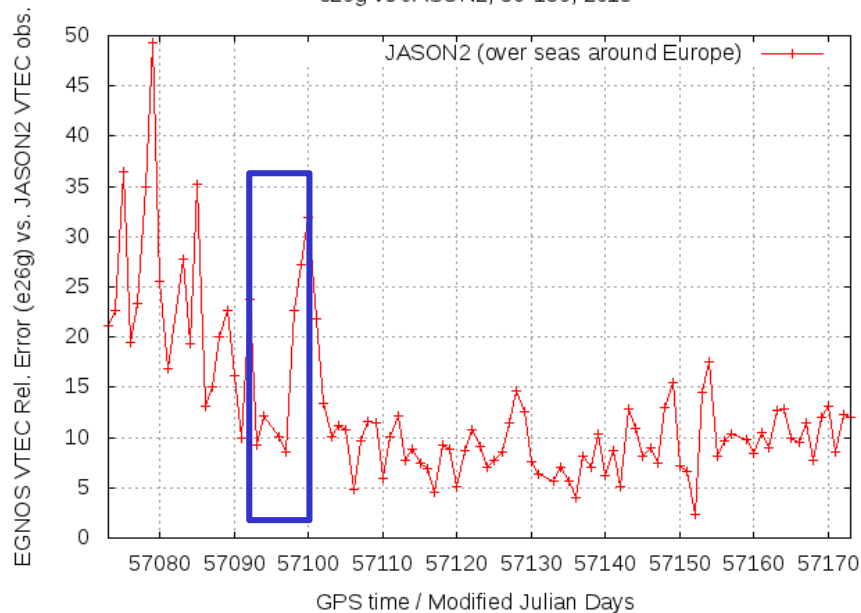
e26g



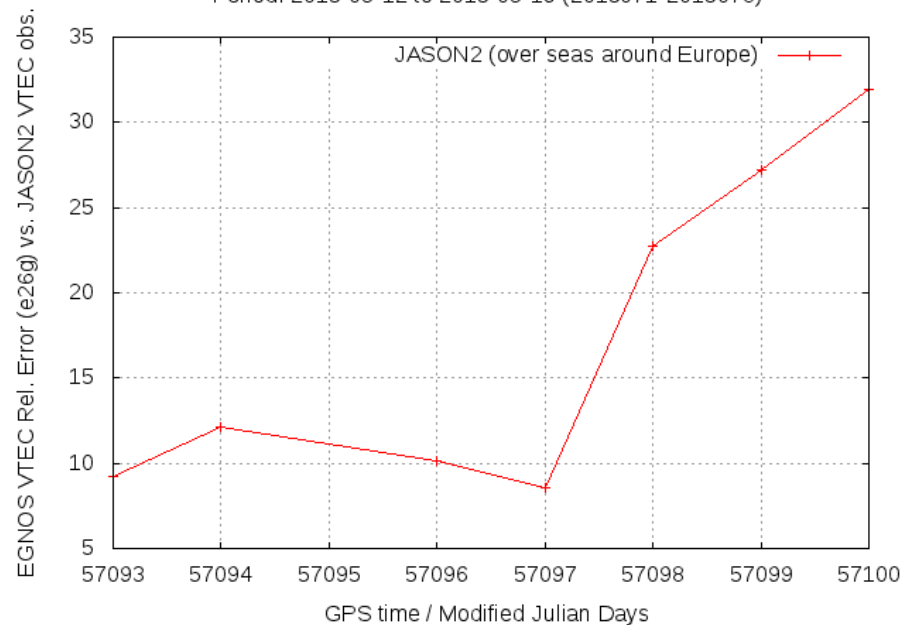
Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: VTEC error vs. JASON2

e26g

e26g vs JASON2, 50-150, 2015



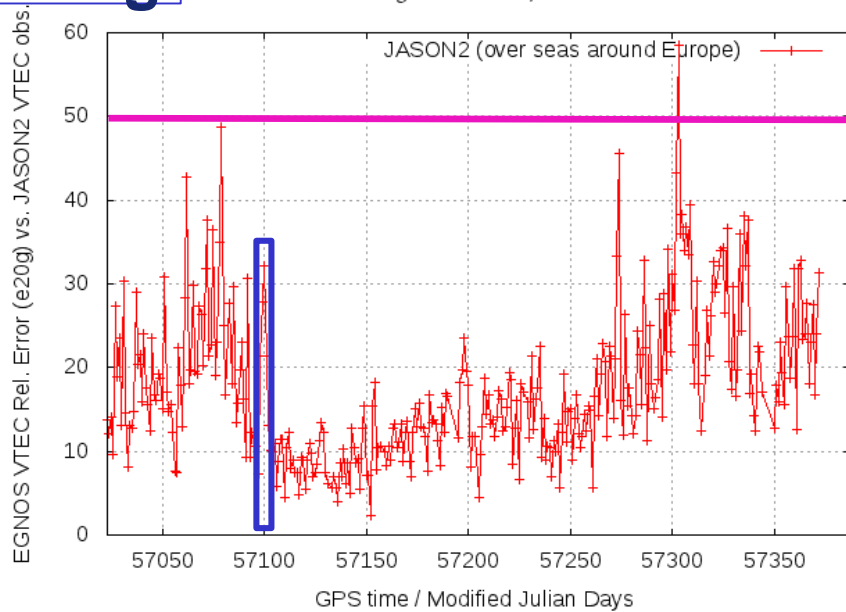
Period: 2015-03-12 to 2015-03-19 (2015071-2015078)



Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: VTEC error vs. JASON2

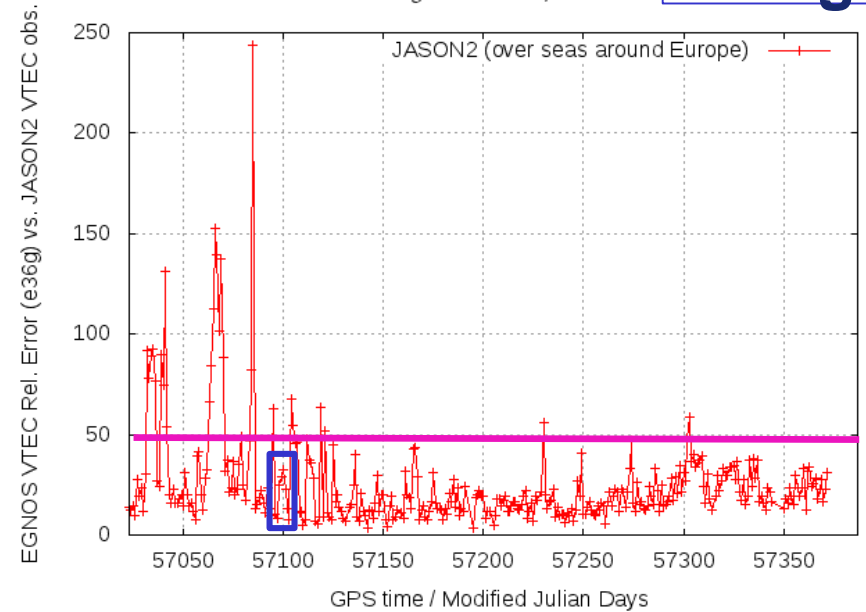
e20g

e20g vs JASON2, 2015



e36g

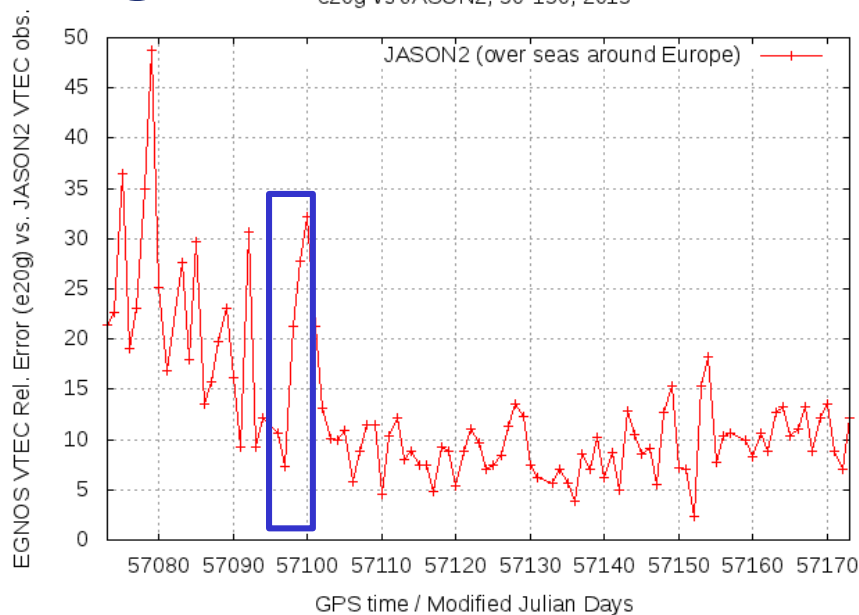
e36g vs JASON2, 2015



Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: VTEC error vs. Altim.

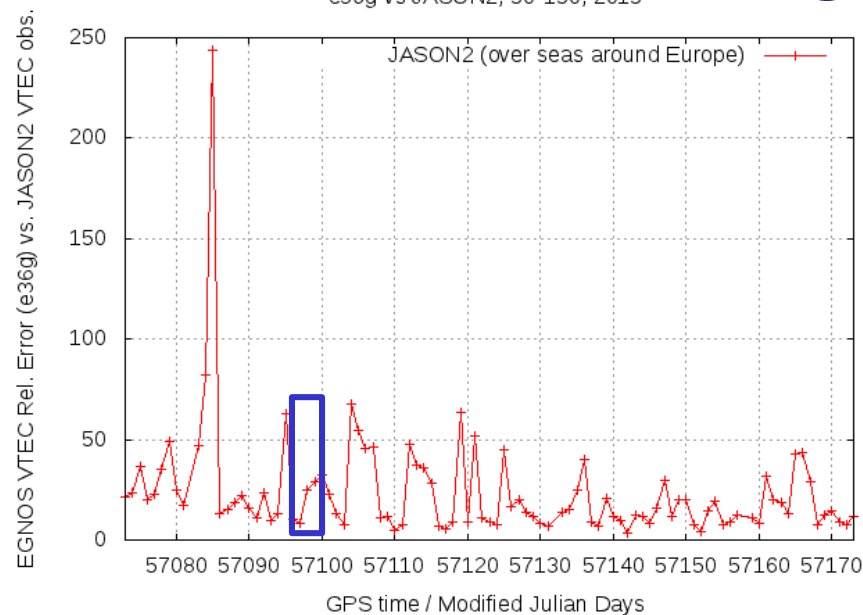
e20g

e20g vs JASON2, 50-150, 2015

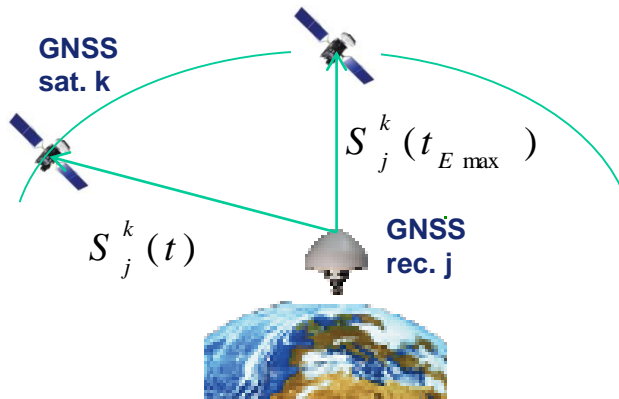


e36g

e36g vs JASON2, 50-150, 2015

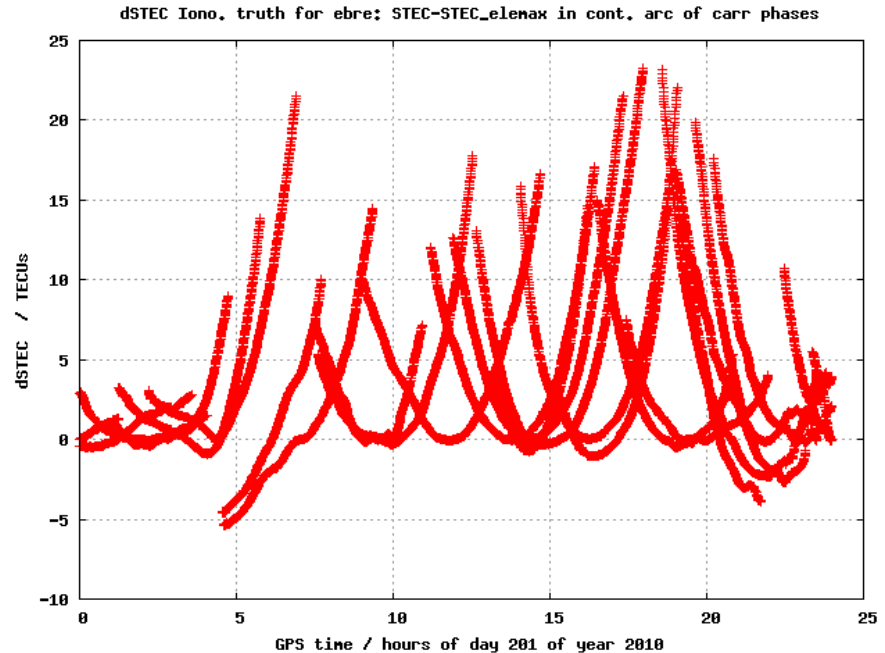


Ionospheric Truth based on STEC variation, dSTEC (ITSVAR)



$$\Delta S_o \equiv S_j^k(t) - S_j^k(t_{E_{\max}}) =$$

$$= [(L_I)_j^k(t) - (L_I)_j^k(t_{E_{\max}})] / \alpha \equiv \Delta L_I / \alpha$$



✓ The GPS ionospheric carrier phase difference, ΔL_I for a given pair rec.(j)-sat.(k), (regarding to the value corresponding to the higher elevation – E_{\max} - ray in the phase-continuous arc of data), provides a **very precise ionospheric truth of the STEC variation, ΔS_o** , in space and time (typically more accurate than 0.1 TECU).

✓ **ITSVAR** (see Figure) **can be used to compare the performance of ionospheric models, i.e. $\Delta S_m - \Delta S_o$** , which can be interpreted (under quiet and similar conditions) as an assessment of the VTEC (V) and mapping function (M) provided by the model:

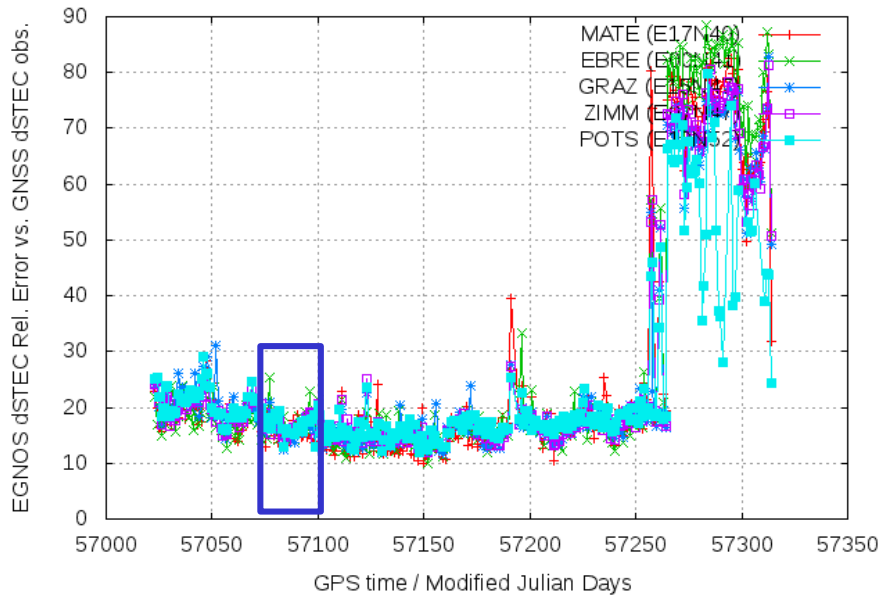
$$\Delta S_o \approx M \cdot V(t) - M_{E_{\max}} \cdot V(t_{E_{\max}}) \sim (M - 1) \cdot V$$

Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: IEWAS (dVTEC error vs. GPS)

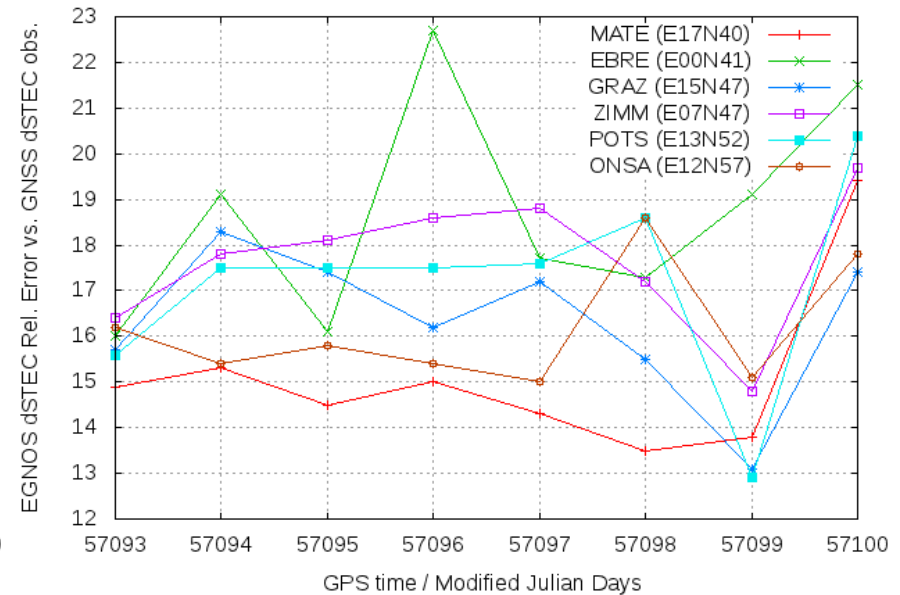
EGNOS dSTEC Rel. Error vs GNSS dSTEC obs.

e26g

e26g dSTEC vs GNSS dSTEC, 2015



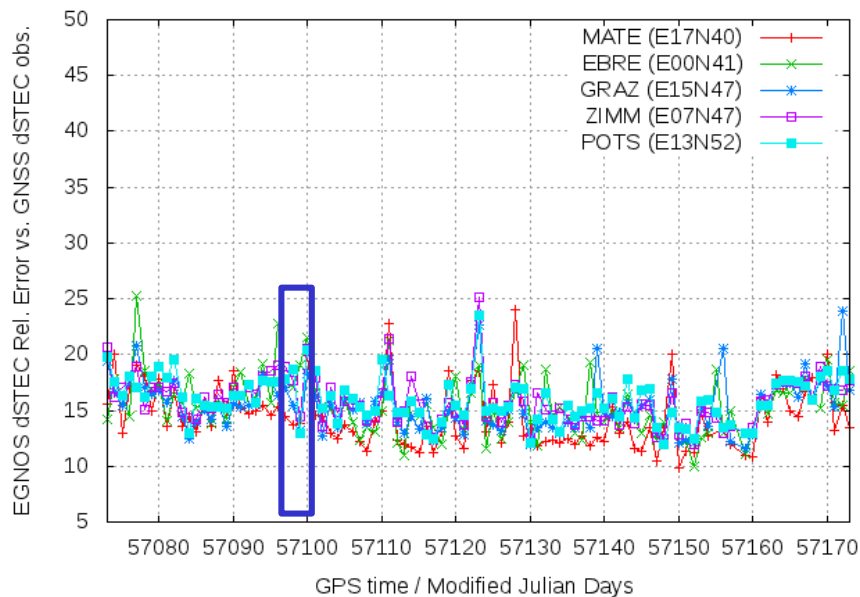
Period: 2015-03-12 to 2015-03-19 (2015071-2015078)



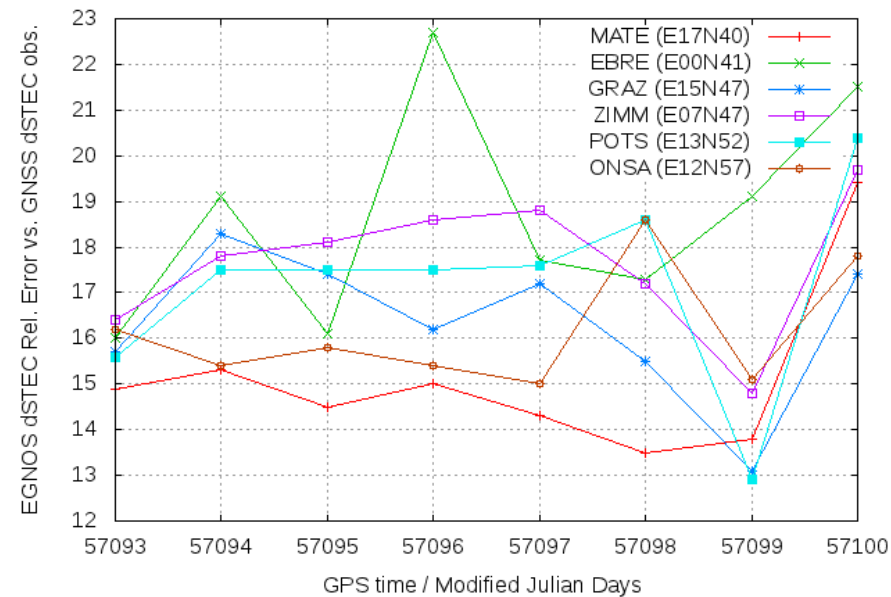
Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: IEWAS (dVTEC error vs. GPS)

e26g

e26g dSTEC vs GNSS dSTEC, 50-150, 2015



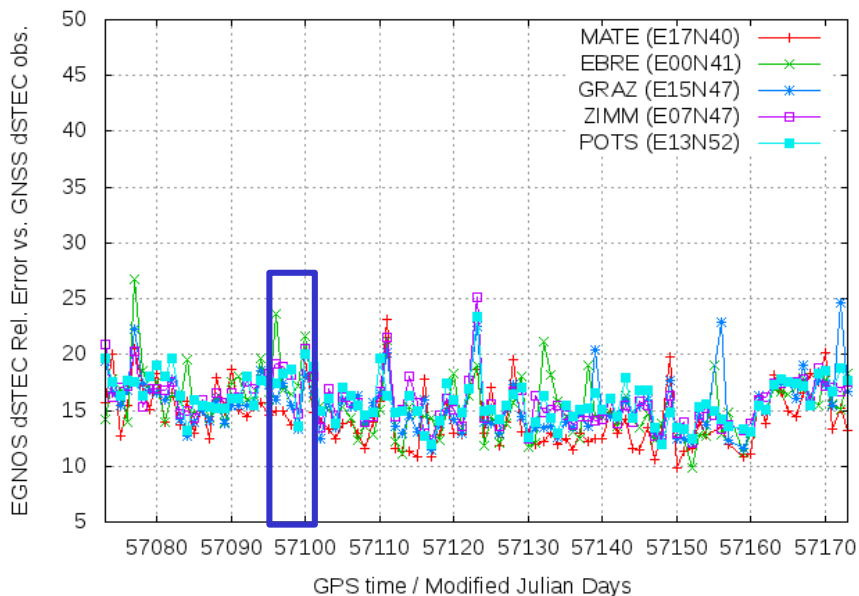
Period: 2015-03-12 to 2015-03-19 (2015071-2015078)



Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: IEWAS (dVTEC error vs. GPS)

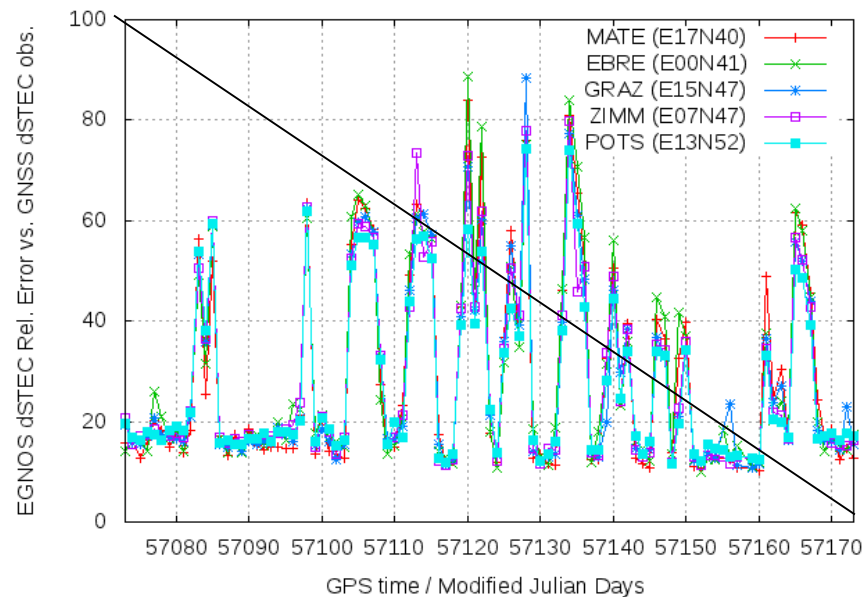
e20g

e20g dSTEC vs GNSS dSTEC, 50-150, 2015



e36g

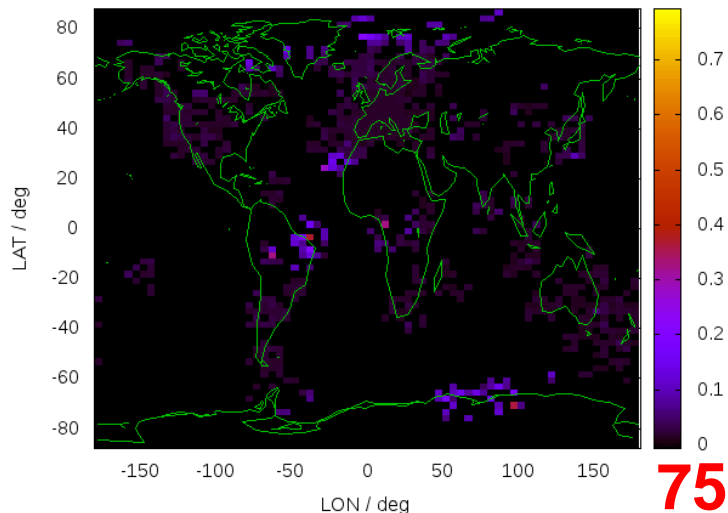
e36g dSTEC vs GNSS dSTEC, 50-150, 2015



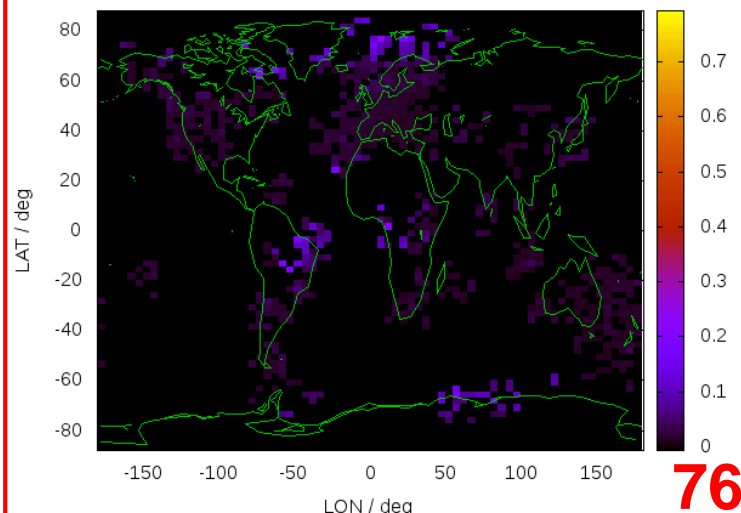
Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: ROTI evol. @N,C,S Europe

Fixed range

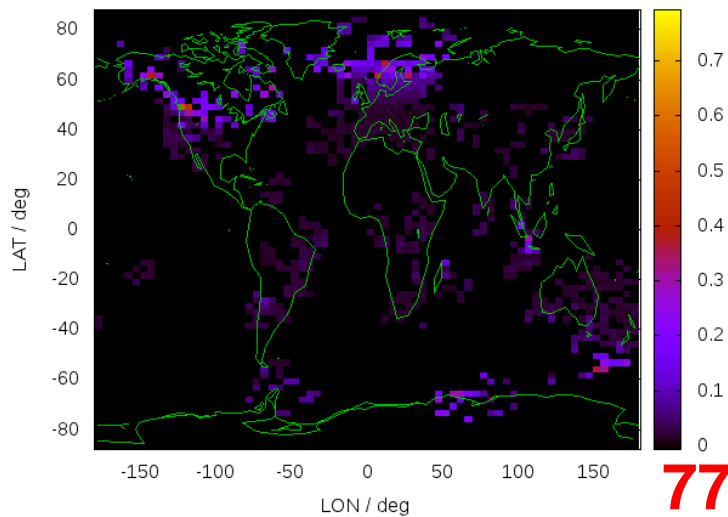
ROTI_from_VTEC_fixed_range / TECU 2015-075_00060-2015-075_00930



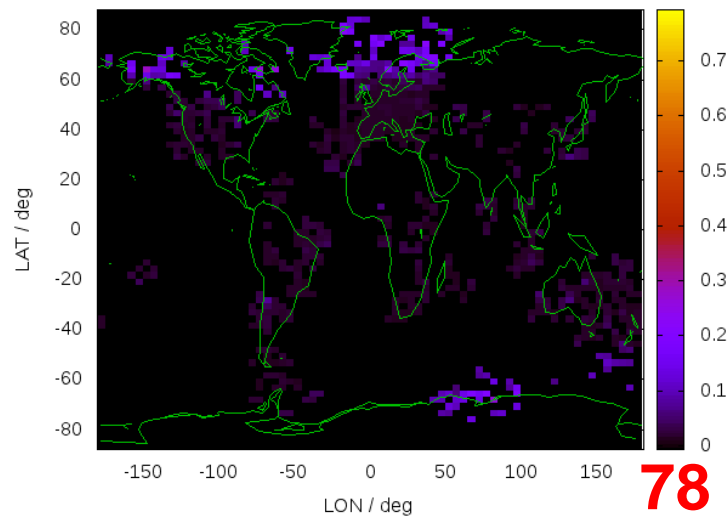
ROTI_from_VTEC_fixed_range / TECU 2015-076_00060-2015-076_00930



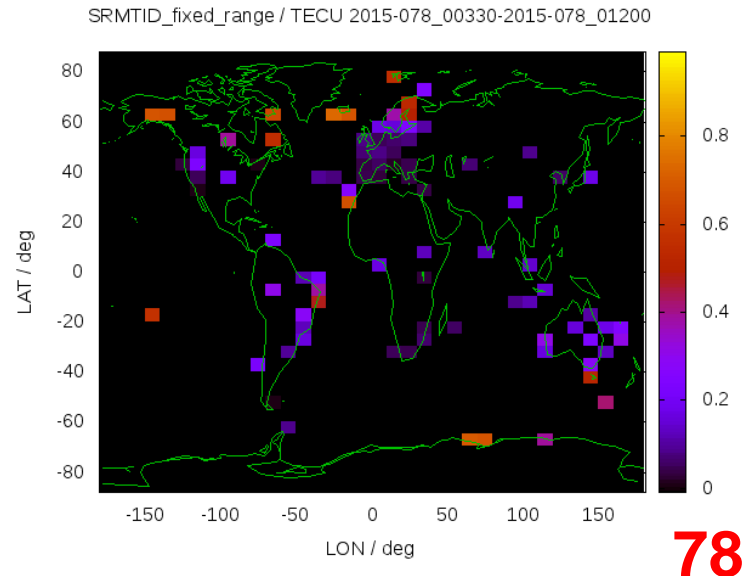
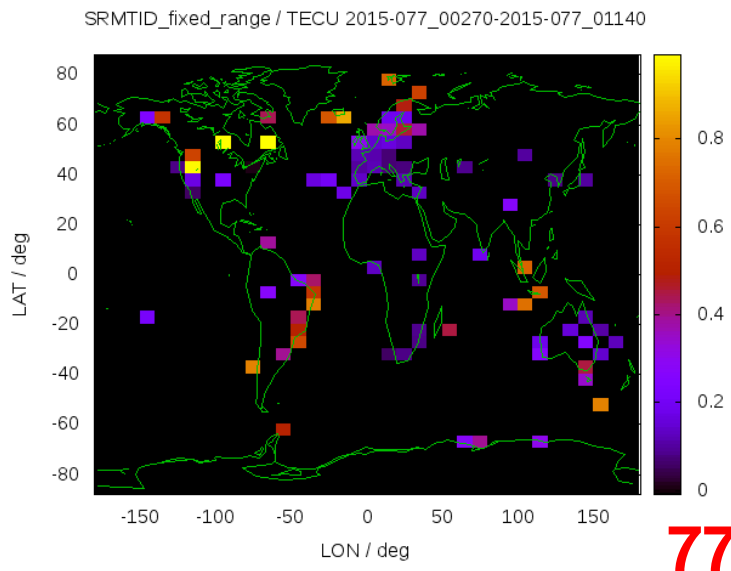
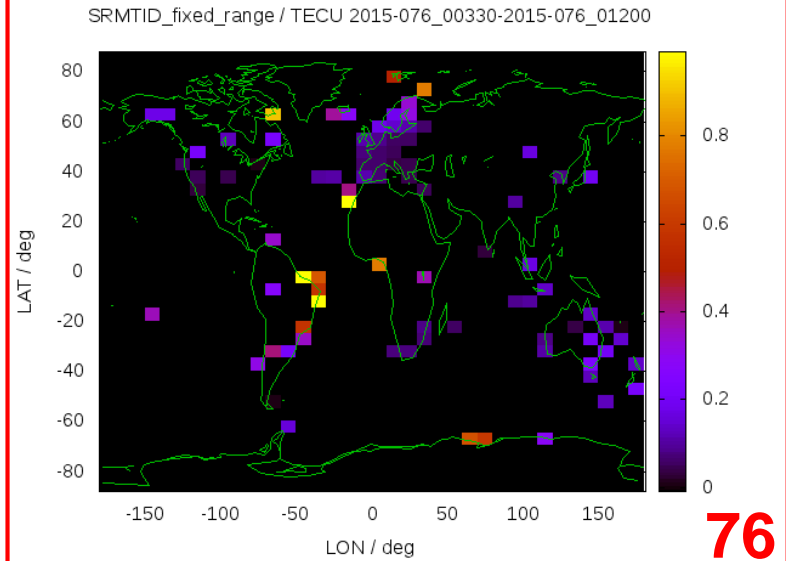
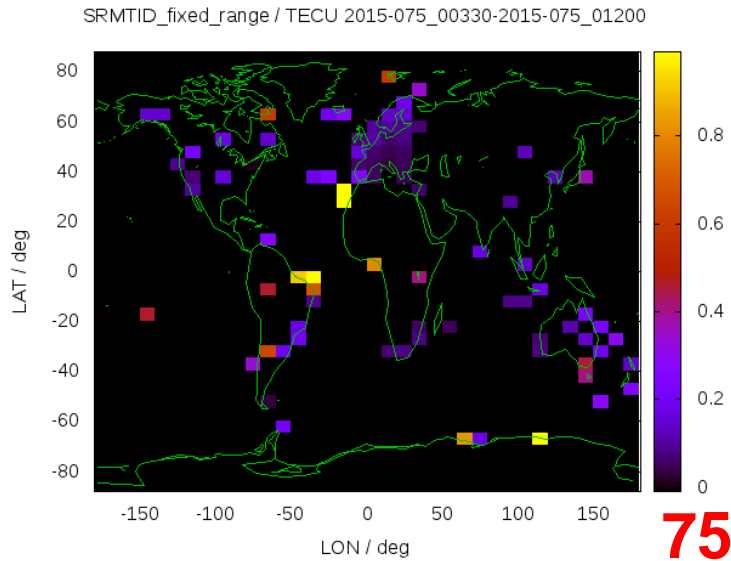
ROTI_from_VTEC_fixed_range / TECU 2015-077_00060-2015-077_00930



ROTI_from_VTEC_fixed_range / TECU 2015-078_00030-2015-078_00900



Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: SRMTID



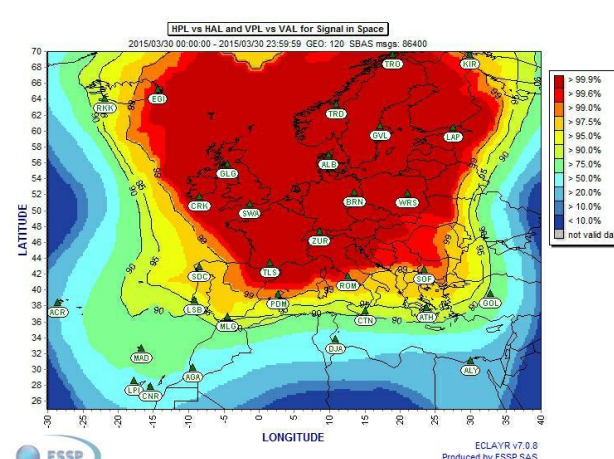
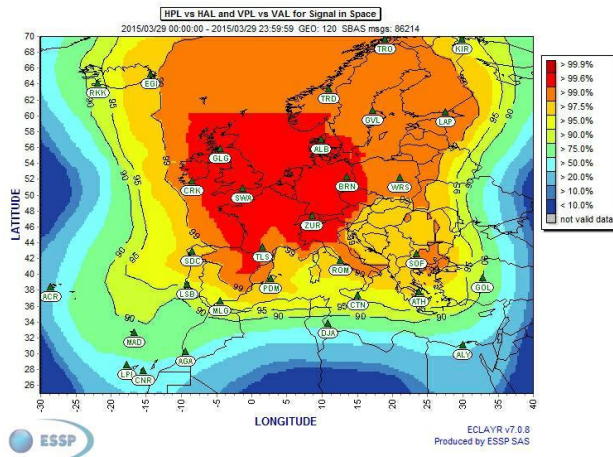
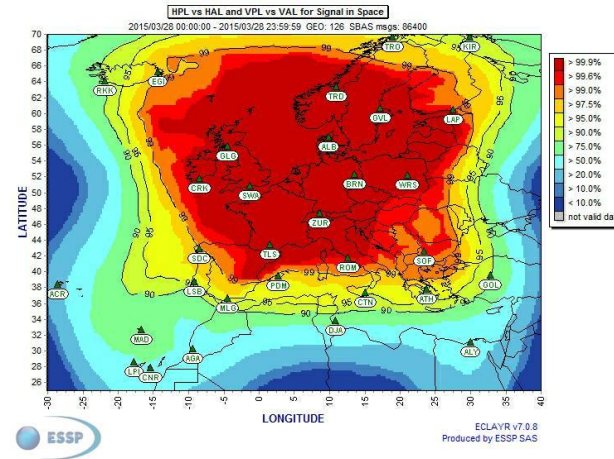
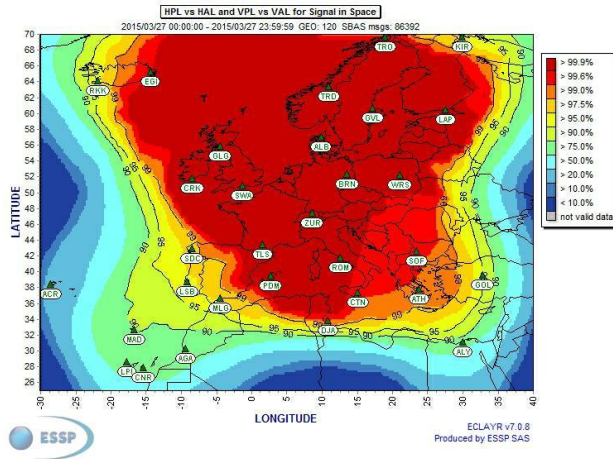
Period #1, 17/03/2015(doy76), 14:59:59 to 19/03/2015(doy78), 07:14:59: Conclusions

- A high degradation of EGNOS VTEC model (errors above 30%, days 75-79) is given for St. Patrick geomagnetic storm.
- Such degradation in ionospheric domain overlapped the EGNOS APV-I Performance Degradation (< 80% of Service Area).
- Clear impact on GSFLAD, SISTED, GEC, ROTI, SRMTID.
- Possibility to further study the correlation of GEC and/or its temporal derivative dGEC with Kp/Dst.



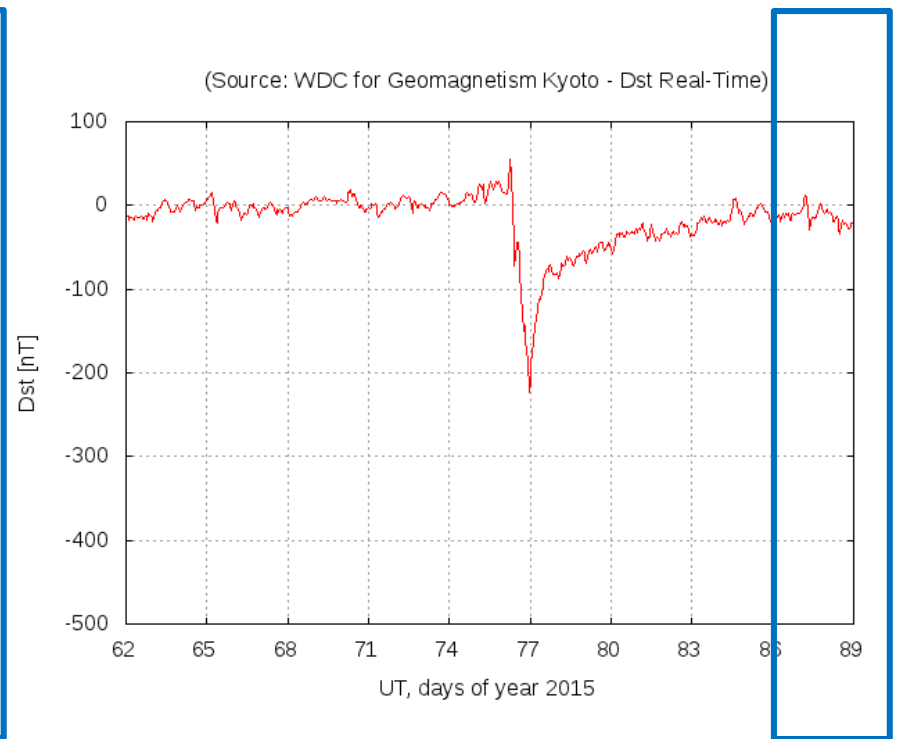
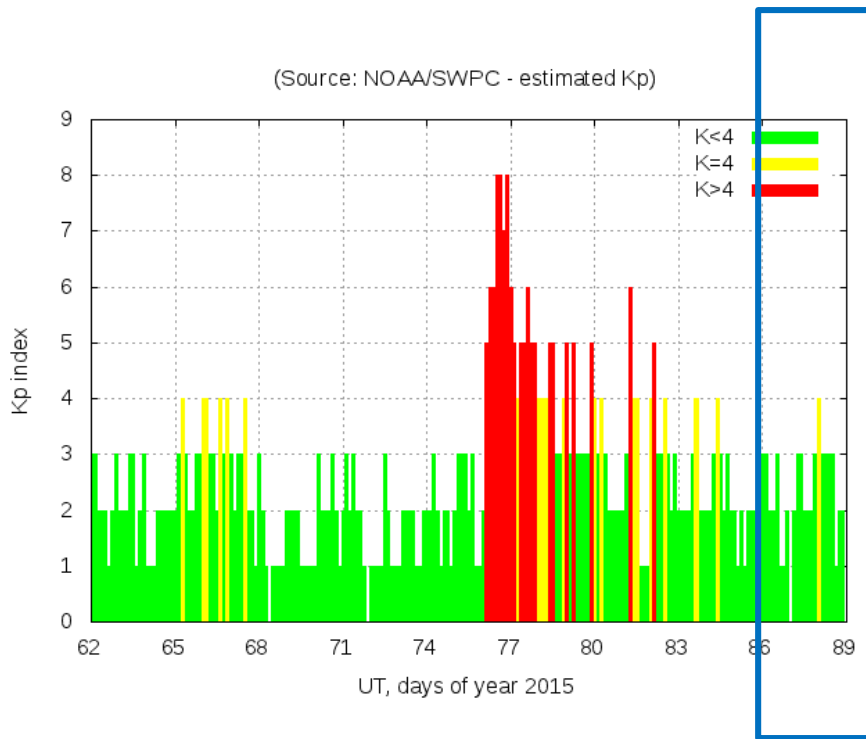
Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): Availability maps

(from https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=apv1_availability)



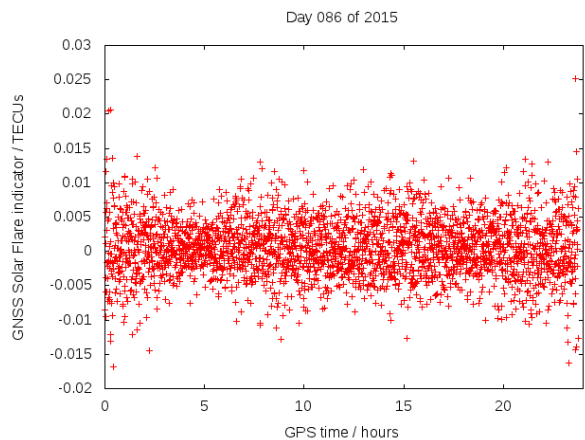
FMI

Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): Kp & Dst

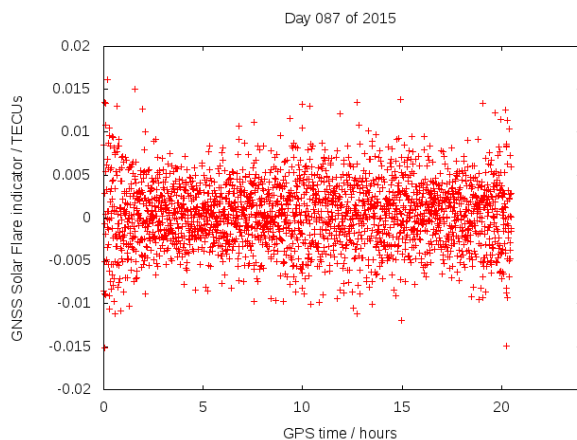


Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): GSFLAI, SISTED

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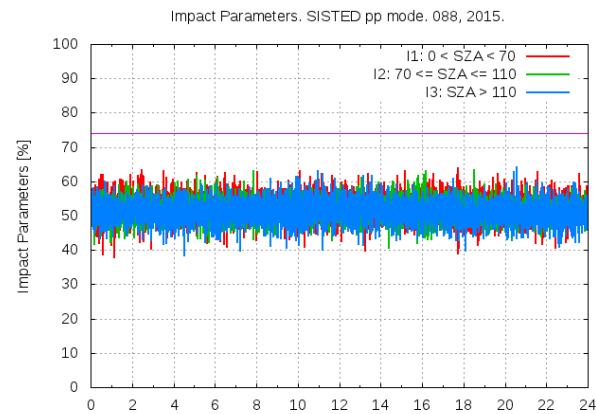
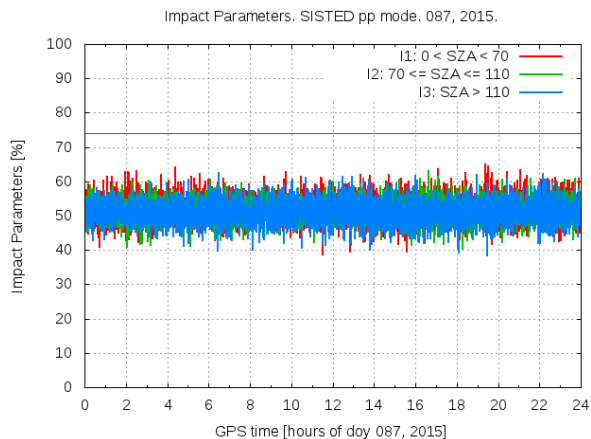
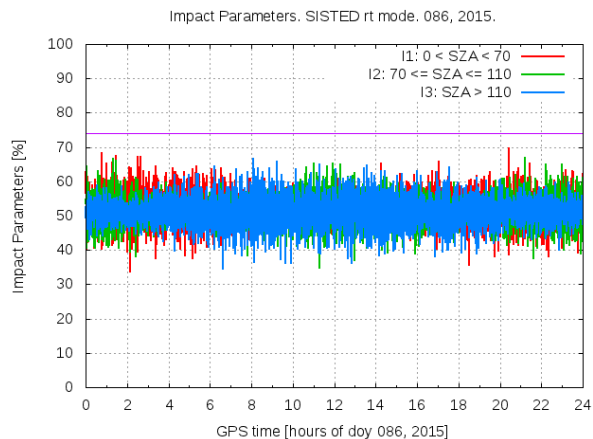


87

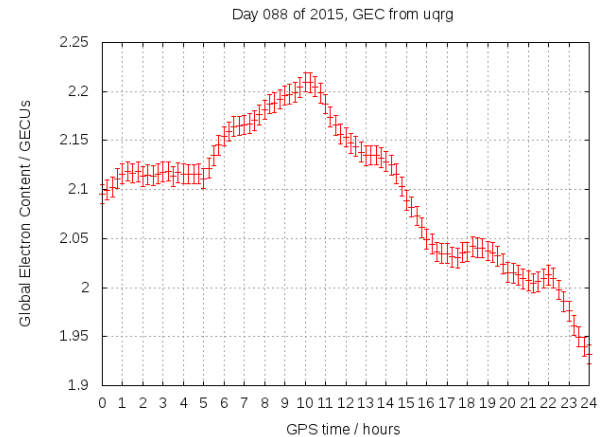
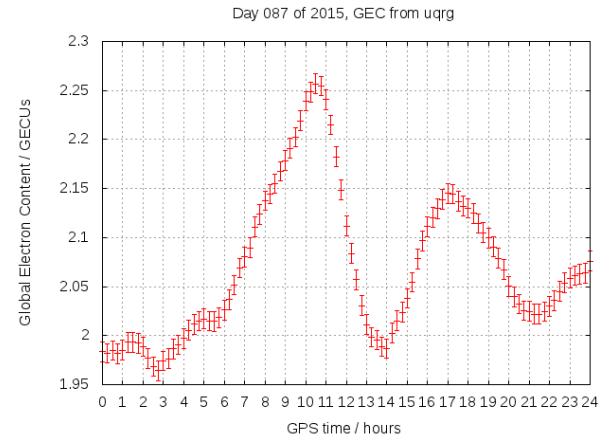
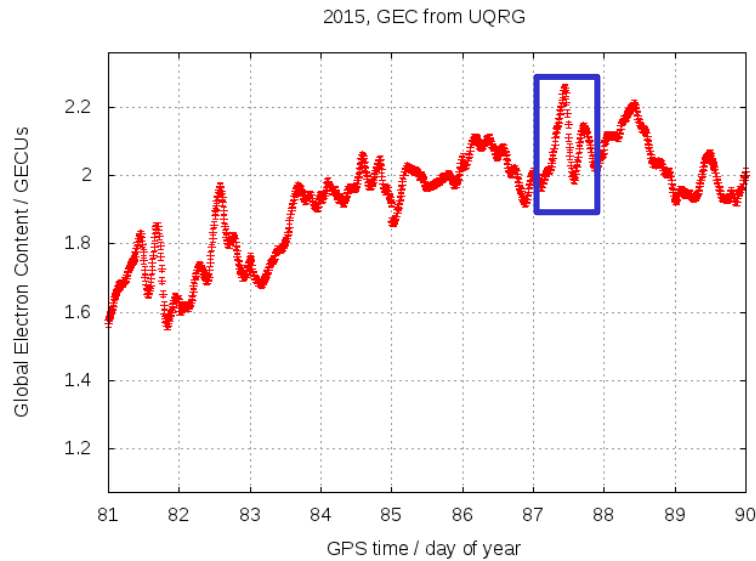


Only C-class flares reported in NOAA's Edited Solar Events list

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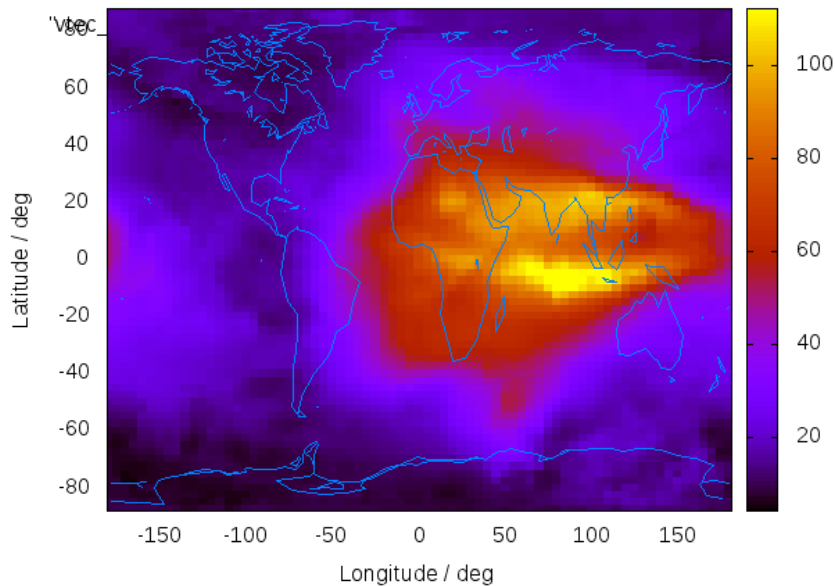


Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): GEC

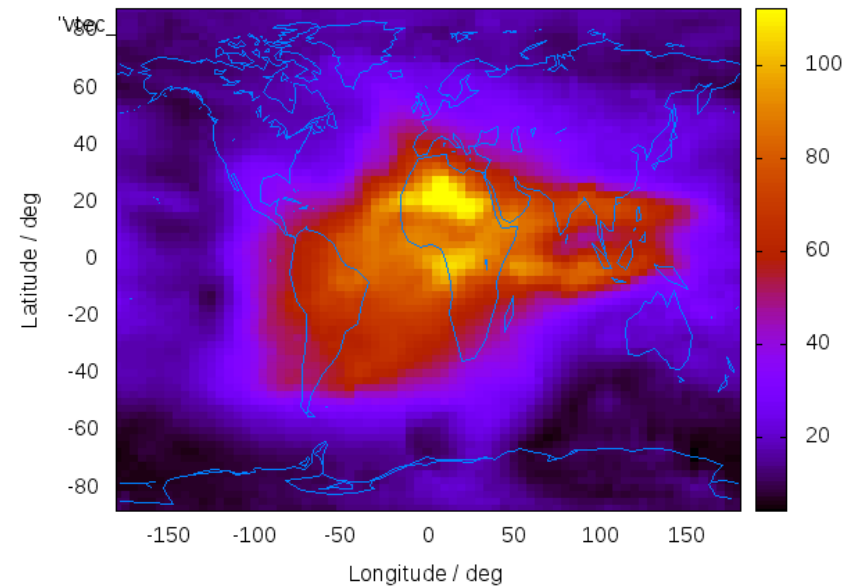


Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): VTEC snapshots

VTEC / TECU 20150329_088.37800

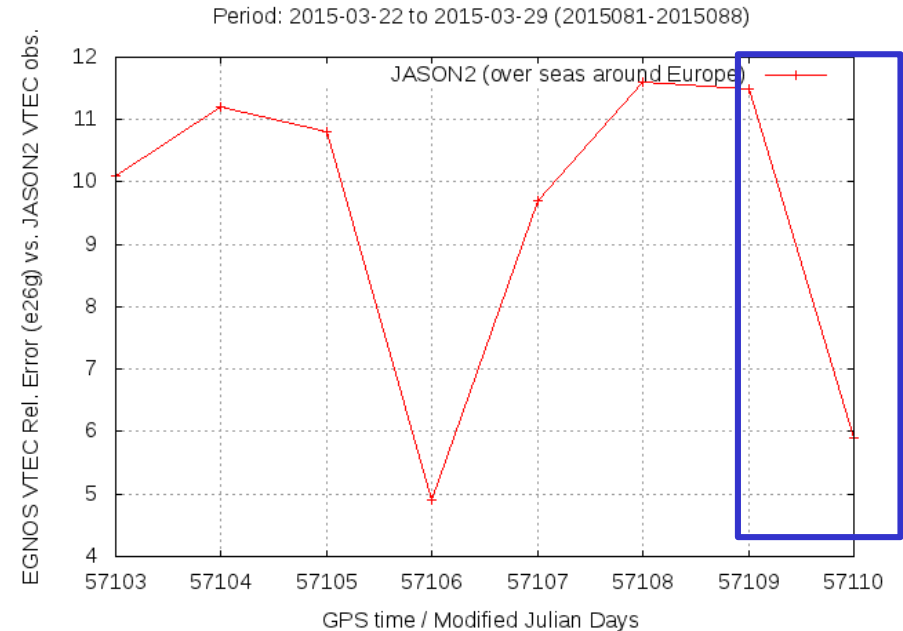
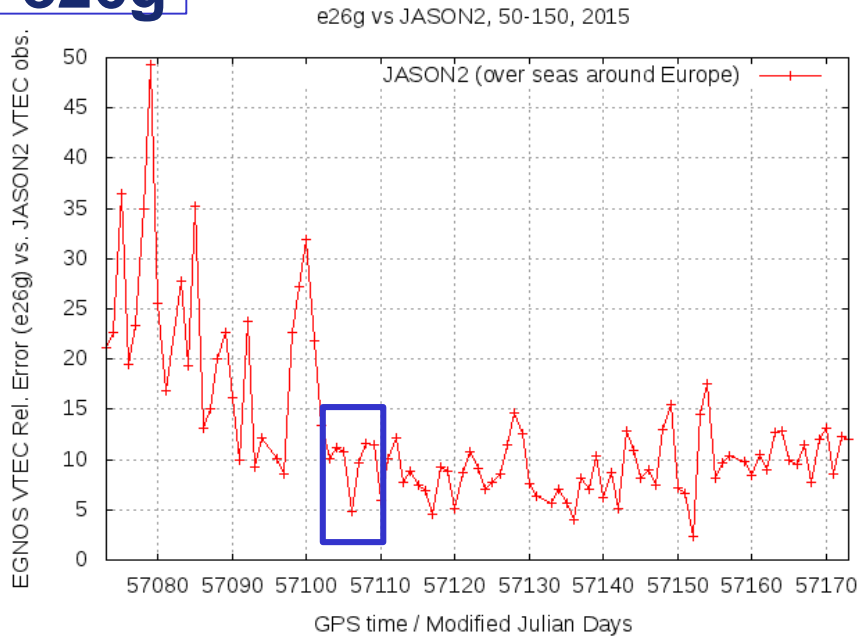


VTEC / TECU 20150329_088.50400



Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): VTEC error vs. Altim.

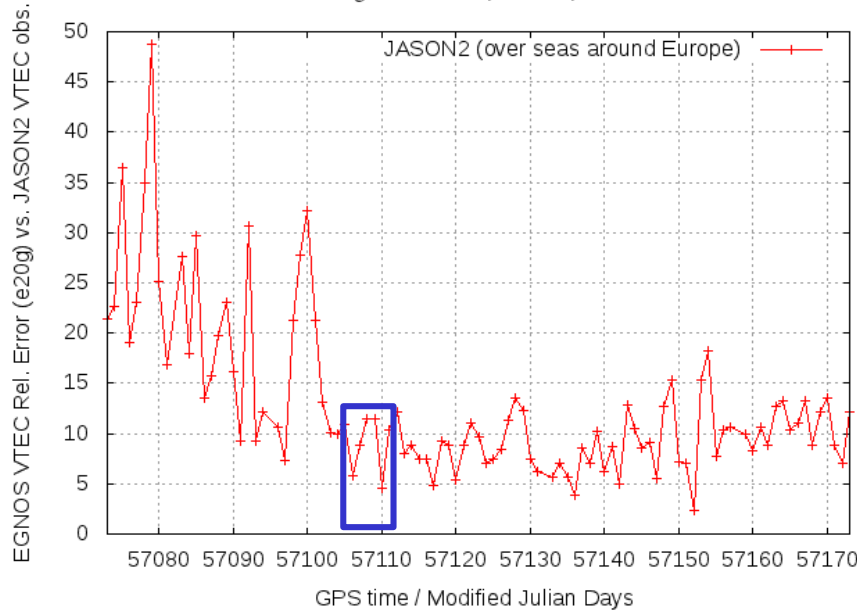
e26g



Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): VTEC error vs. Altim.

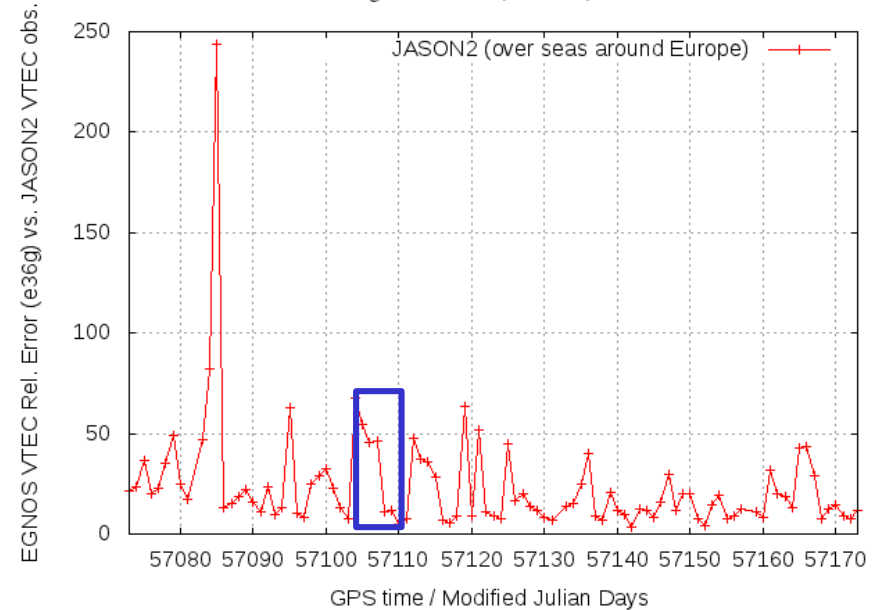
e20g

e20g vs JASON2, 50-150, 2015



e36g

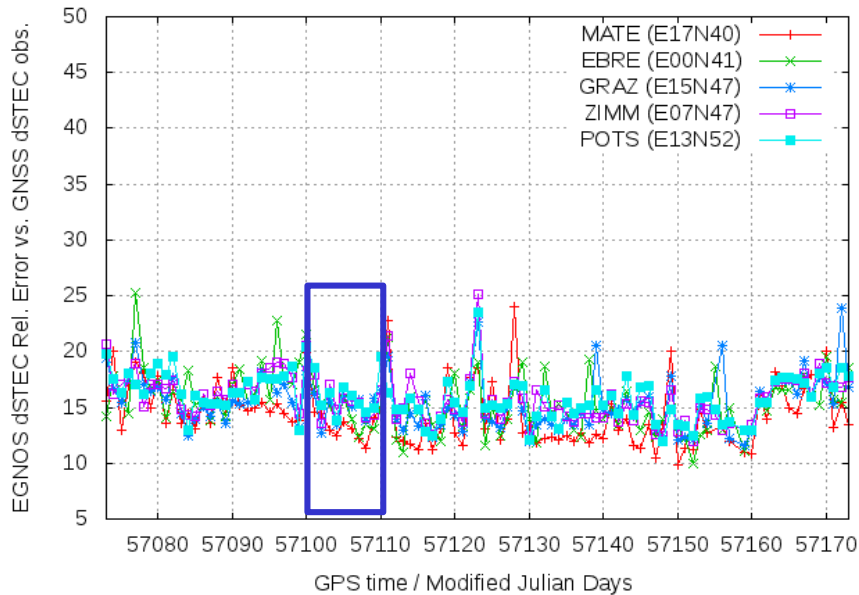
e36g vs JASON2, 50-150, 2015



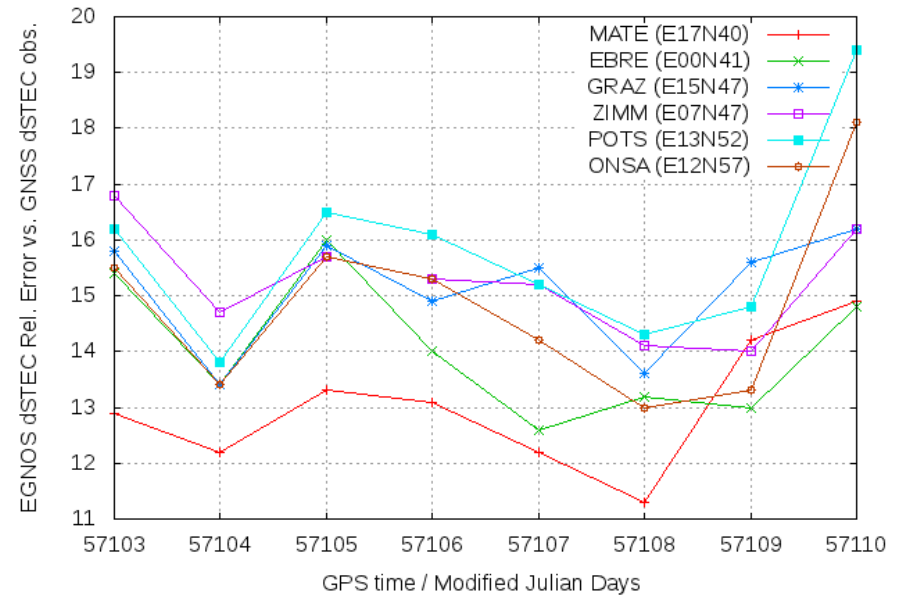
Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): IEWAS (dVTEC error vs. GPS)

e26g

e26g dSTEC vs GNSS dSTEC, 50-150, 2015



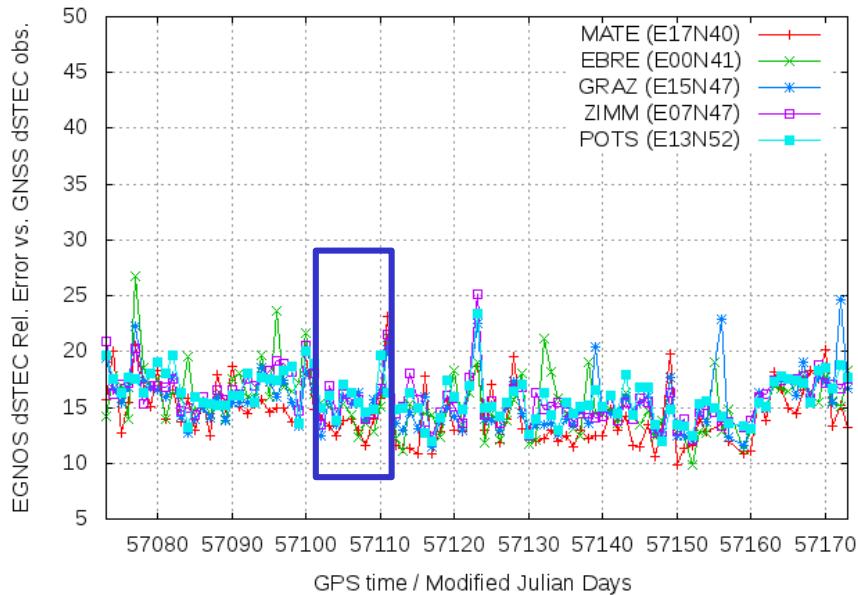
Period: 2015-03-22 to 2015-03-29 (2015081-2015088)



Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): IEWAS (dVTEC error vs. GPS)

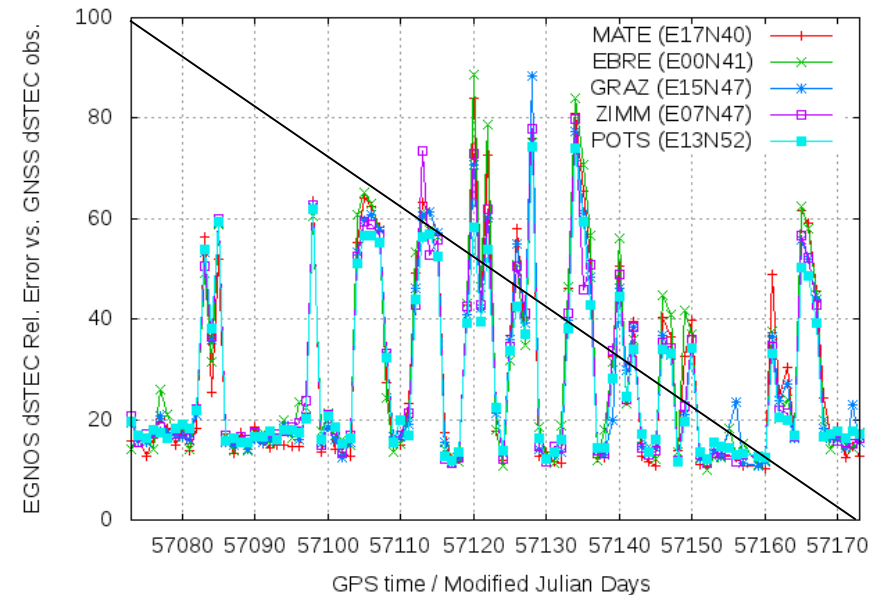
e20g

e20g dSTEC vs GNSS dSTEC, 50-150, 2015



e36g

e36g dSTEC vs GNSS dSTEC, 50-150, 2015



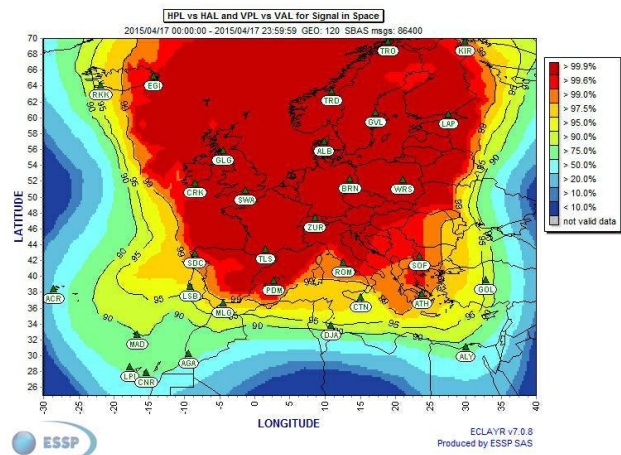
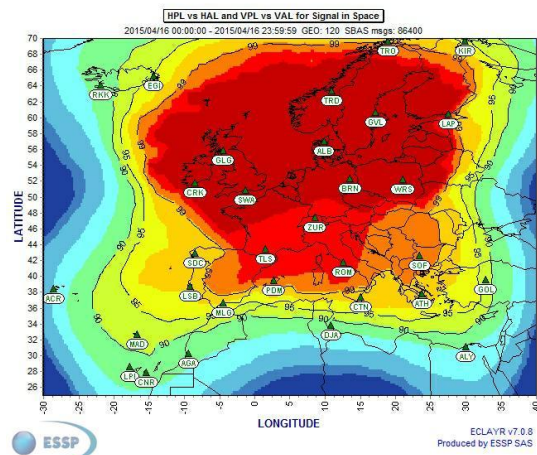
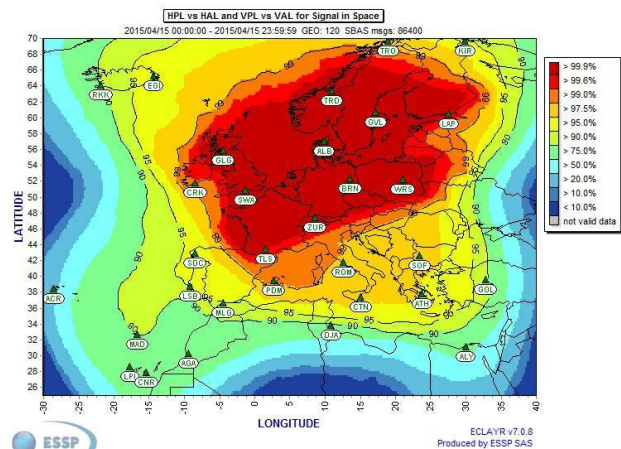
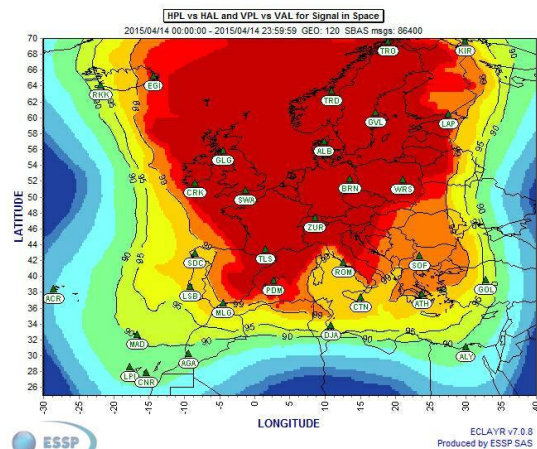
Period #2, 28/03/2015, 22:59:59 (doy 87), to 29/03/2015, 22:44:59 (doy 88): Conclusions

- There is no abnormal ionospheric information on available GSFLAD, SISTED, GEC, VTEC and VTEC error against JASON2.
- Beginning of an increase of dSTEC error for e20g and e26g not relevant enough when looking at the time series.
- Lack of multiple products at MIR, such as ROTI/SRMTID/AATR/Scintillations, for that date. Possibility to recompute them to further check this period.

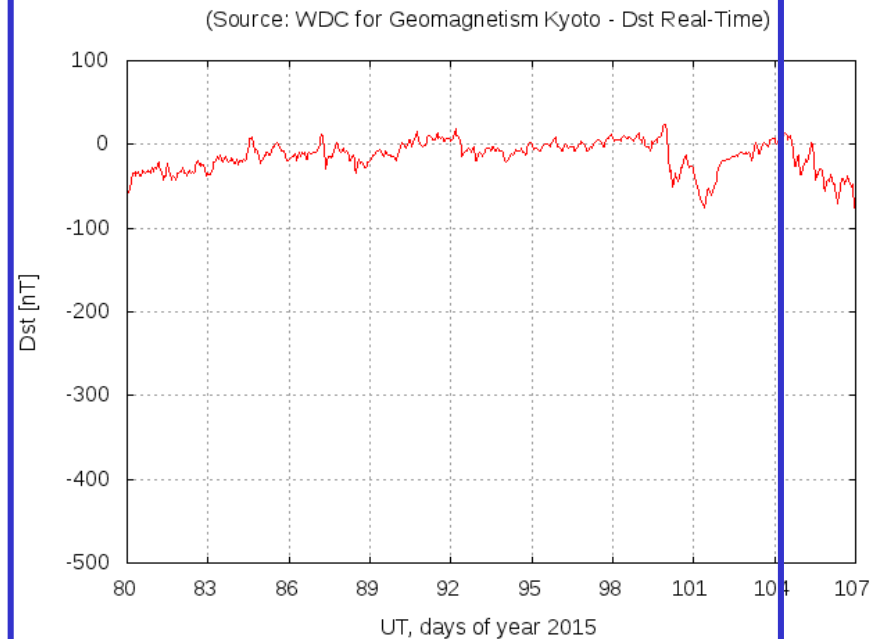
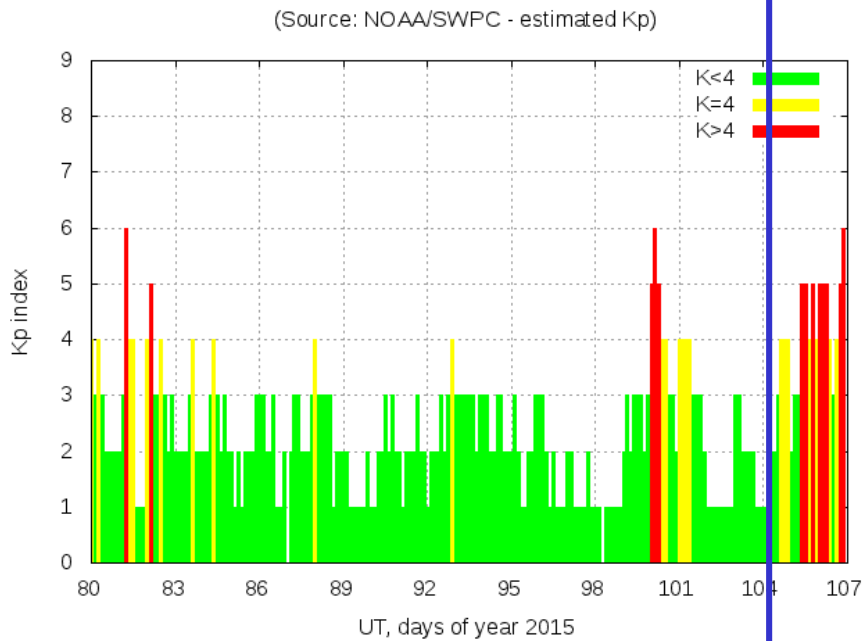


Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): Availability maps

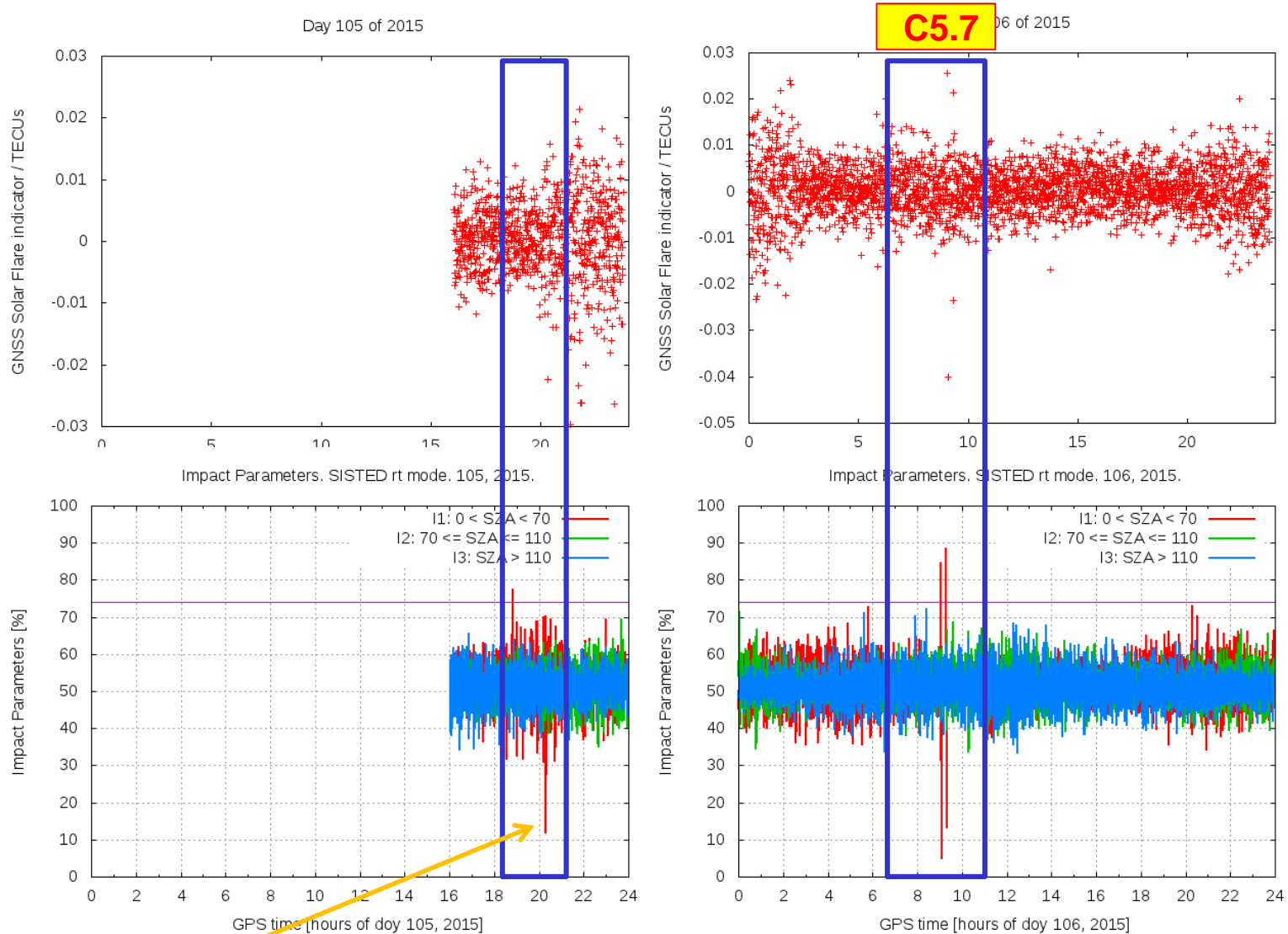
(from https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=apv1_availability)



Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): Kp & Dst



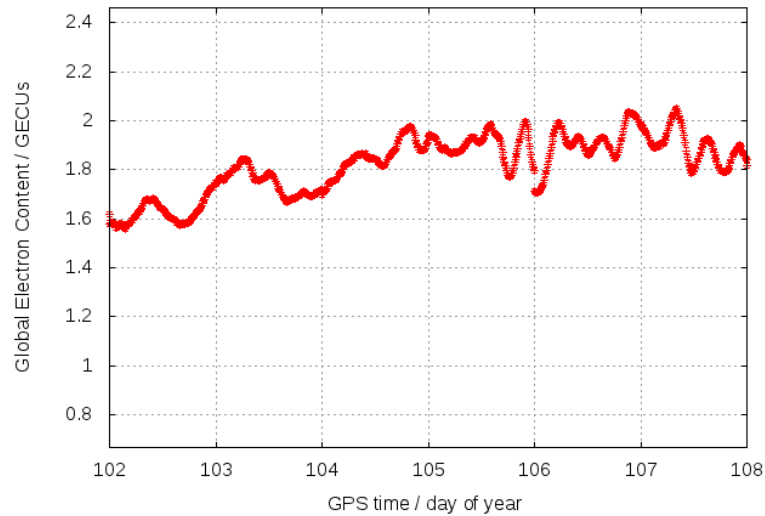
Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): GSFLAI, SISTED



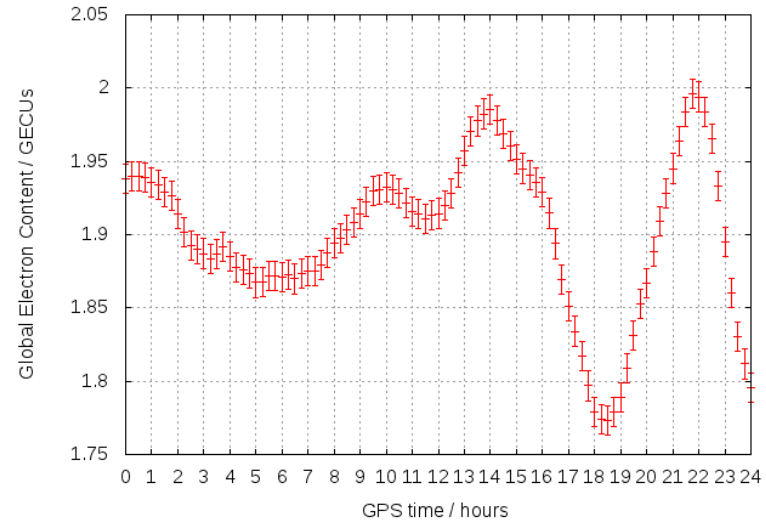
15 04 15 2013 2021 2135 HOL 3 FLA N10E15 2N ERU => Optical flare observed in H-alpha (ERU - several eruptive centers)

Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): GEC

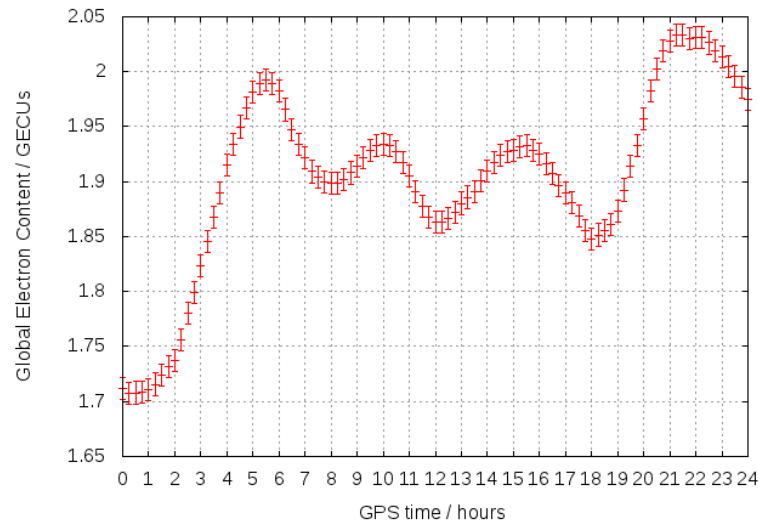
2015, GEC from UQRG



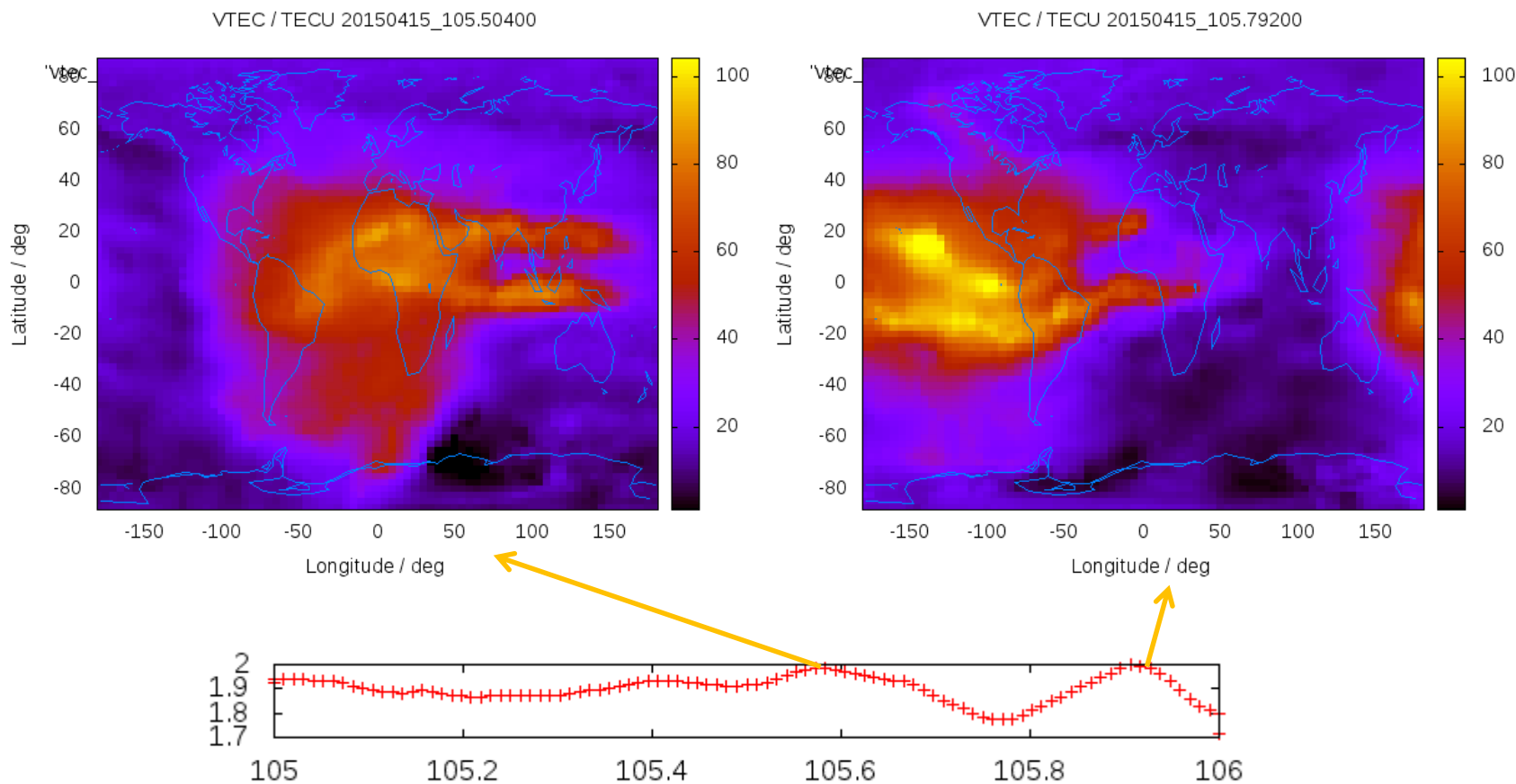
Day 105 of 2015, GEC from uqrg



Day 106 of 2015, GEC from uqrg

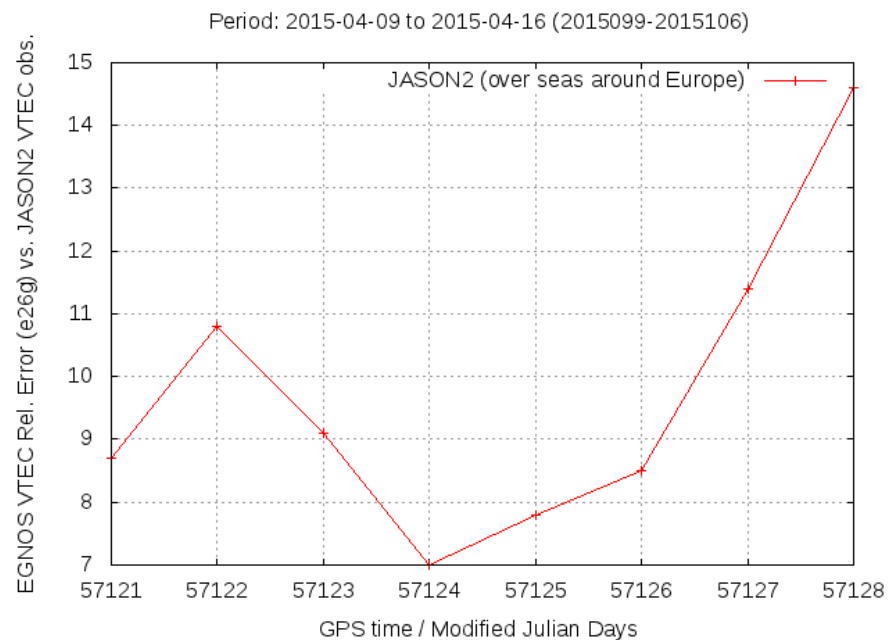
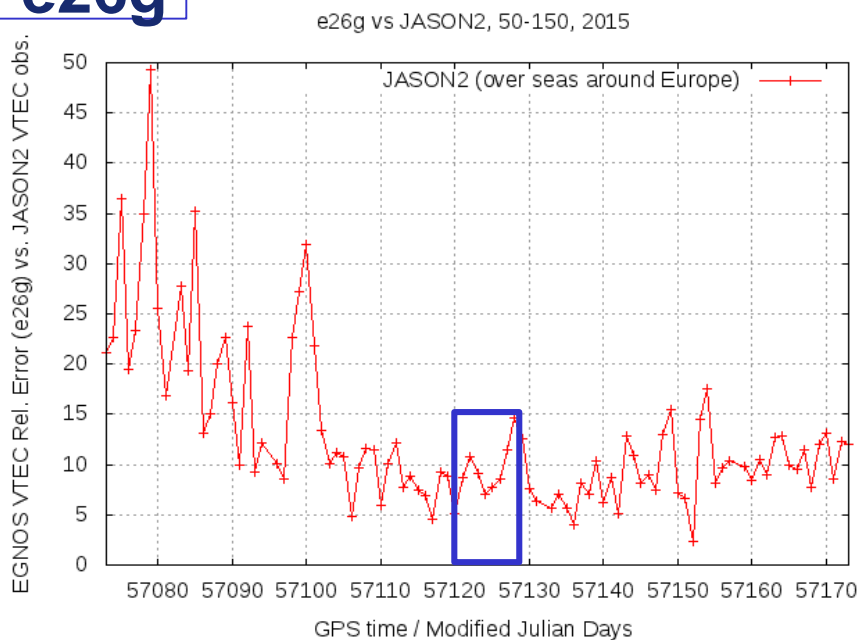


Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): VTEC snapshots



Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): VTEC error vs. Altim.

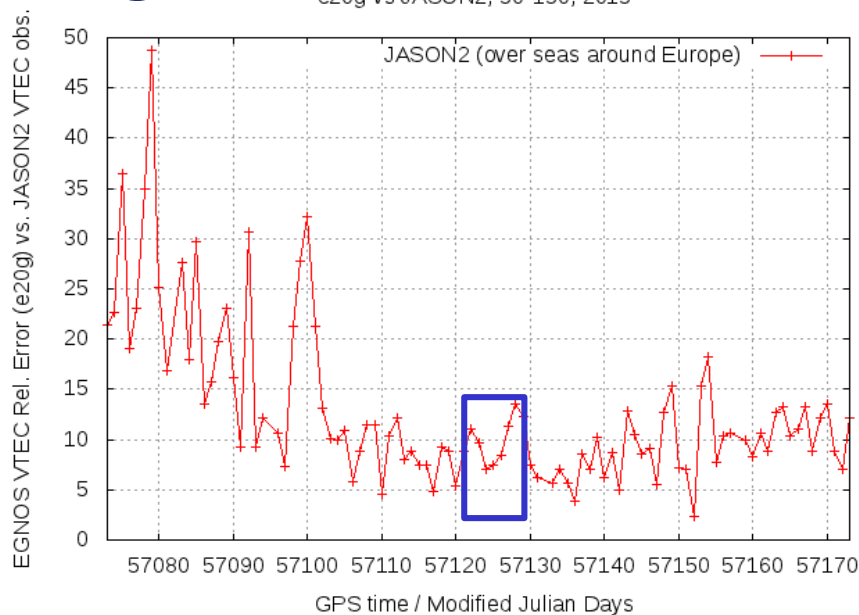
e26g



Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): VTEC error vs. Altim.

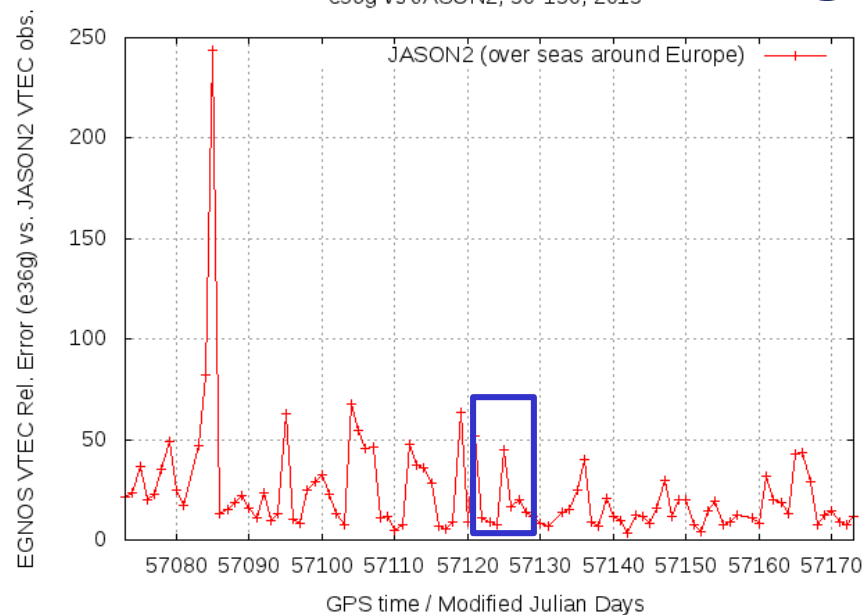
e20g

e20g vs JASON2, 50-150, 2015



e36g

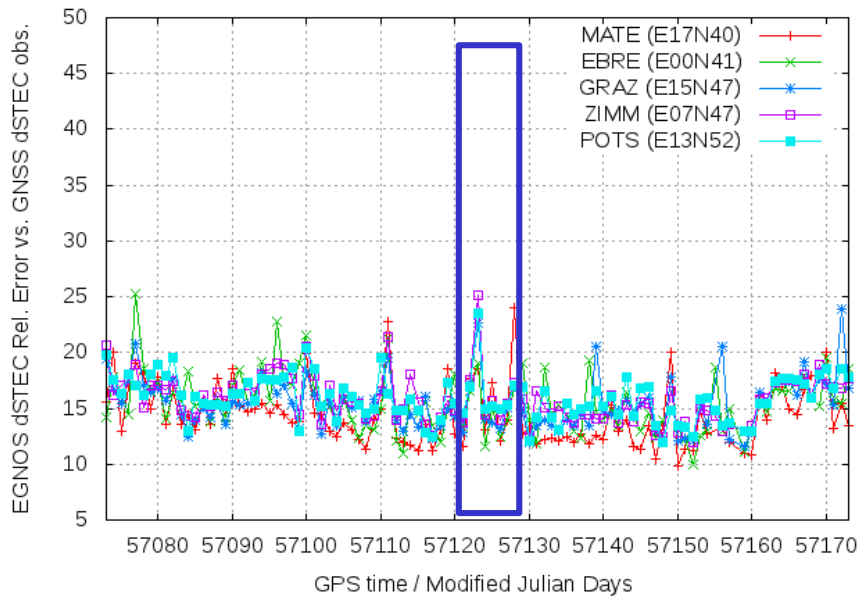
e36g vs JASON2, 50-150, 2015



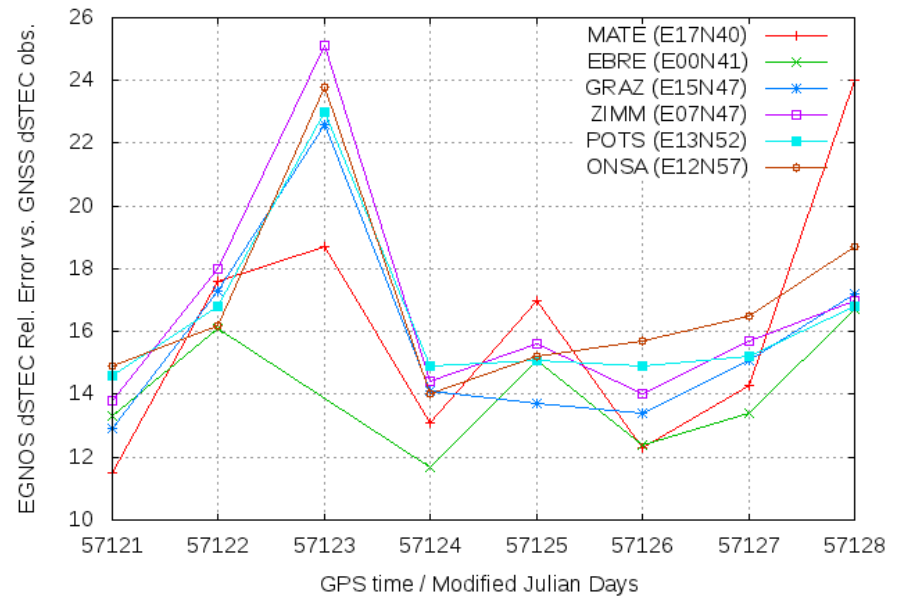
Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): IEWAS (dVTEC error vs. GPS)

e26g

e26g dSTEC vs GNSS dSTEC, 50-150, 2015



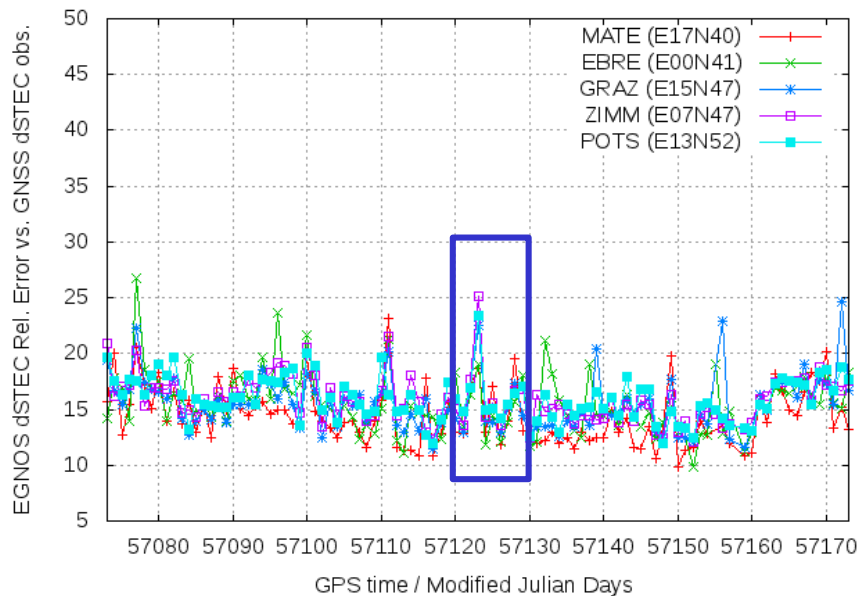
Period: 2015-04-09 to 2015-04-16 (2015099-2015106)



Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): IEWAS (dVTEC error vs. GPS)

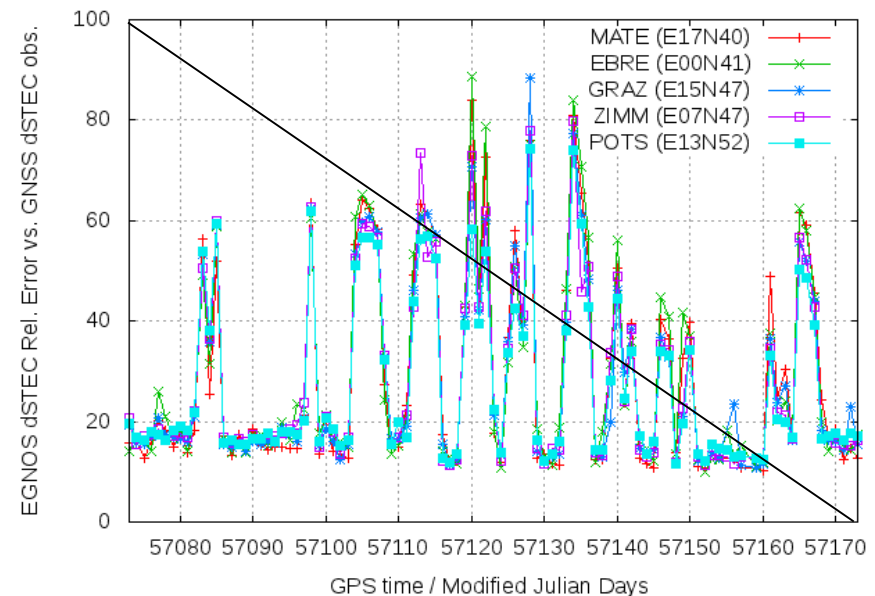
e20g

e20g dSTEC vs GNSS dSTEC, 50-150, 2015



e36g

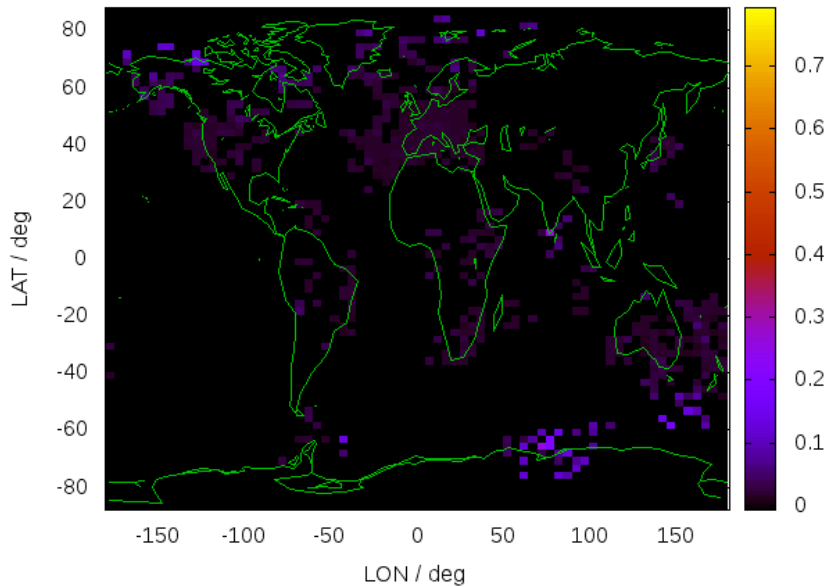
e36g dSTEC vs GNSS dSTEC, 50-150, 2015



Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): ROTI evol. @N,C,S

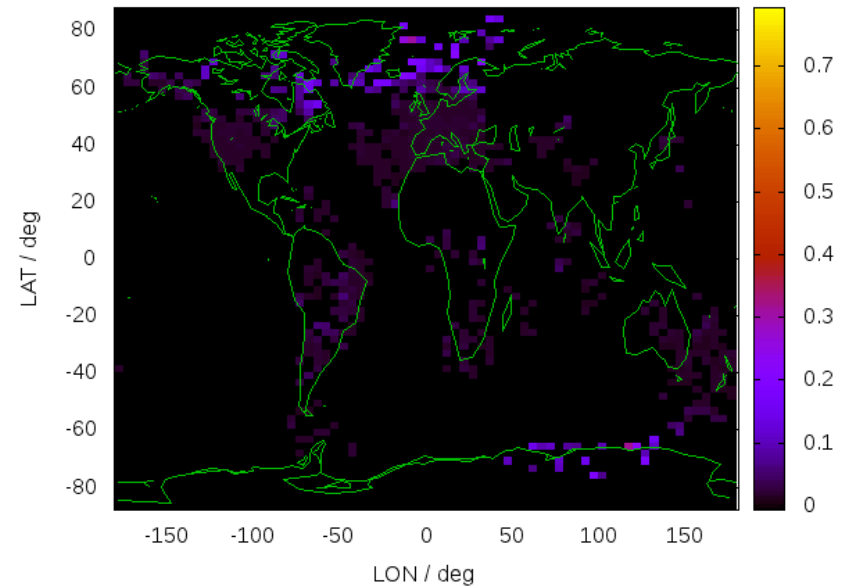
Fixed range

ROTI_from_VTEC_fixed_range / TECU 2015-105_57930-2015-105_58500



105

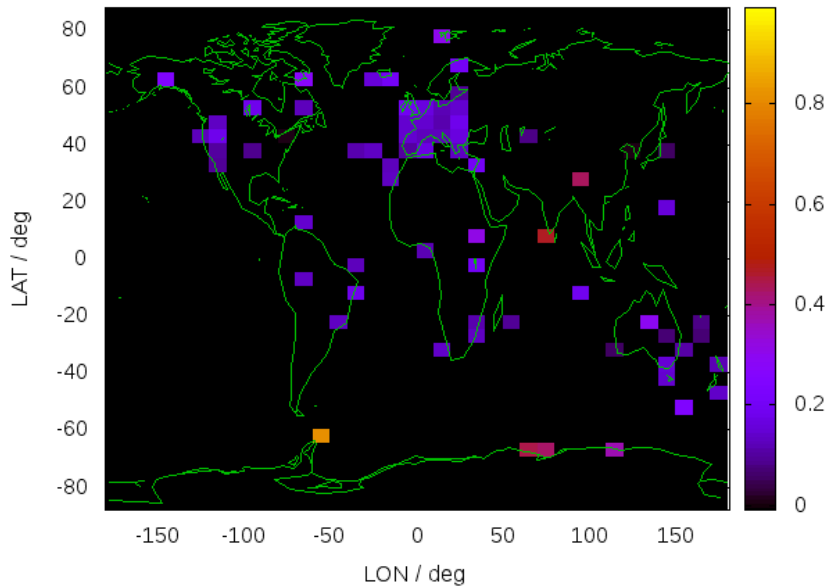
ROTI_from_VTEC_fixed_range / TECU 2015-106_00060-2015-106_00930



106

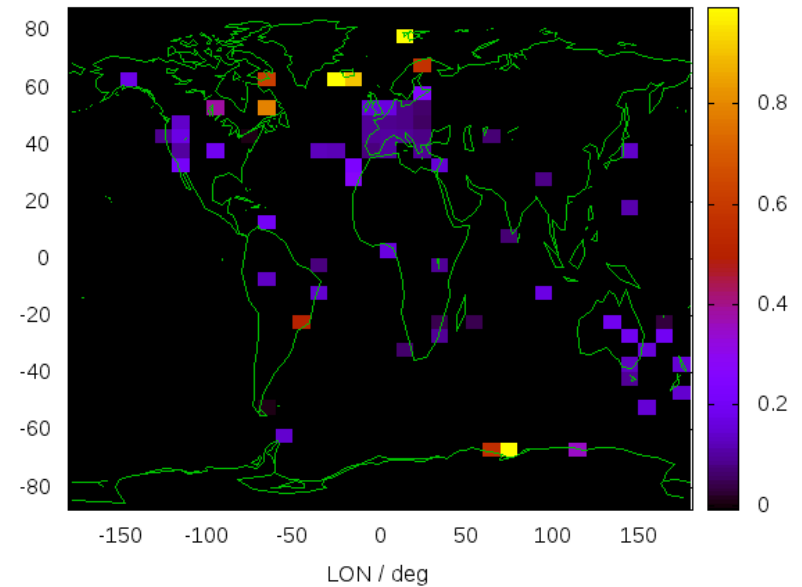
Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): SRMTID

SRMTID_fixed_range / TECU 2015-105_58020-2015-105_58890



105

SRMTID_fixed_range / TECU 2015-106_00450-2015-106_01320



106

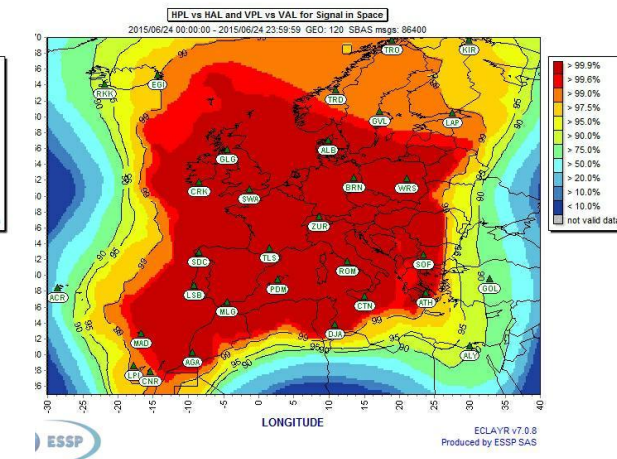
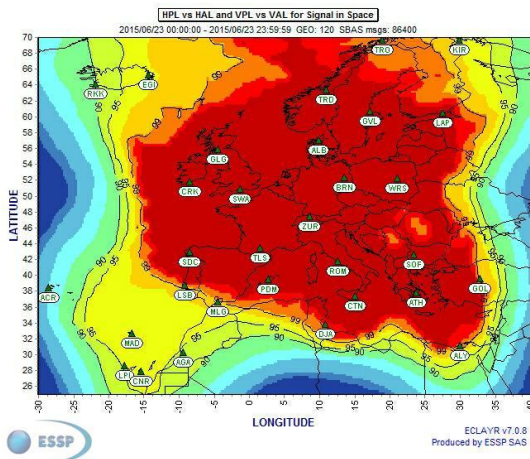
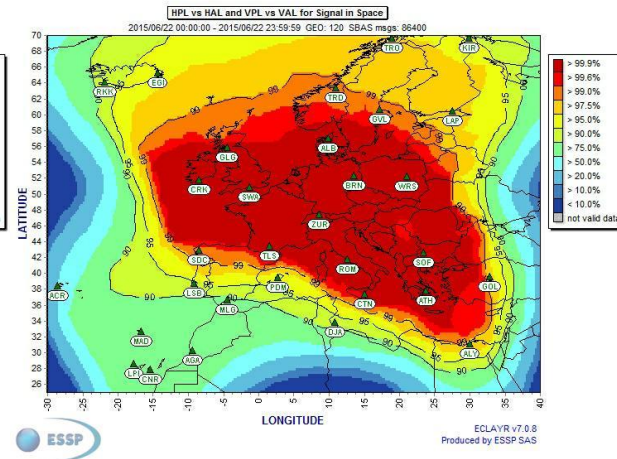
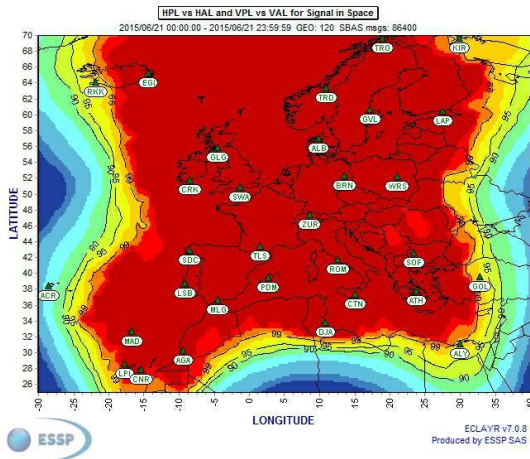
Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): Conclusions

- **SISTED** shows abnormal sunlit hemisphere activity.
- Increase of EGNOS VTEC relative error vs JASON2 and dSTEC error vs GPS though not significant looking at the time series.
- Relevant ROTI/SRMTID activity.

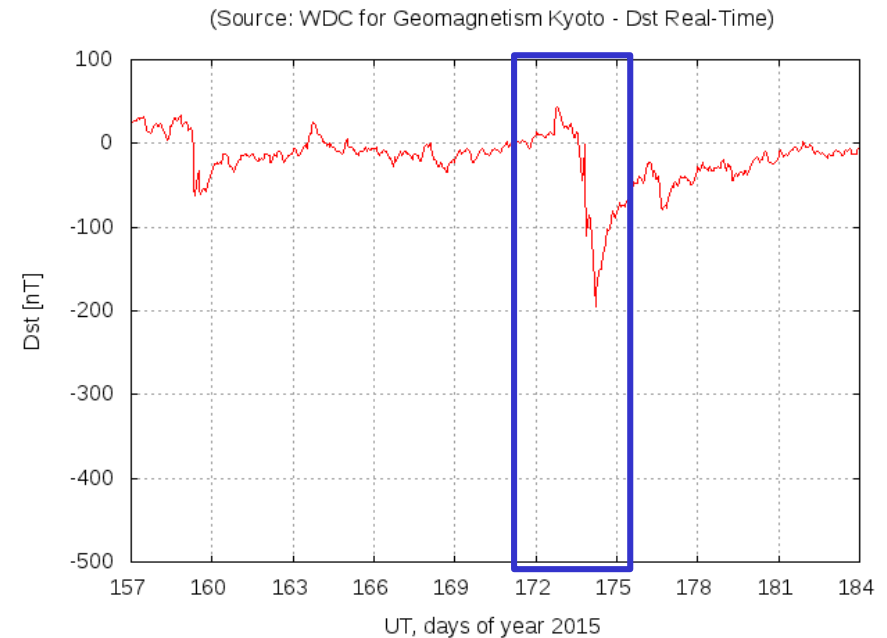
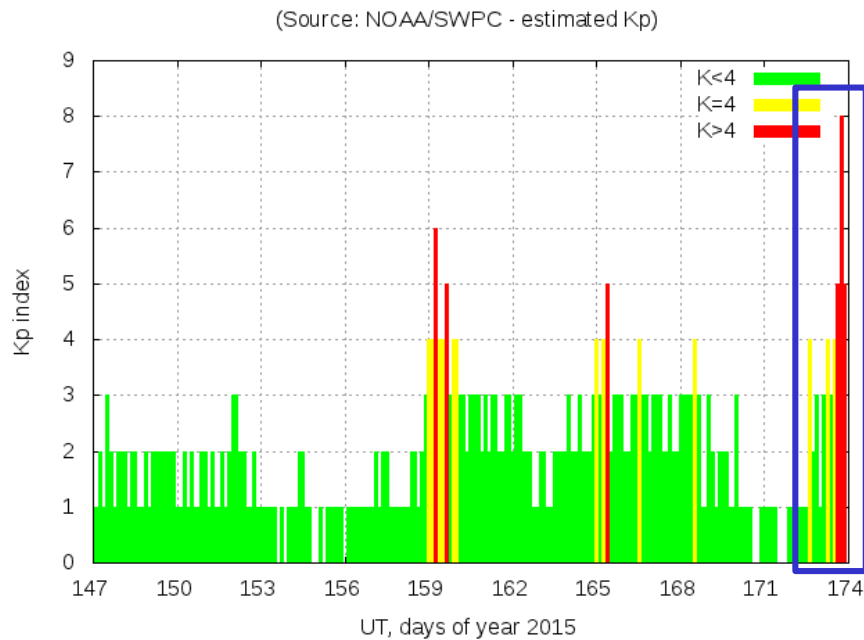


Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): Availability maps

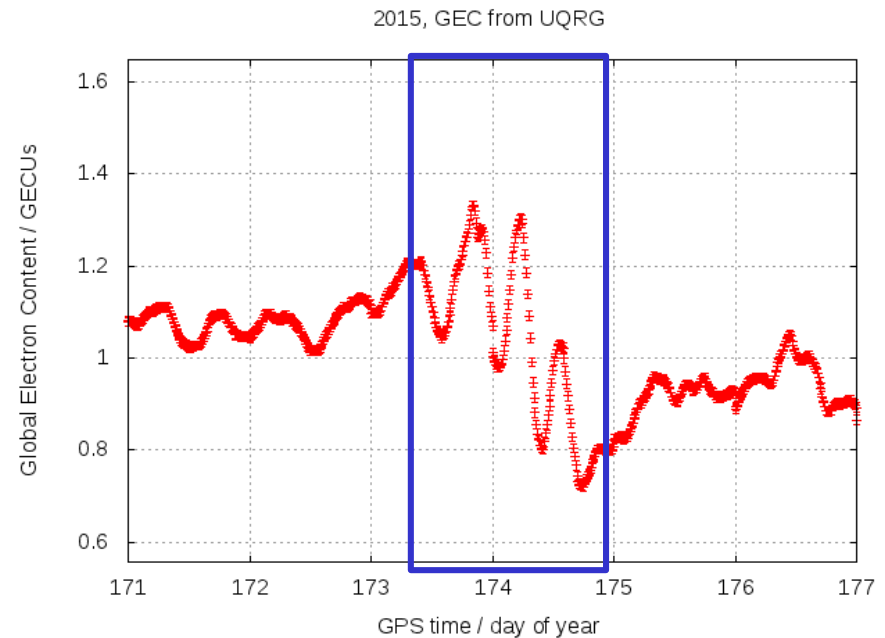
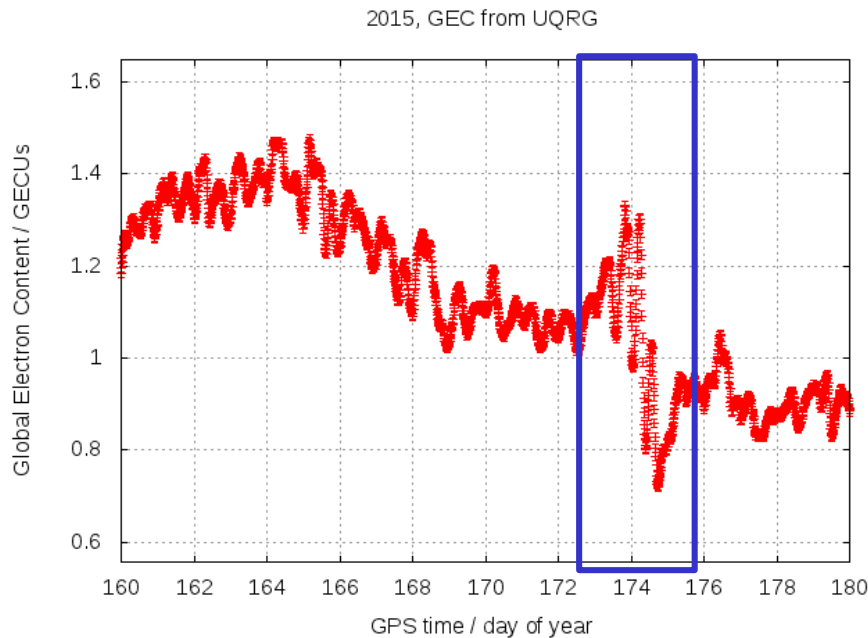
(from https://eqnos-user-support.essp-sas.eu/new_eqnos_ops/?q=apv1_availability)



Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): Kp & Dst

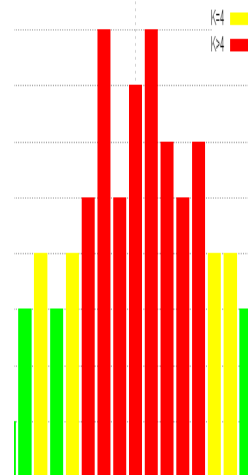
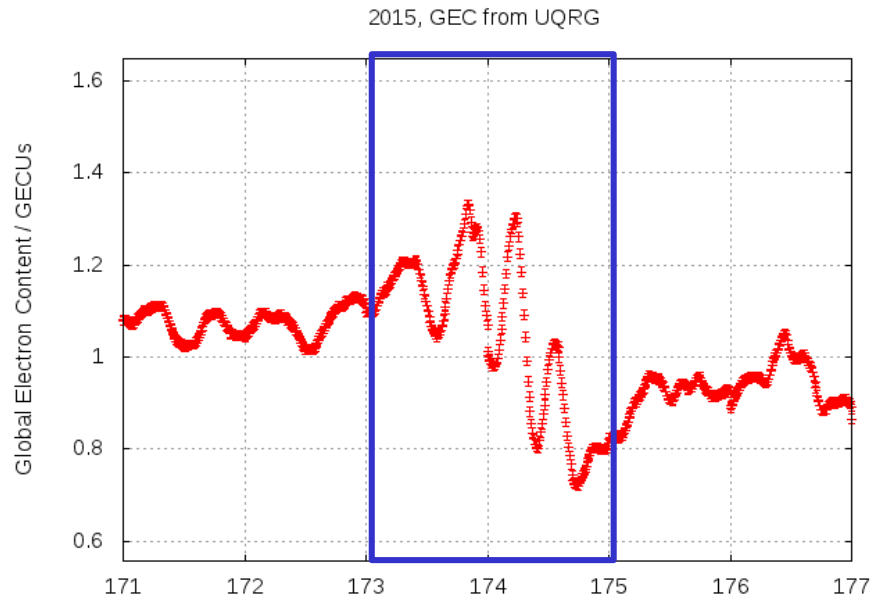


Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): GEC



Clear dropdown with oscillations in GEC general trend

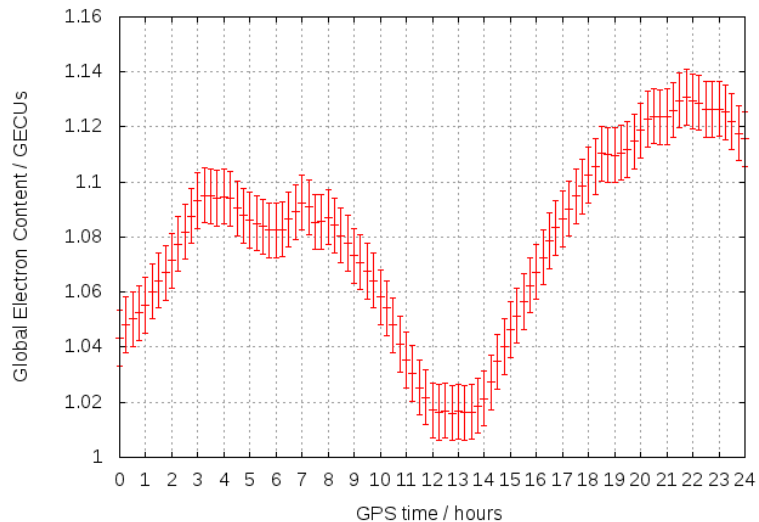
Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): GEC



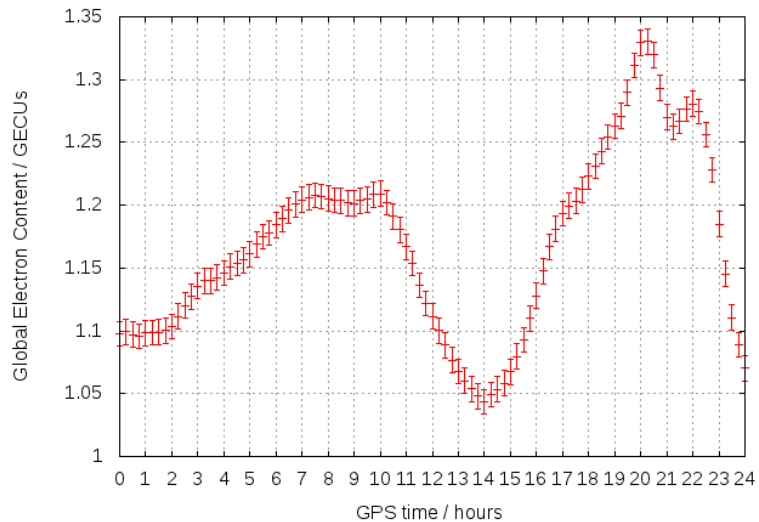
**$d(\text{GEC})/dt$ could be
analysed as a potential
index on geomagnetic
activity**

Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): Kp, Dst & GEC

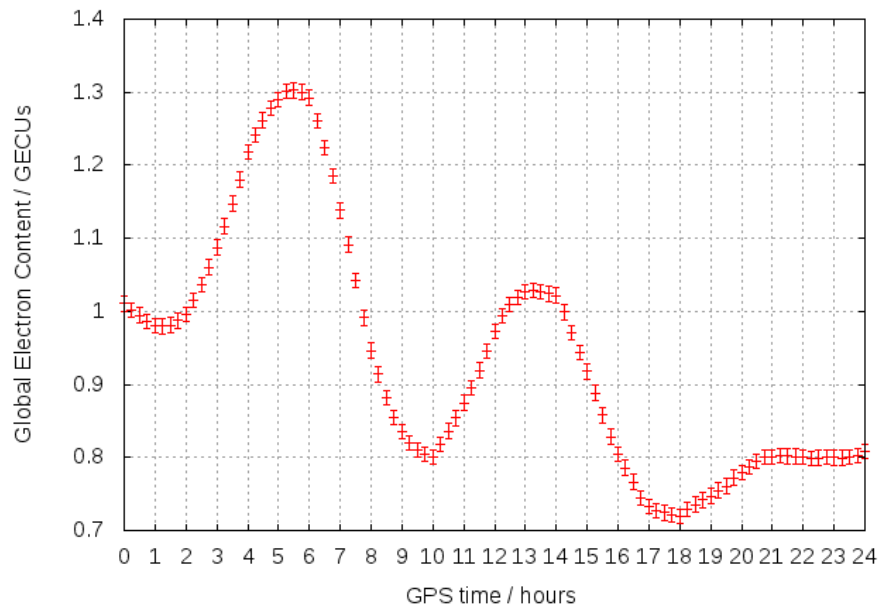
Day 172 of 2015, GEC from uqrq



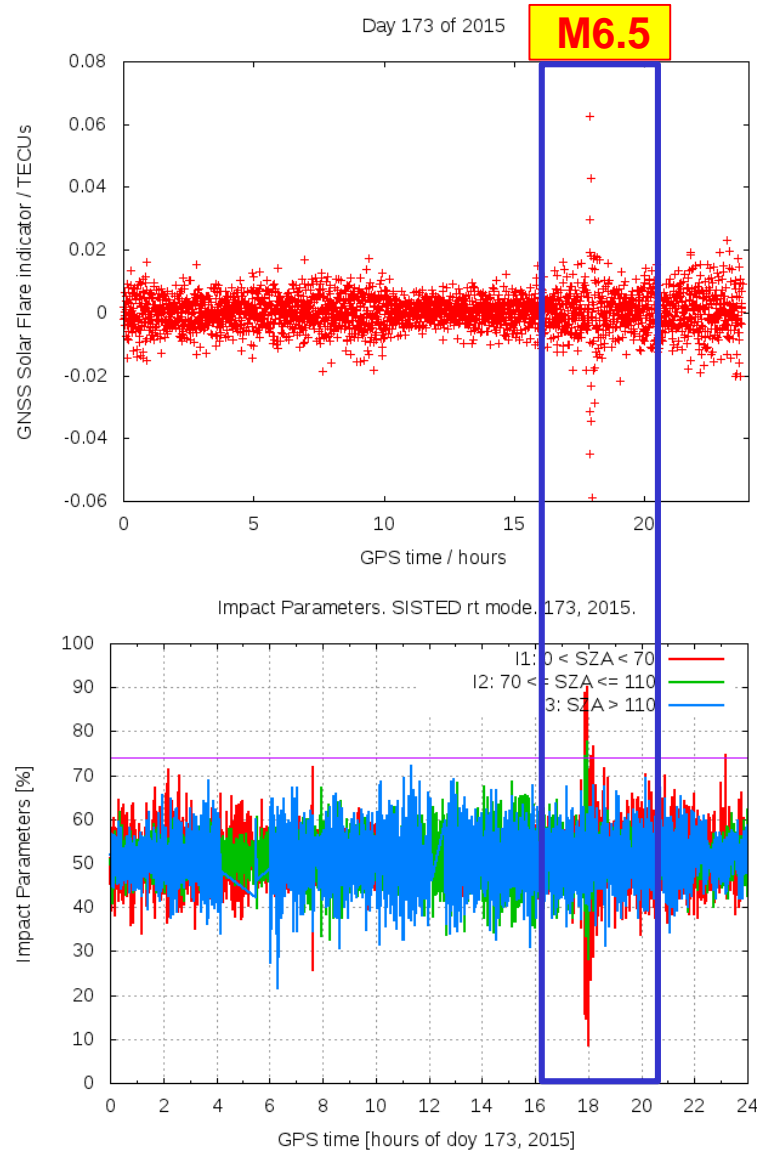
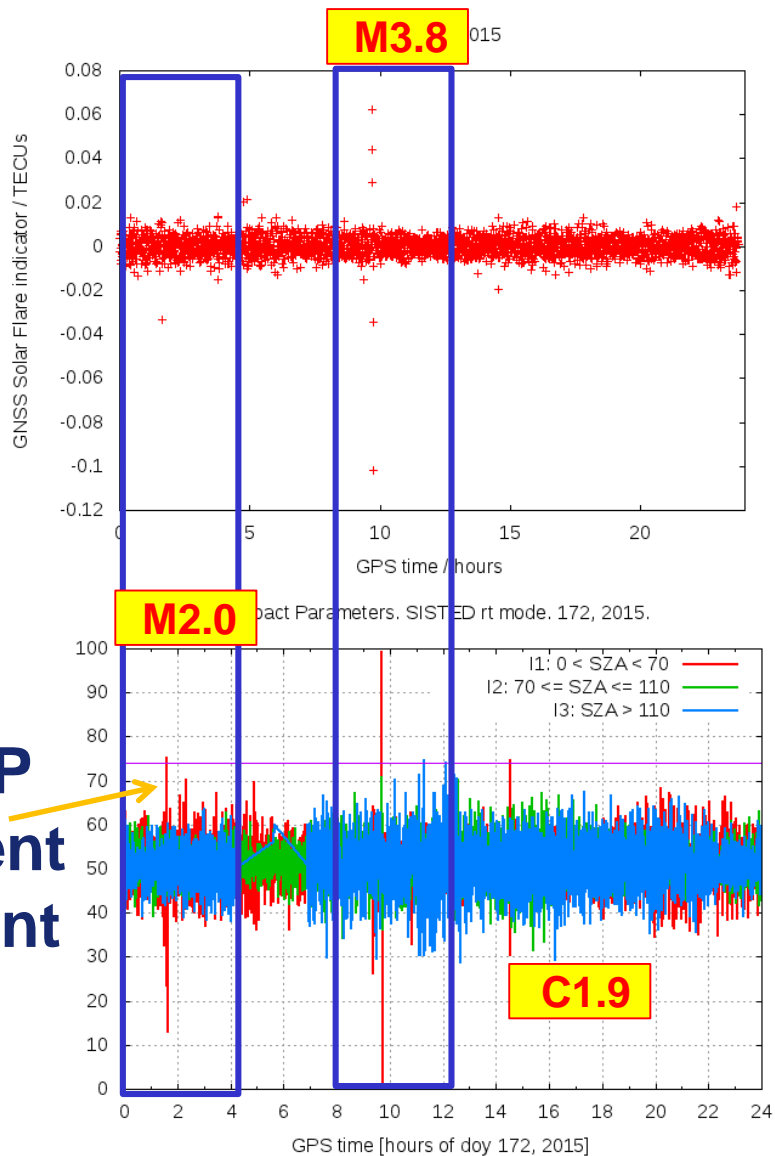
Day 173 of 2015, GEC from uqrq



Day 174 of 2015, GEC from uqrq



Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): GSFLAI, SISTED



Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): SEP events

SEP events reported by NOAA in 2015 (from <http://umbra.nascom.nasa.gov/SEP>)

Start(Day/UT) (DOY 169, 2015)	Maximum Proton Flux (pfu @ >10 MeV) CME	Max(Day/UT) Import.(X ray/Opt)	Location
Jun 18/1135	Jun 18/1445 16 Narrow SW limb event/18 0125	18/0127 M1	SW limb
(DOY 172, 2015) Jun 21/2135	Jun 22/1900 1070 Full halo/21 0236	21/0236 M2	N13W00
DOY 177, 2015 Jun 26/0350	Jun 27/0030 22 Asymmetric full halo/25 0836	25/0816 M7	N12W40
DOY 302, 2015 Oct 29/0550	Oct 29/1000 23 Far-sided on W limb, S11/29 0236	(Farside)	

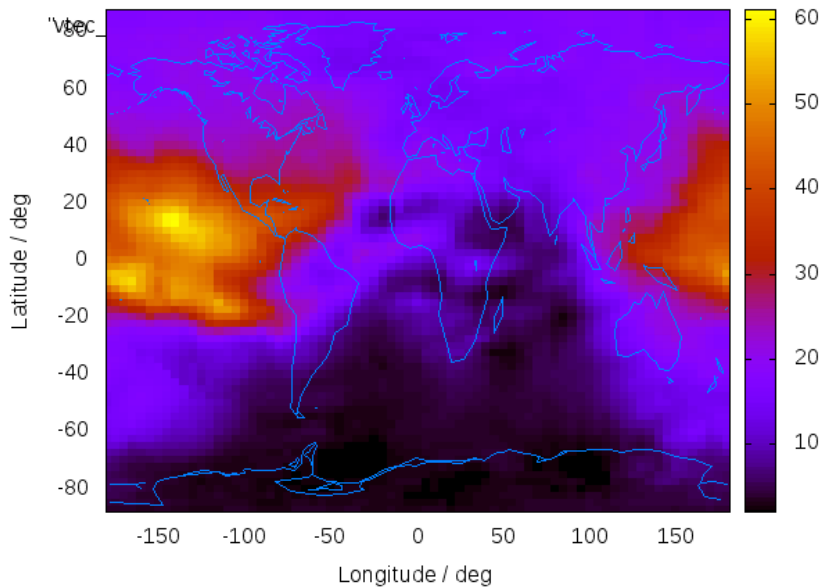


Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): VTEC

MONITOR UQRG

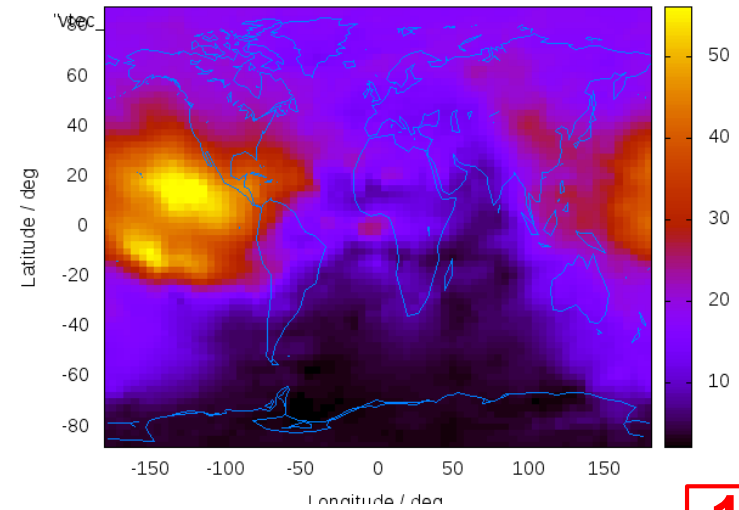
170

VTEC / TECU 20150619_170.00000



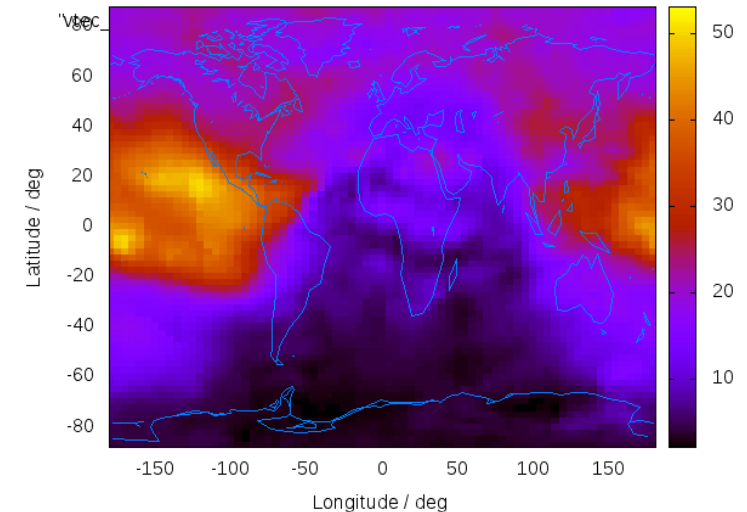
171

VTEC / TECU 20150620_171.00000



172

VTEC / TECU 20150621_172.00000

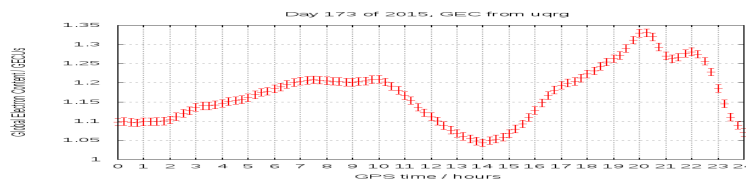
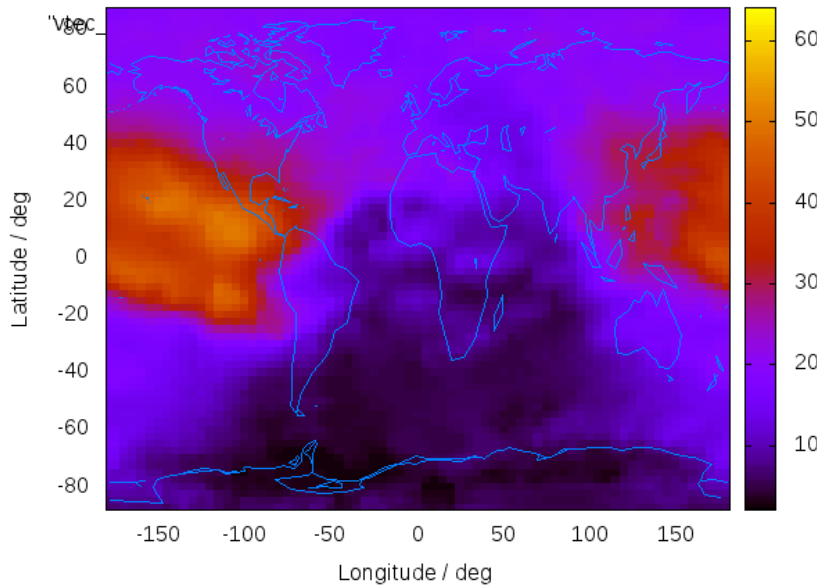


Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): VTEC

MONITOR UQRG

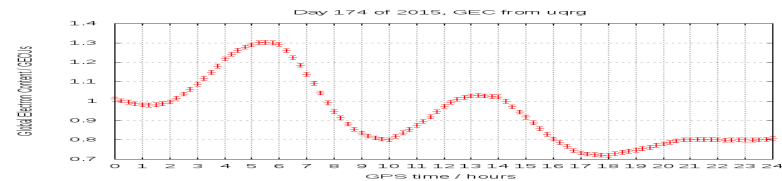
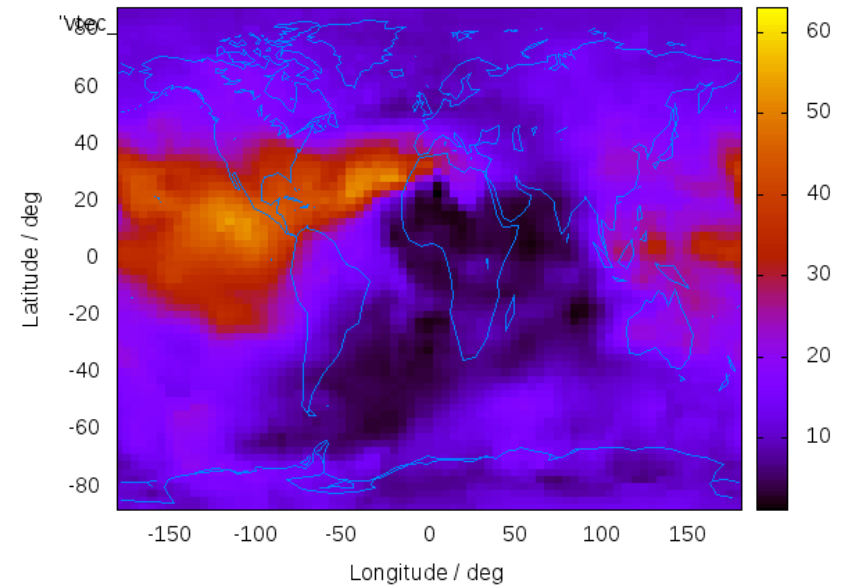
173

VTEC / TECU 20150622_173.00000

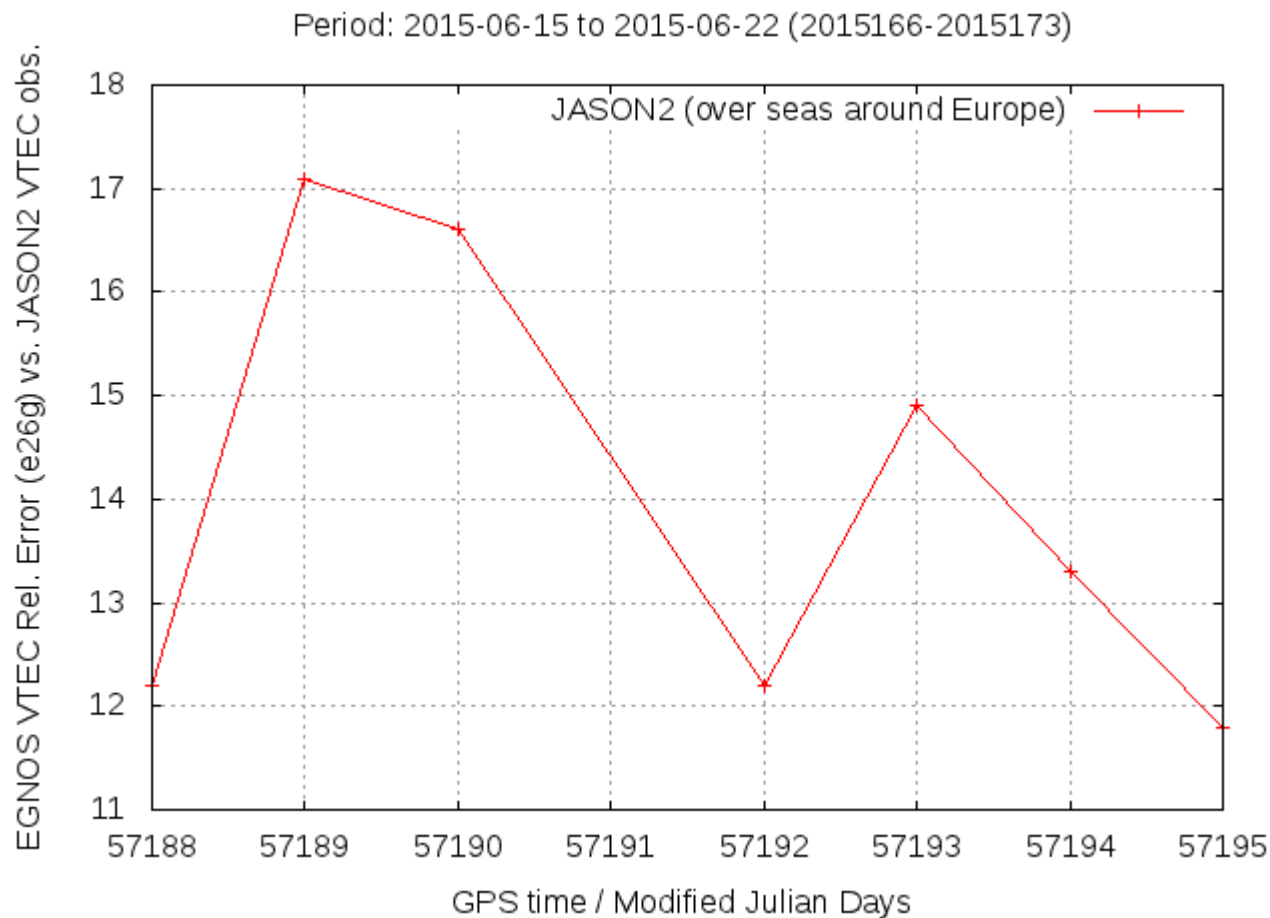


174

VTEC / TECU 20150623_174.00000



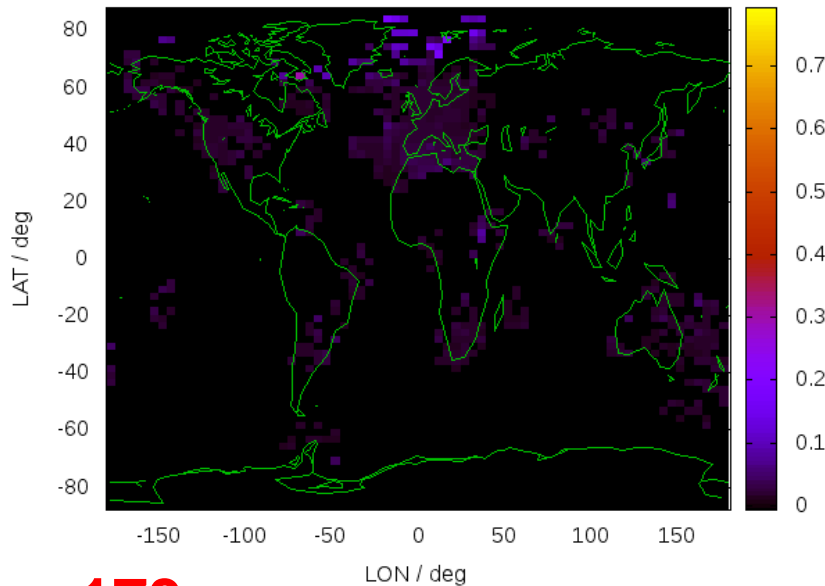
Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): VTEC error vs. Altim.



Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): ROTI evol. @N,C,S

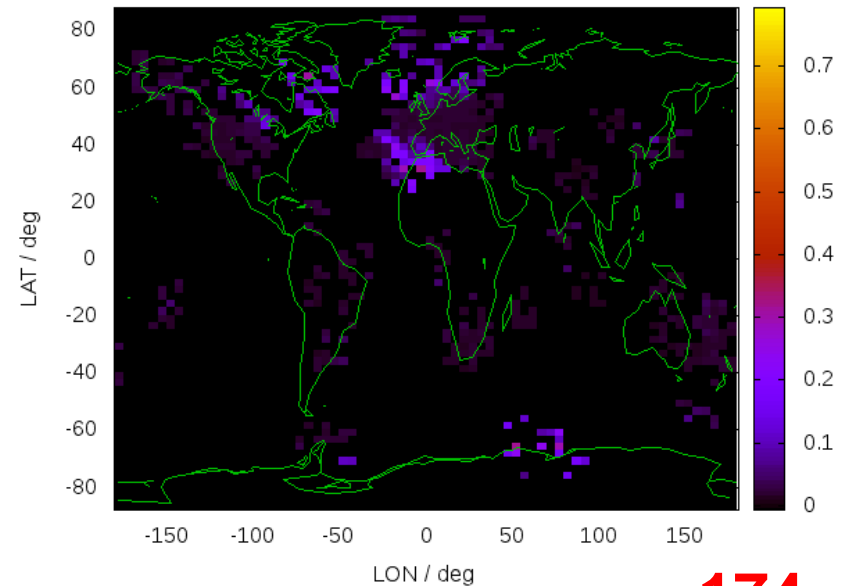
Fixed range

ROTI_from_VTEC_fixed_range / TECU 2015-173_00030-2015-173_00900



173

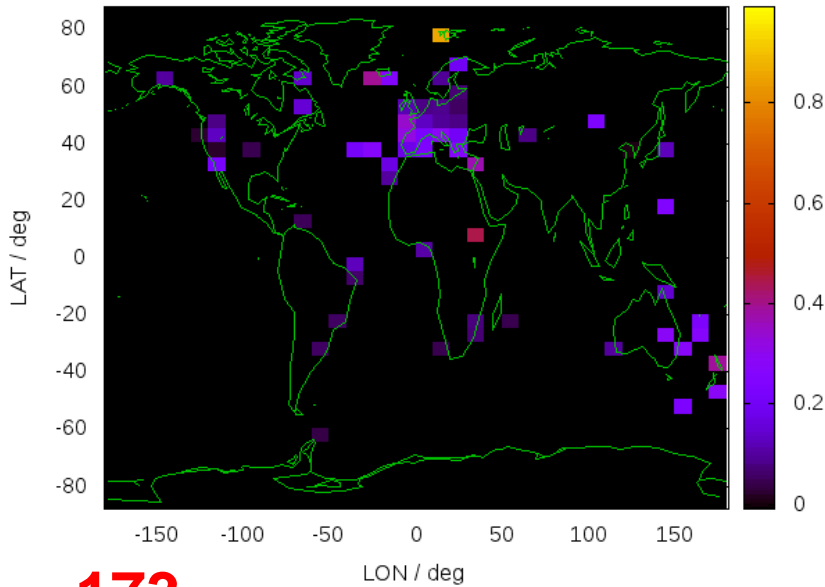
ROTI_from_VTEC_fixed_range / TECU 2015-174_00030-2015-174_00900



174

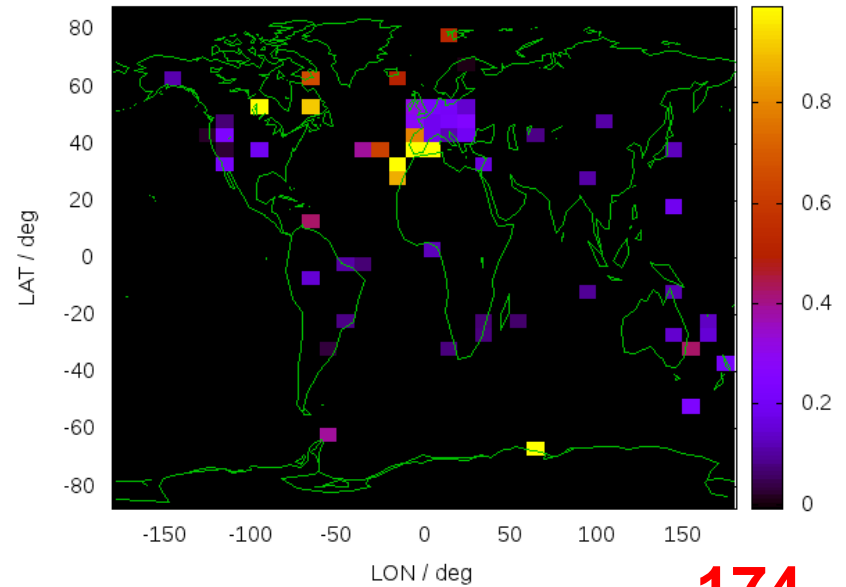
Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): SRMTID

SRMTID_fixed_range / TECU 2015-173_00000-2015-173_00870



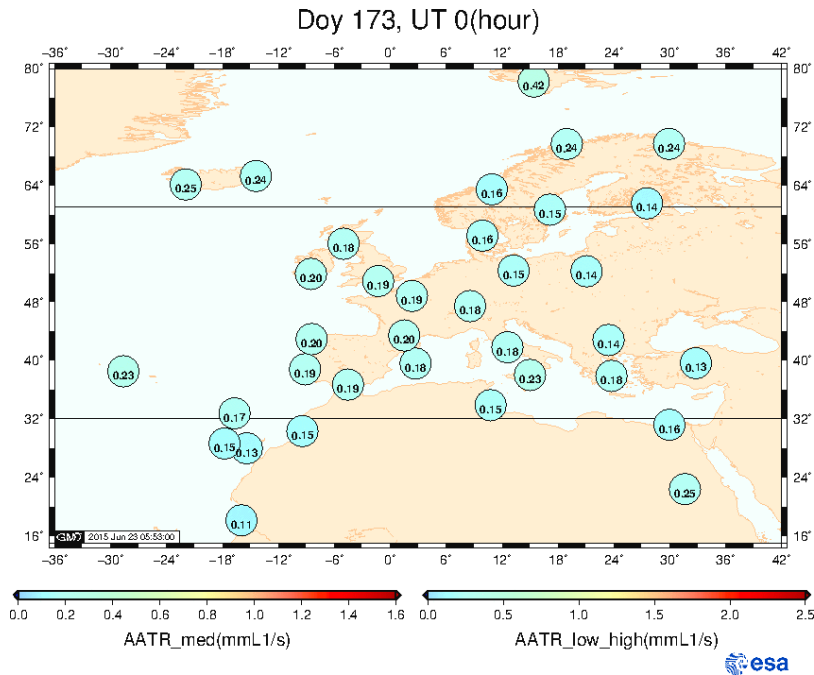
173

SRMTID_fixed_range / TECU 2015-174_00000-2015-174_00870

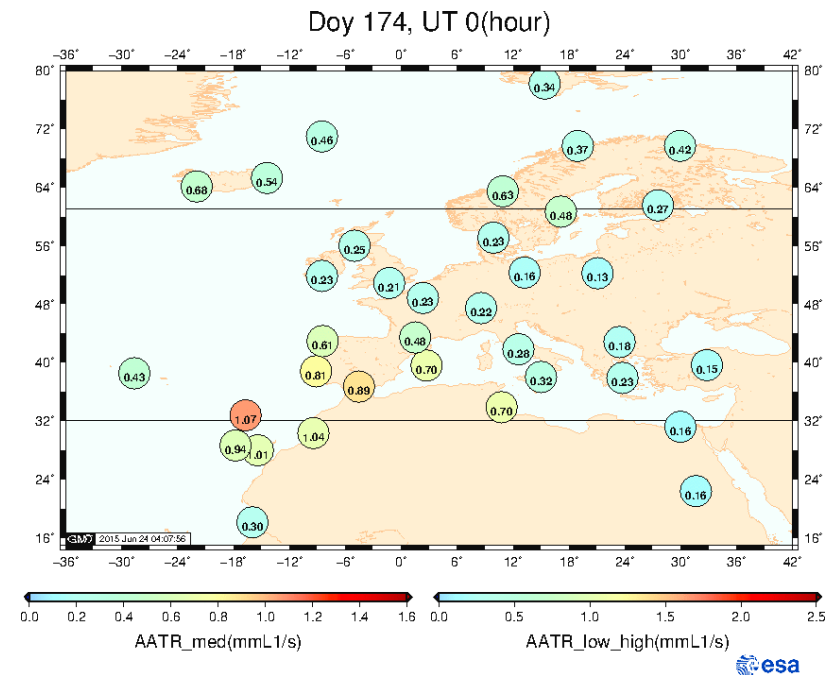


174

Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): AATR



173



174

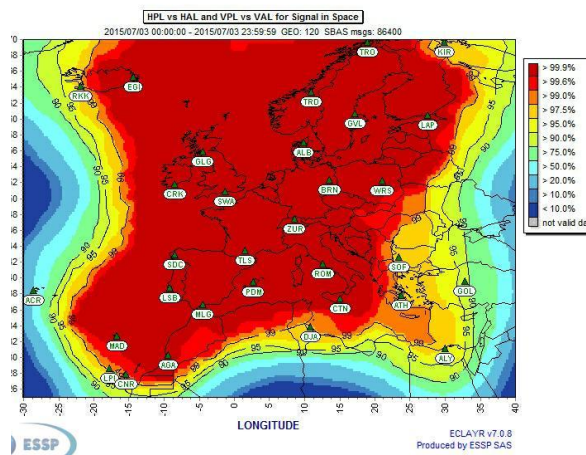
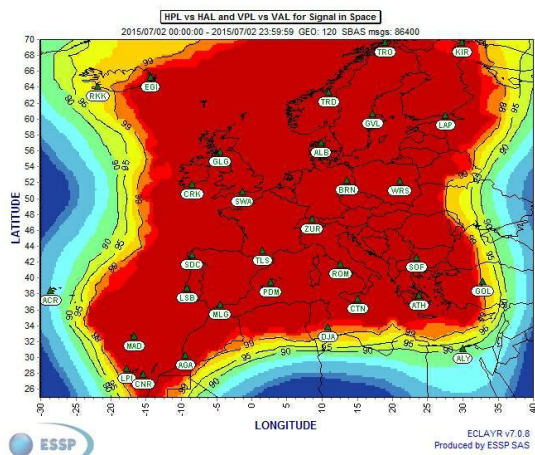
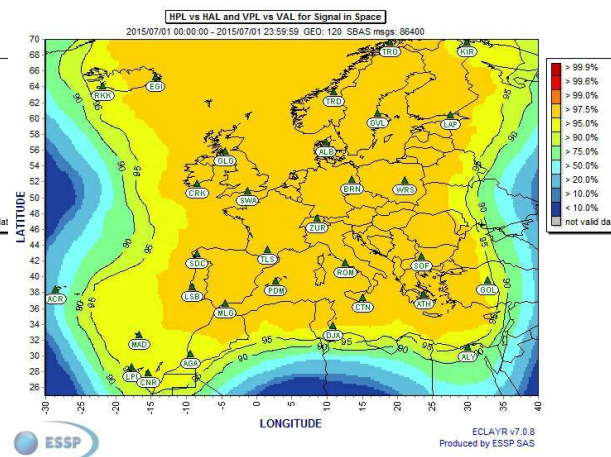
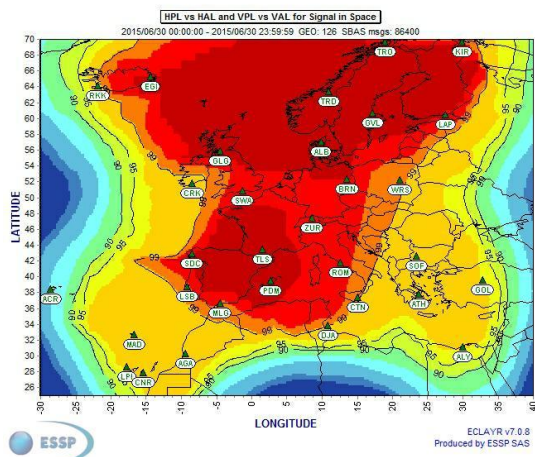
Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): Conclusions

- Geomagnetic high activity probably unleashed by a SEP event reported by NOAA.
- Solar flare activity + SEP event on day 172 (increased particle flux reaching the Earth).
- GSFLAD/SISTED show solar flares the days prior to the SEP event.
- Clear dropdown with oscillations in GEC trend coinciding with Kp high values.
- SRMTID/ROTI/AATR increased activity is clearly visible both at high latitudes and low European latitudes coinciding with decrease of EGNOS Availability.



Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): Availability maps

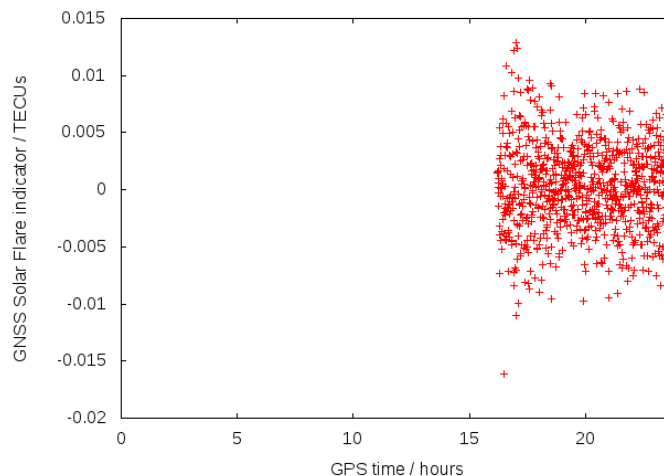
(from https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=apv1_availability)



Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): GSFLAI, SISTED

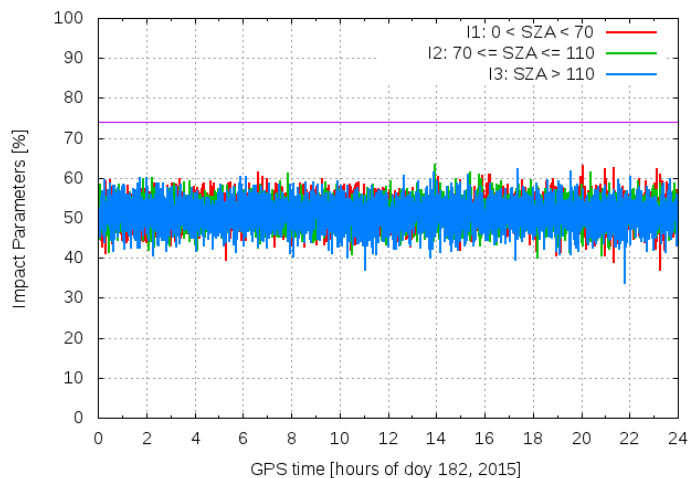
183

Day 184 of 2015

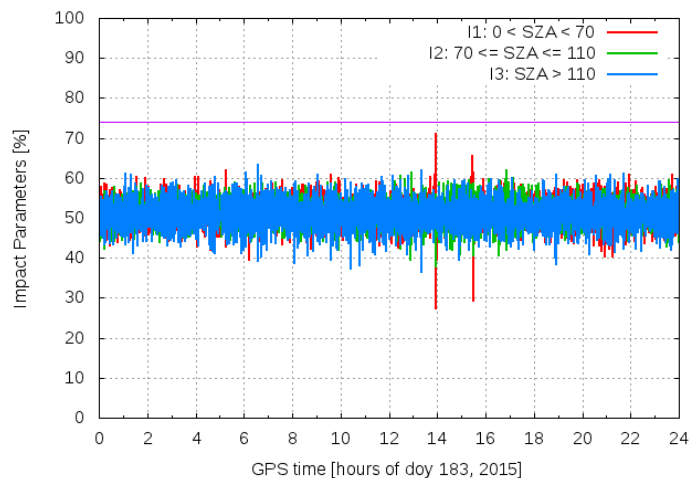


182

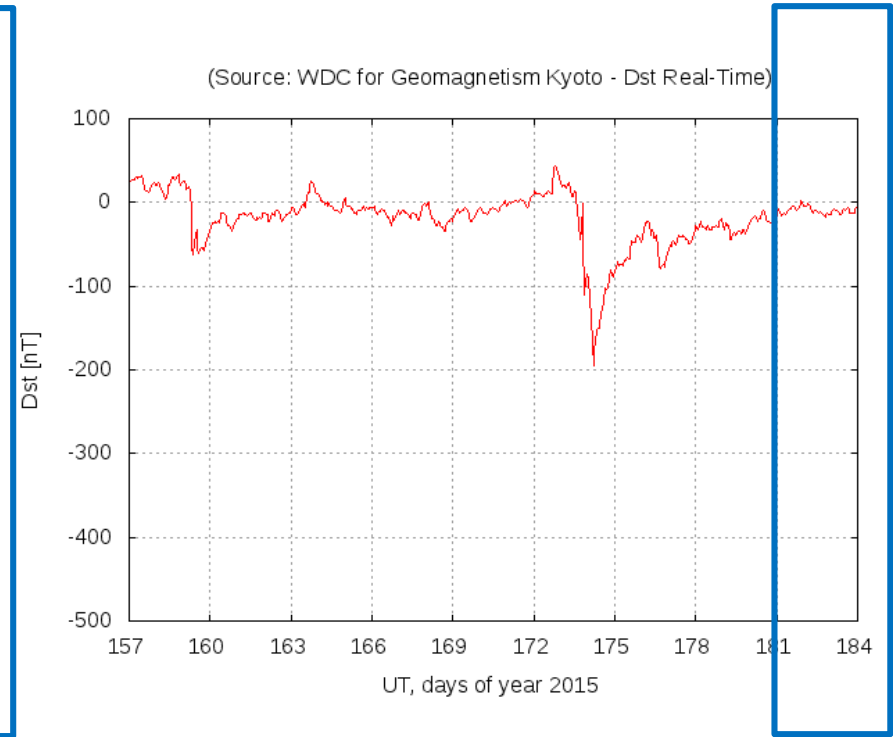
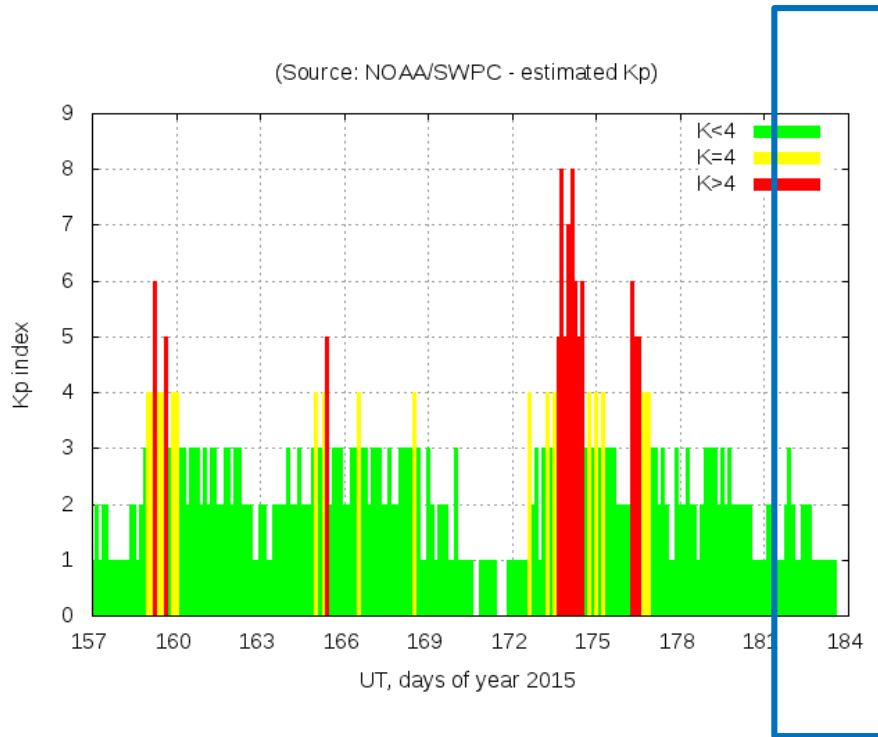
Impact Parameters. SISTED pp mode. 182, 2015.



Impact Parameters. SISTED pp mode. 183, 2015.

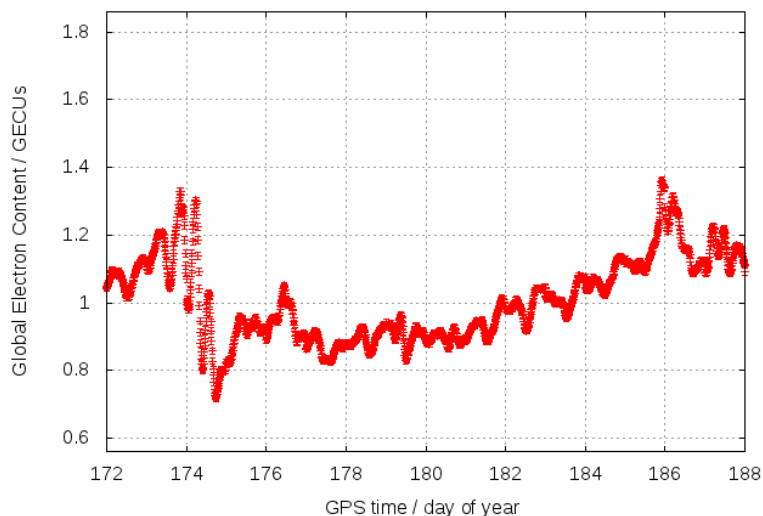


Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): Kp, Dst & GEC

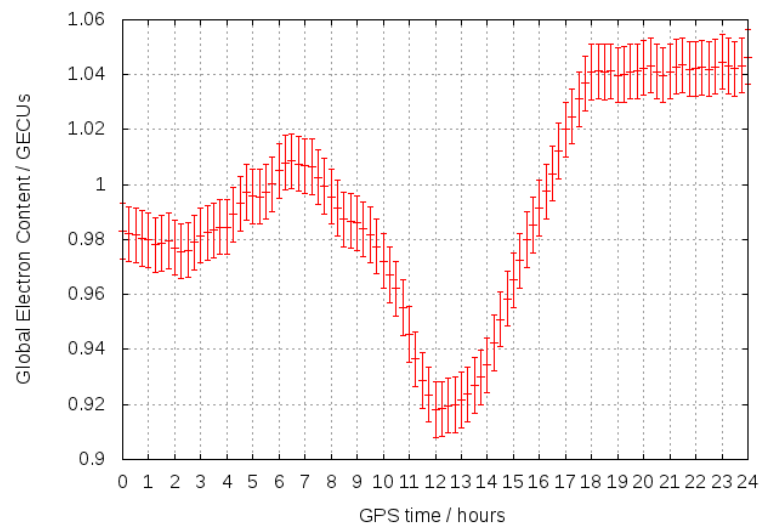


Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): Kp, Dst & GEC

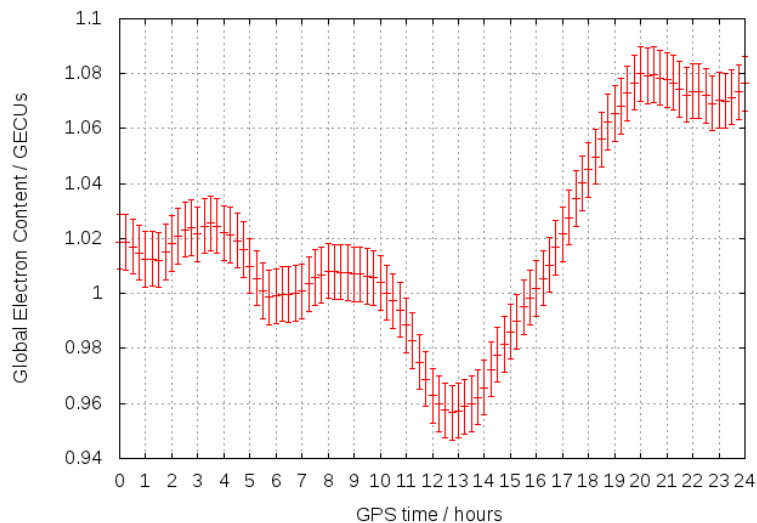
2015, GEC from UQRG



Day 182 of 2015, GEC from uqrg

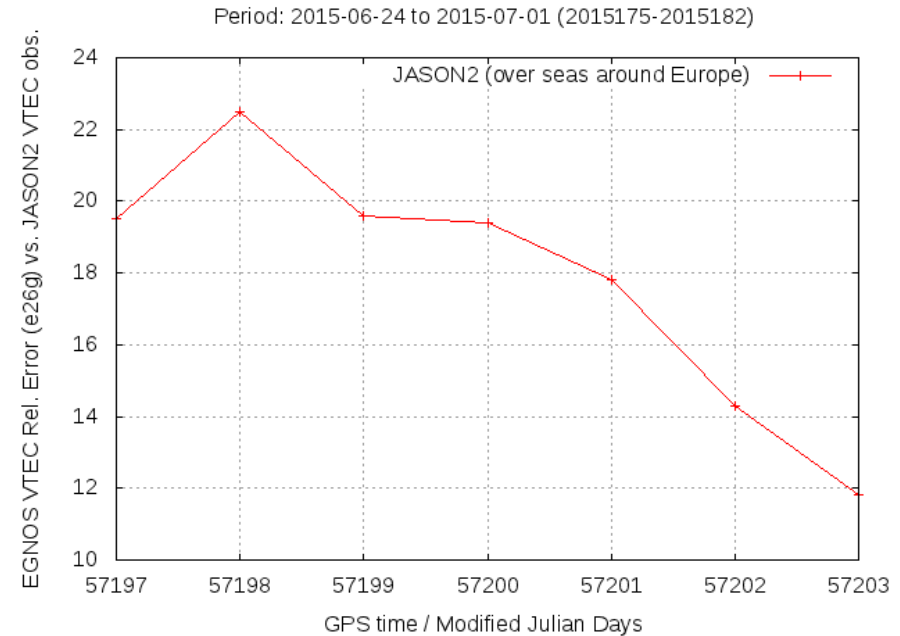
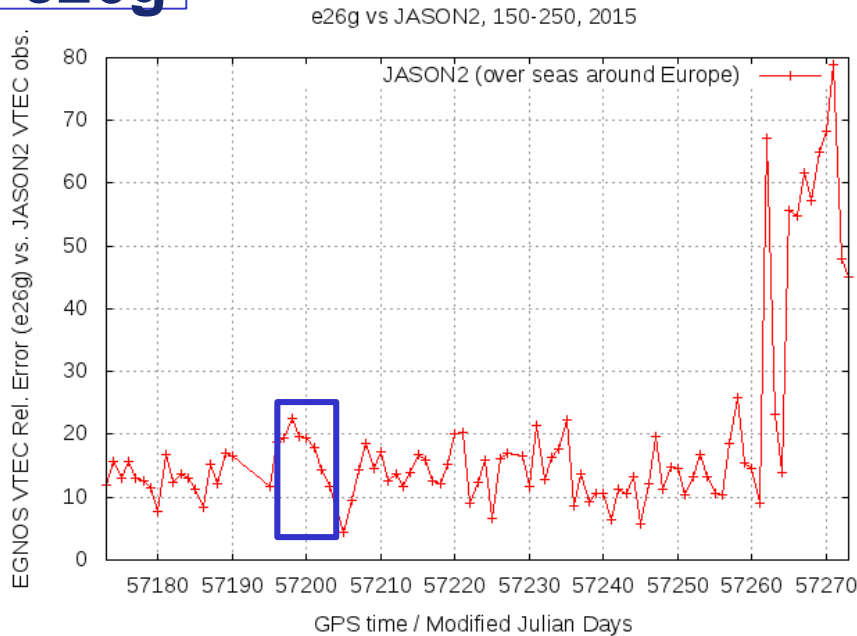


Day 183 of 2015, GEC from uqrg



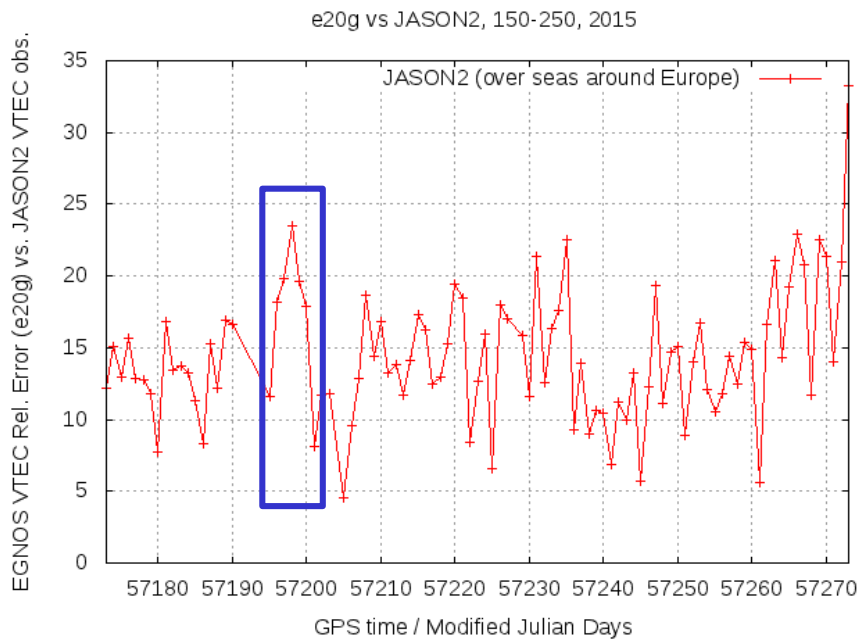
Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): VTEC error vs. Altim.

e26g

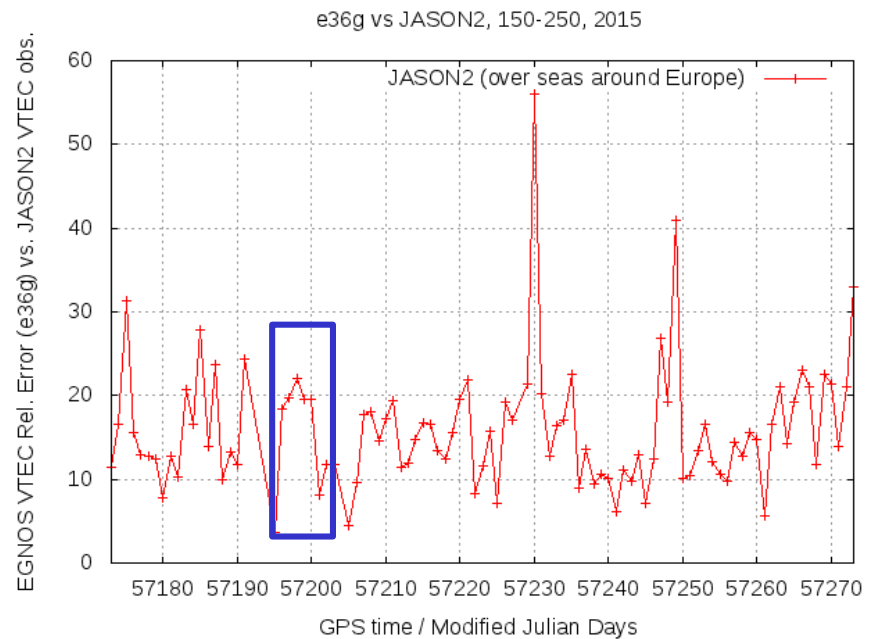


Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): VTEC error vs. Altim.

e20g



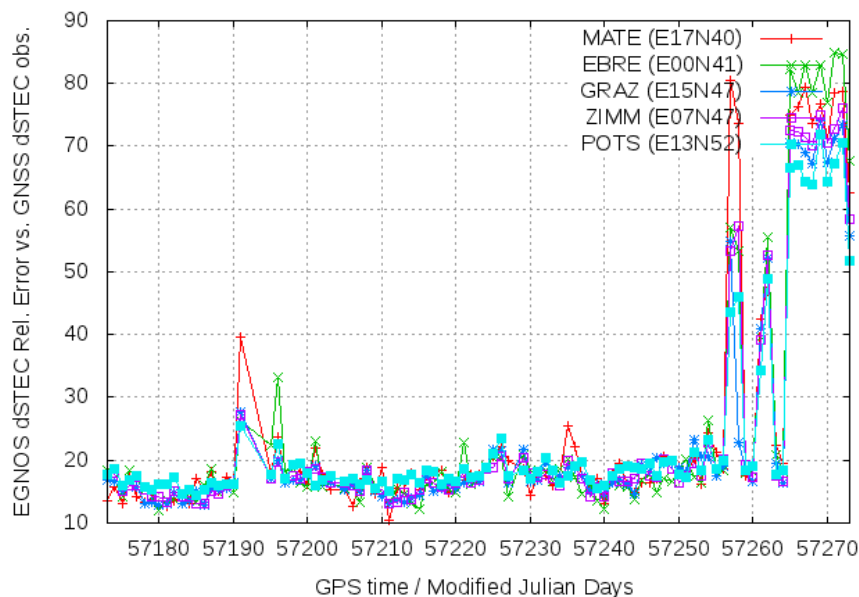
e36g



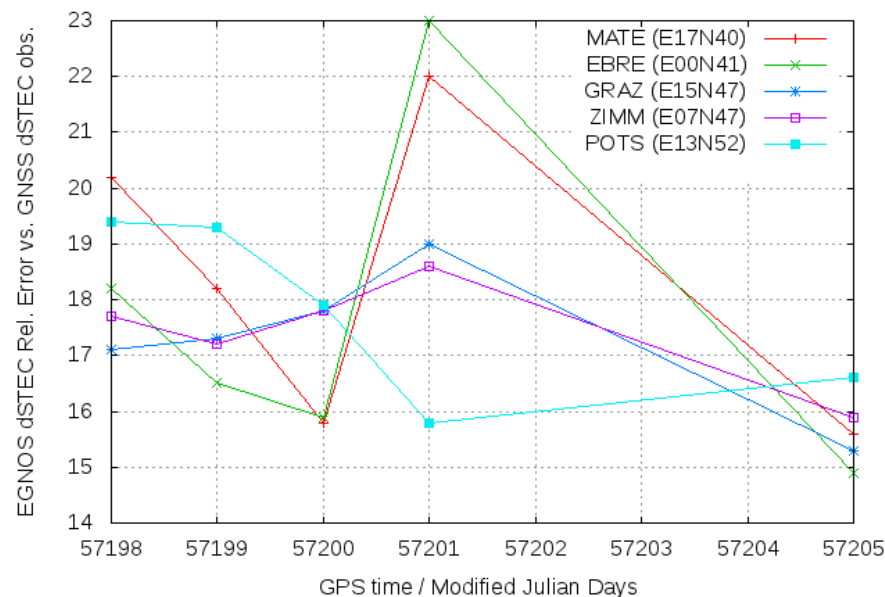
Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): IEWAS (dVTEC error vs. GPS)

e26g

e26g dSTEC vs GNSS dSTEC, 150-250, 2015



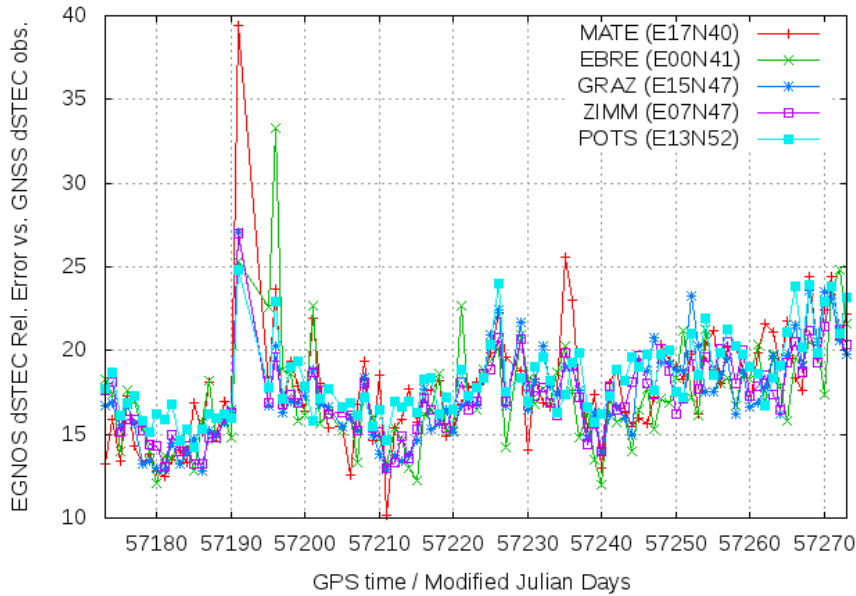
Period: 2015-06-25 to 2015-07-02 (2015176-2015183)



Period #4, 22/06/2015, 20:14:59 (doy 173), to 23/06/2015, 20:29:59 (doy 174): IEWAS (dVTEC error vs. GPS)

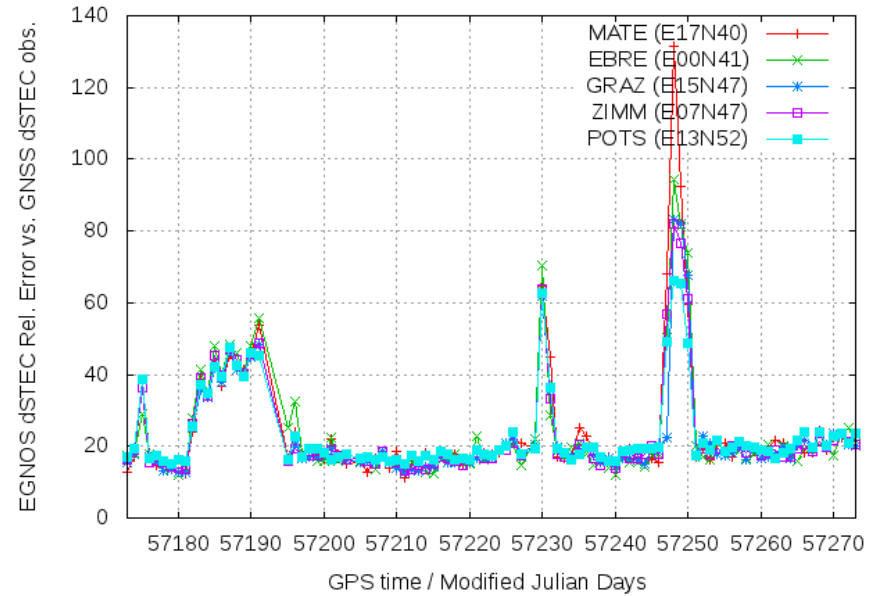
e20g

e20g dSTEC vs GNSS dSTEC, 150-250, 2015

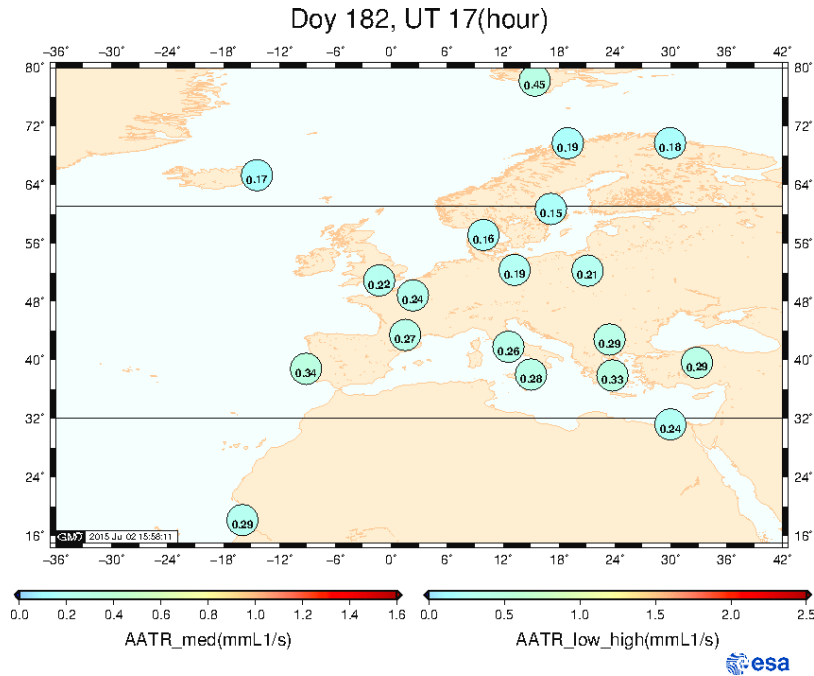


e36g

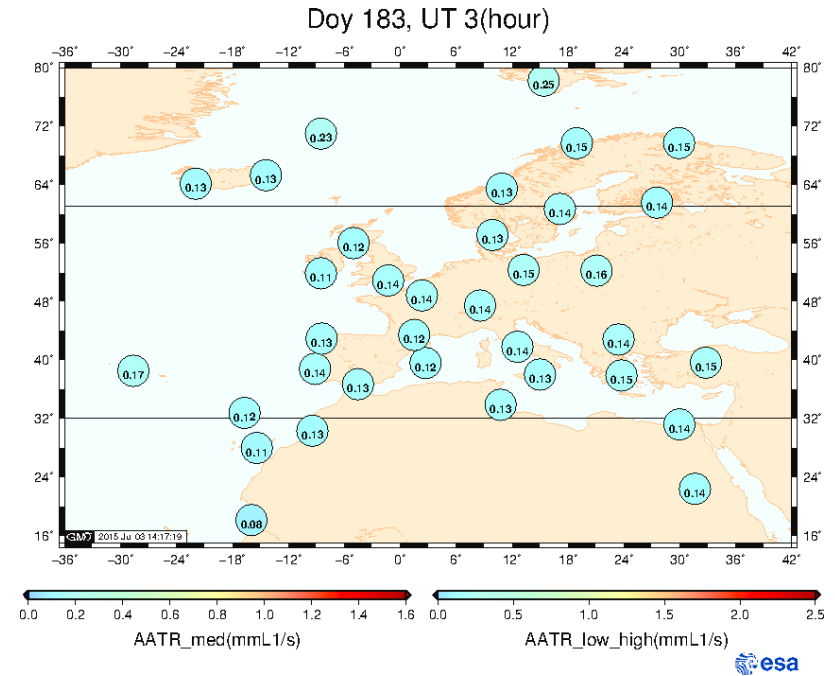
e36g dSTEC vs GNSS dSTEC, 150-250, 2015



Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): AATR



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Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): Conclusions

- **Non-significant ionospheric information has been obtained from the considered available MONITOR2 products for this period.**



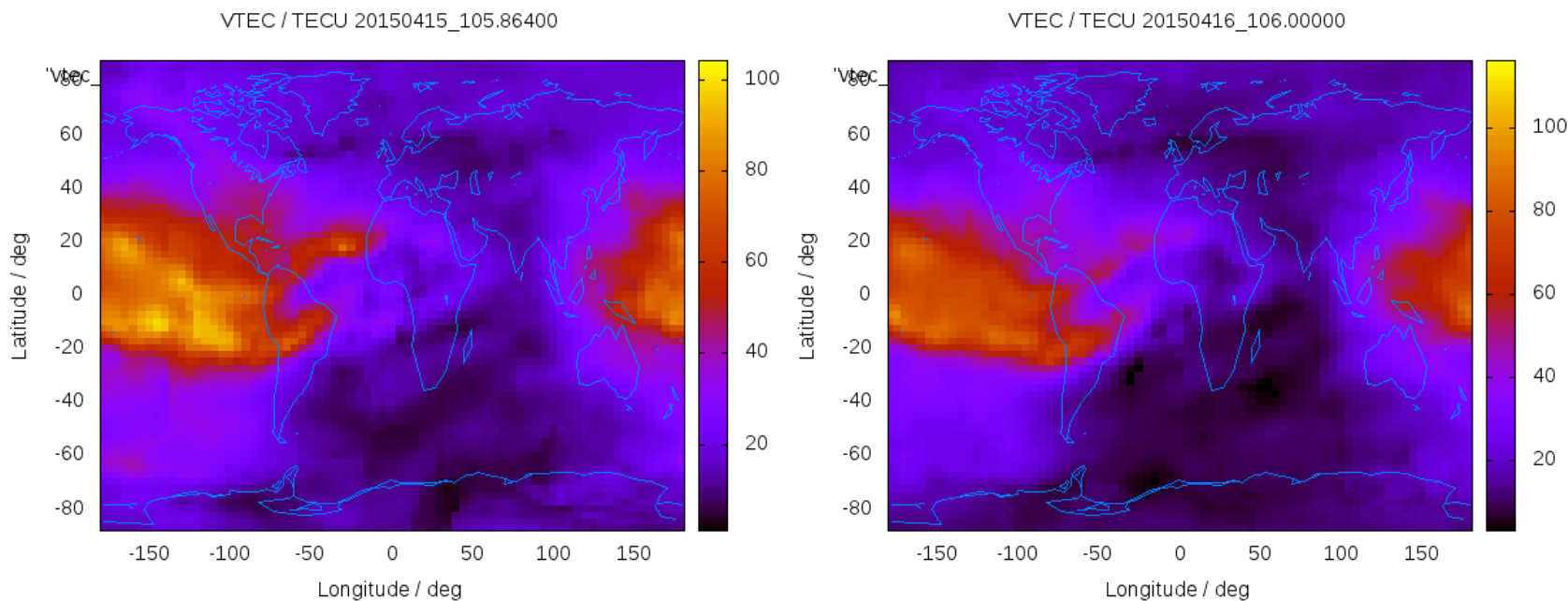
General Conclusion & additional comments

- It has been analyzed with several relevant MONITOR2 products most of the EGNOS performance events reported since March 2015, and we have identified the ones happening in coincidence with space weather events affecting the ionosphere.
- Possibility to modify the GEC window to show not only daily variations but also another larger window to see relevant changes wrt the general trend.
- Reprocessing campaign partially completed for 2015.
- Minor update on AutoREPORT scripts:
 - Polar ROTI, GEC, F10.7 and SSN shall not be seen for 1-day latency AutoREPORT.
 - Update for IEWAS section on 7-day latency AutoREPORT.

BACKUP SLIDES

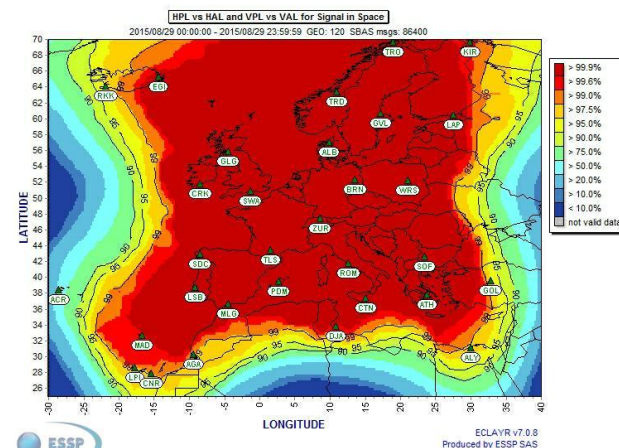
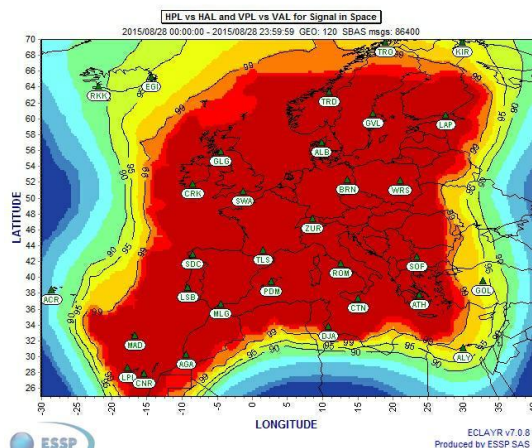
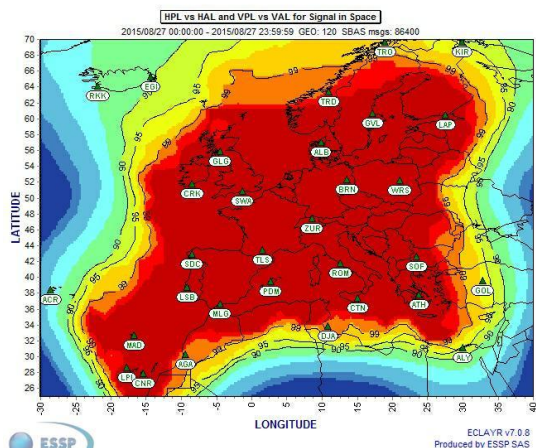


Period #3, 15/04/2015, 20:29:59 (doy 105), to 16/04/2015, 21:44:59 (doy 106): VTEC snapshots

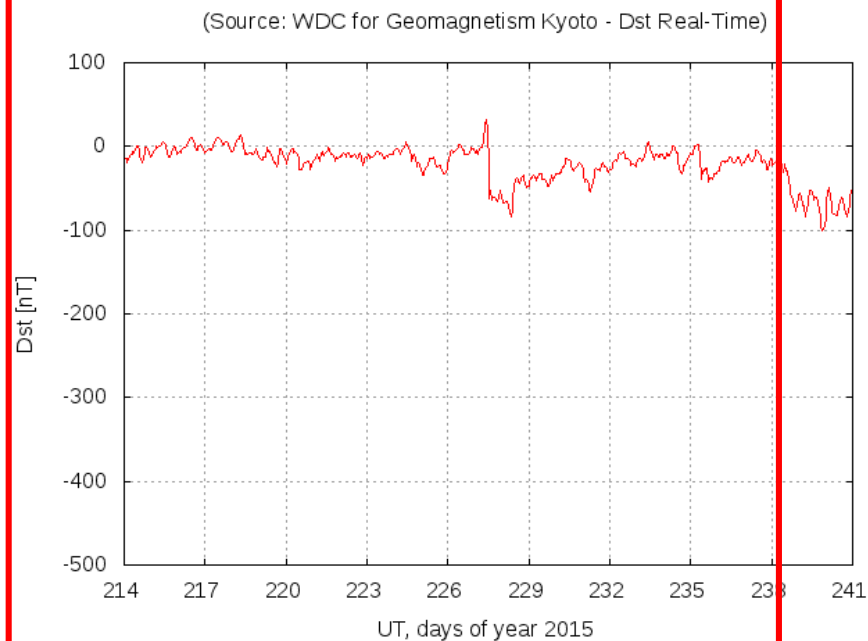
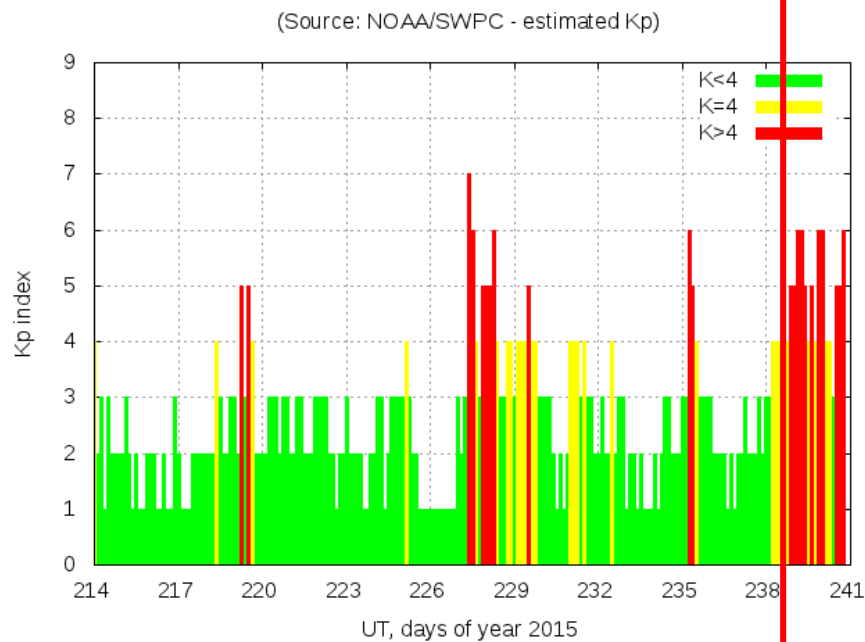


Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): Availability maps

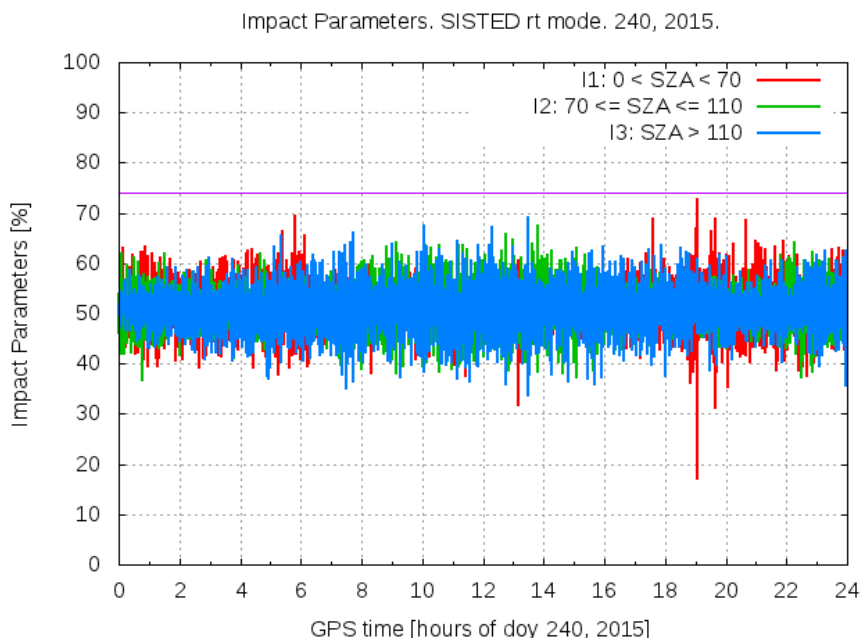
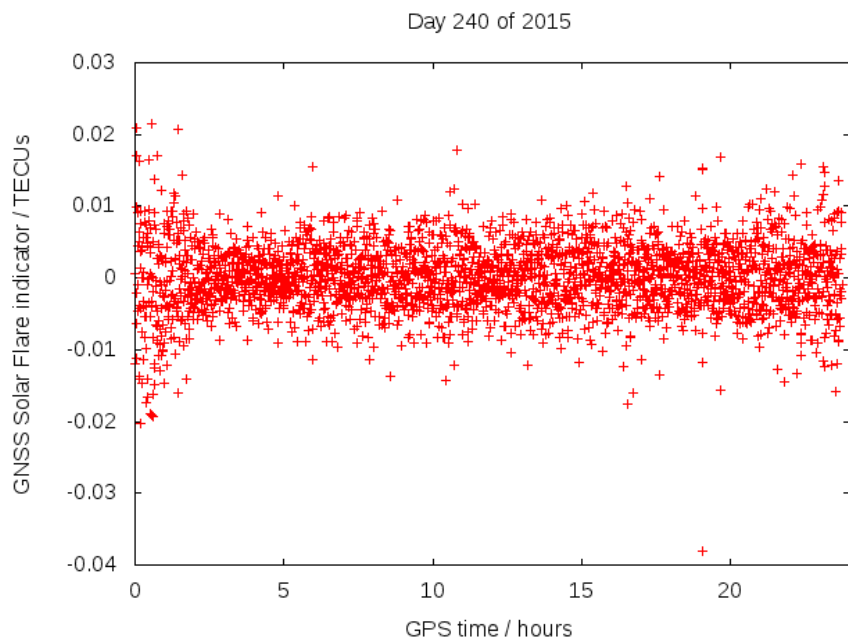
(from https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=apv1_availability)



Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): Kp, Dst & GEC



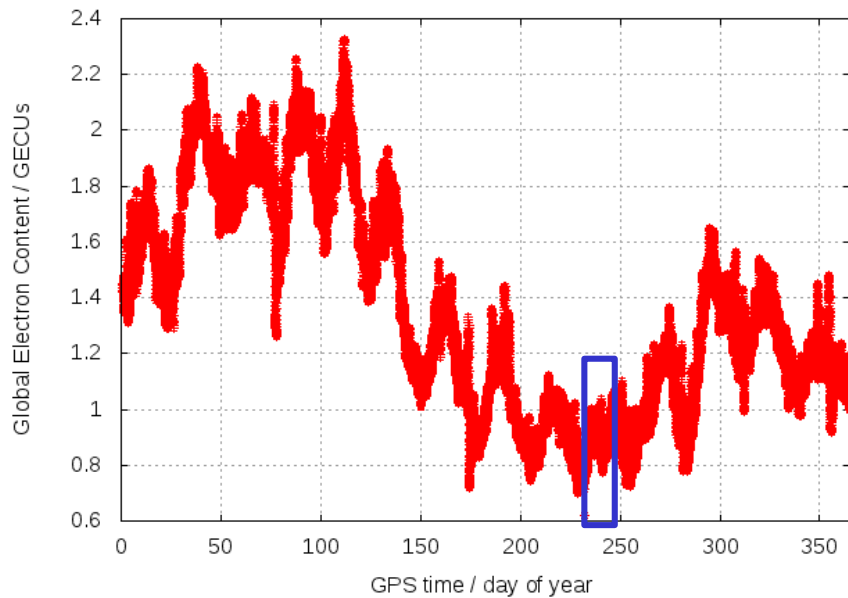
Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): GSFLAI, SISTED



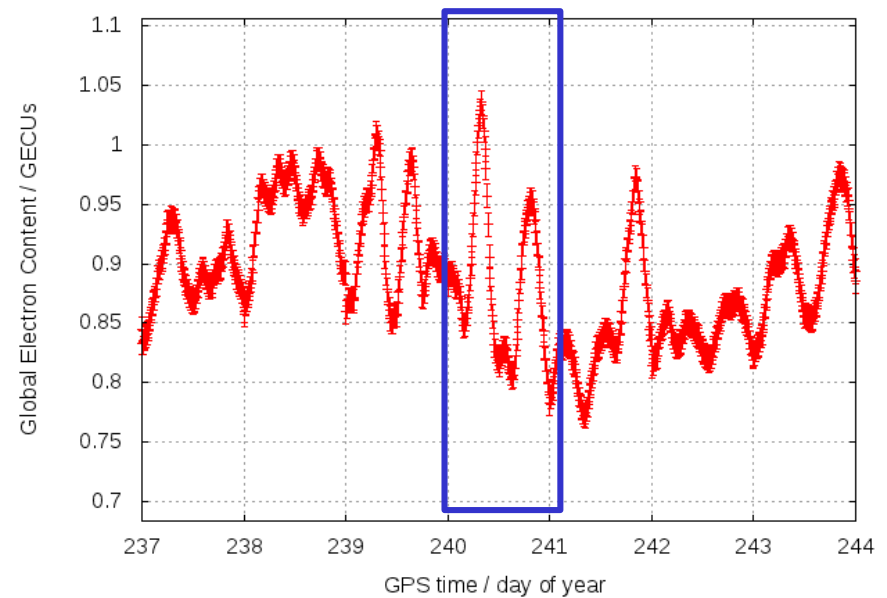
High activity on solar flares in the previous days, specially on doy 236 (change graphics...)

Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): GEC

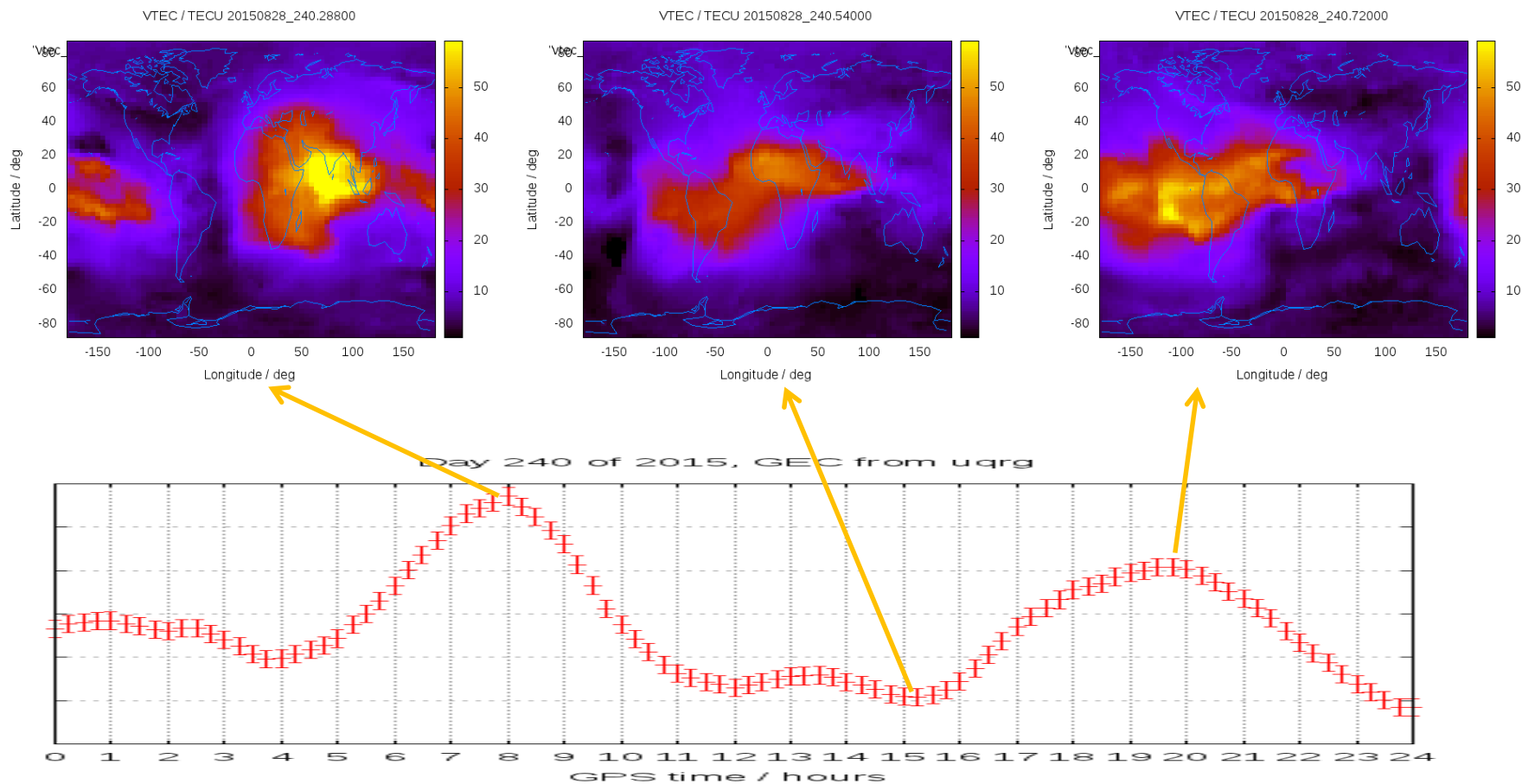
2015, GEC from UQRG



2015, GEC from UQRG

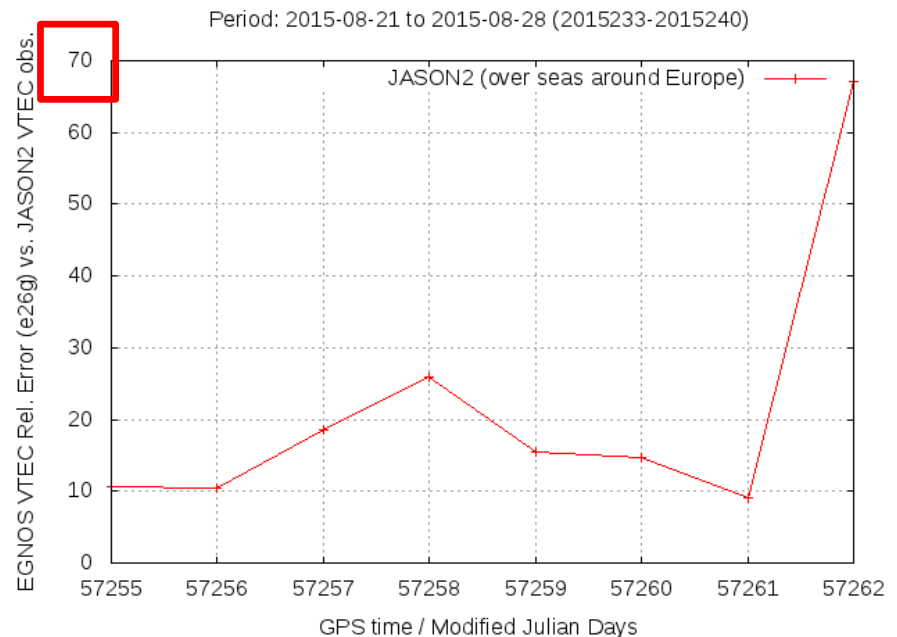
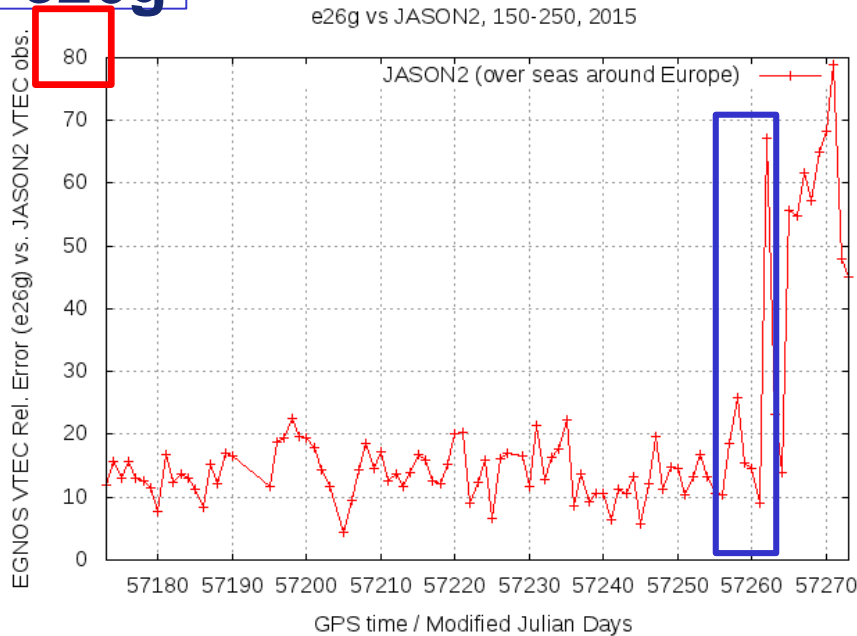


Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): VTEC snapshots



Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): VTEC error vs. Altim.

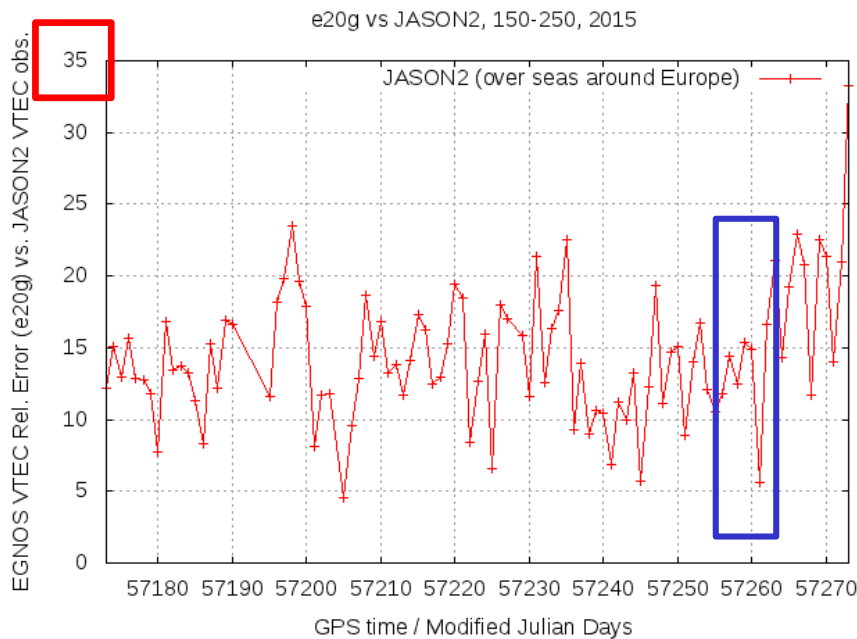
e26g



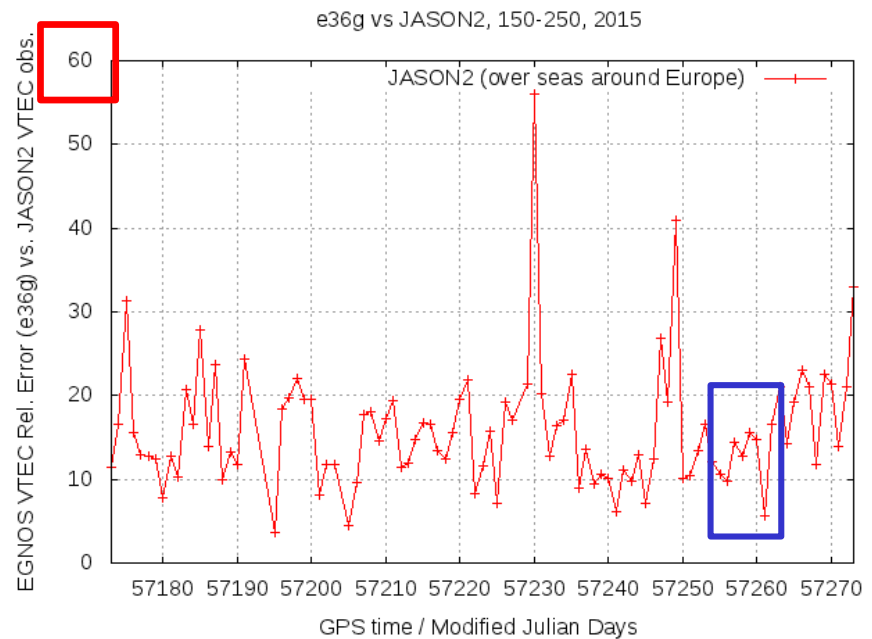
Significant increase but coinciding with e26g problems

Period #5, 01/07/2015, 01:14:59 (doy 182), to 02/07/2015, 01:29:59 (doy 183): VTEC error vs. Altim.

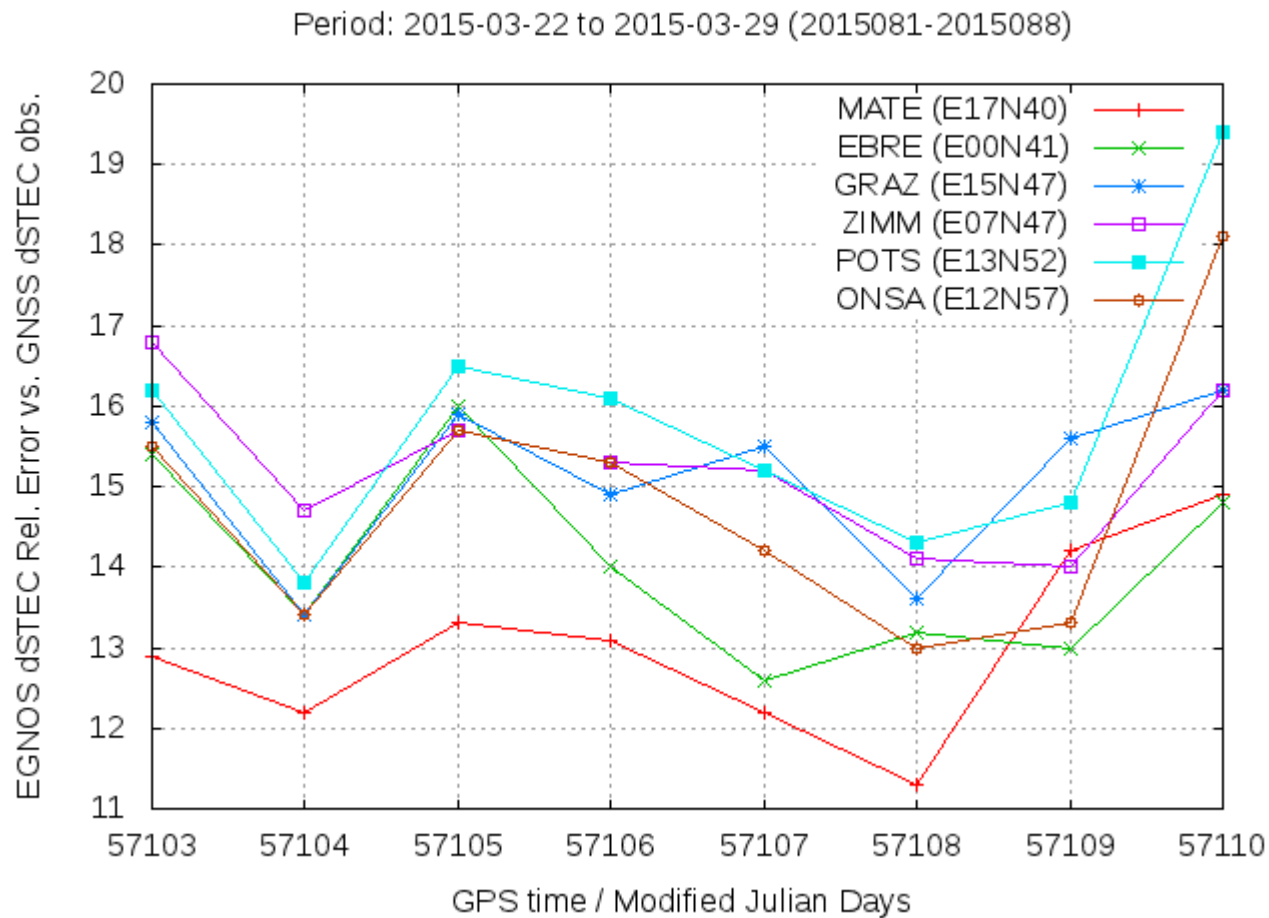
e20g



e36g

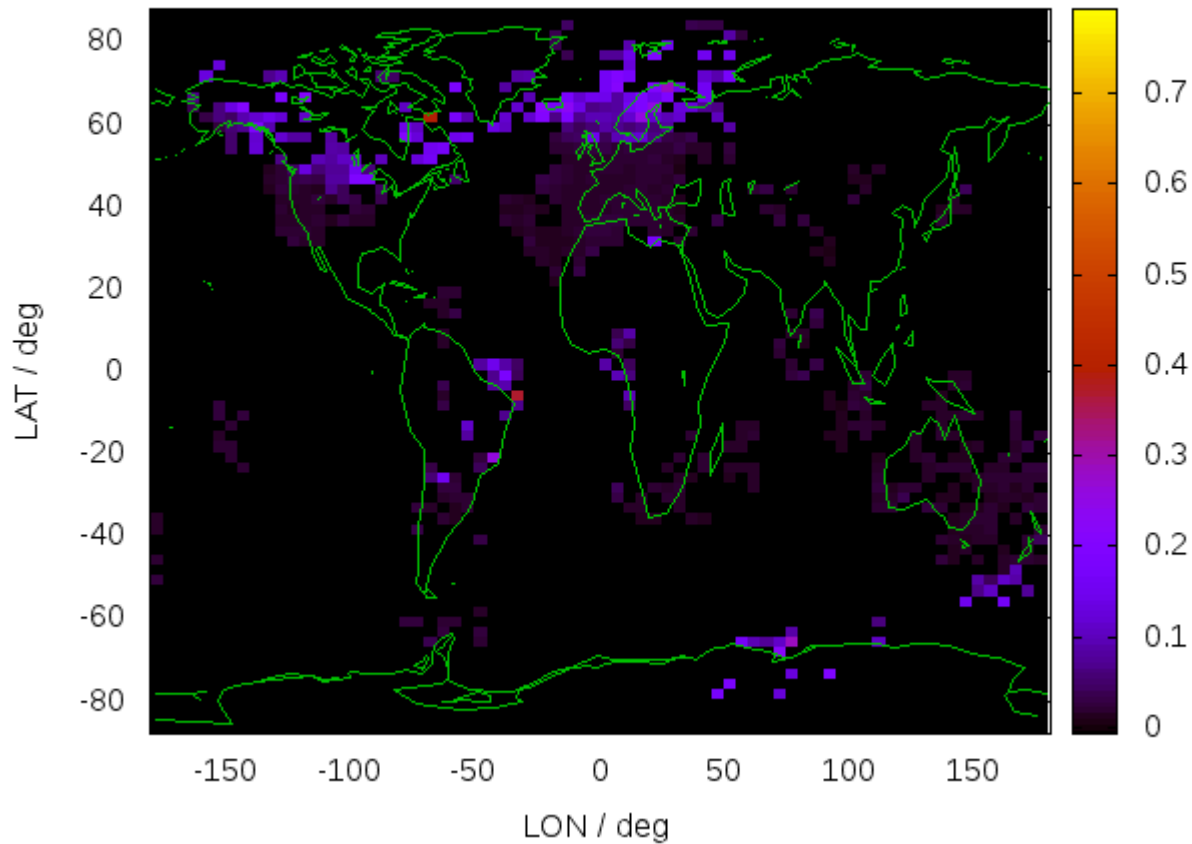


Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): IEWAS (dVTEC error vs. GPS)



Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): ROTI evol. @N,C,S

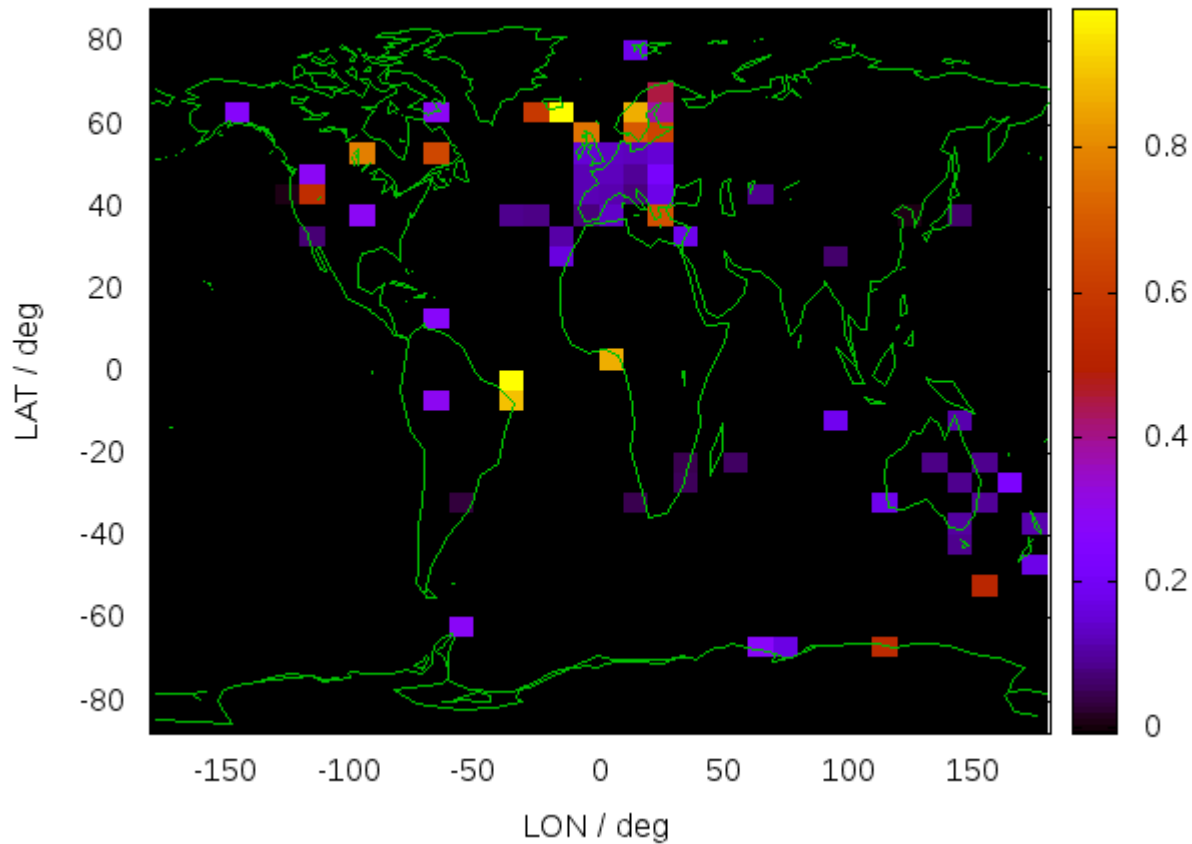
ROTI_from_VTEC_fixed_range / TECU 2015-240_00030-2015-240_00900



**Fixed
range**

Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): SRMTID

SRMTID_fixed_range / TECU 2015-240_00000-2015-240_00870



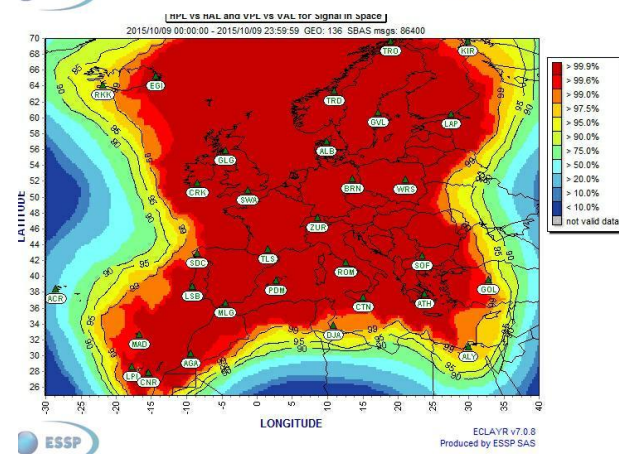
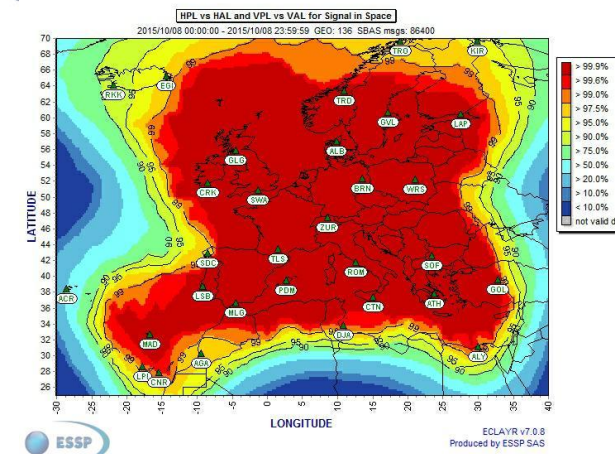
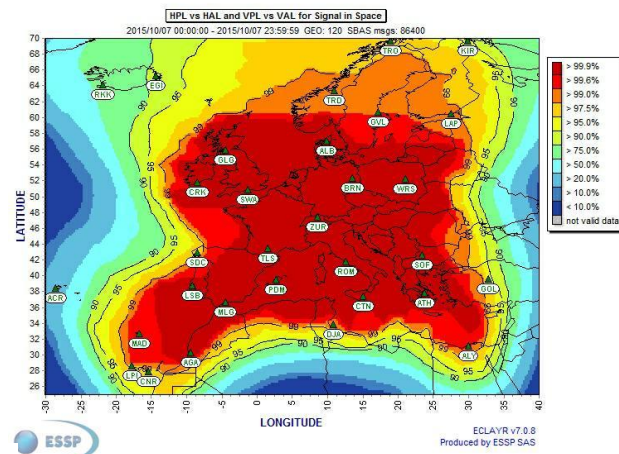
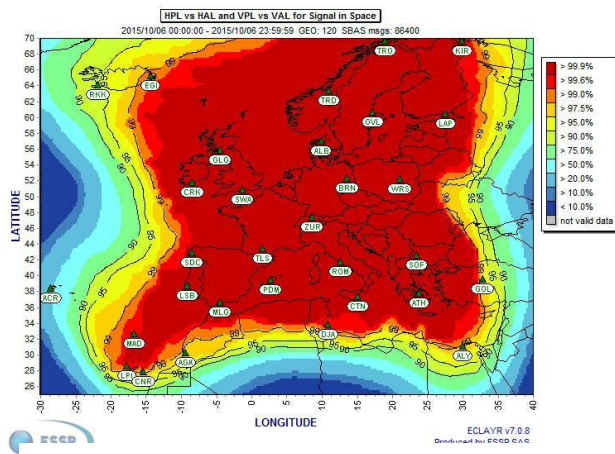
Period #6, 28/08/2015, 05:44:59 (doy 240), to 28/08/2015, 23:59:59 (doy 240): Conclusions

- **GEC shows an atypical behavior though not relevant for Europe.**
- **EGNOS increased error when considering JASON2 and dSTEC tests (not relevant enough looking at time series).**
- **ROTI and SRMTID have an impact at high latitudes, where the drop of availability is given.**



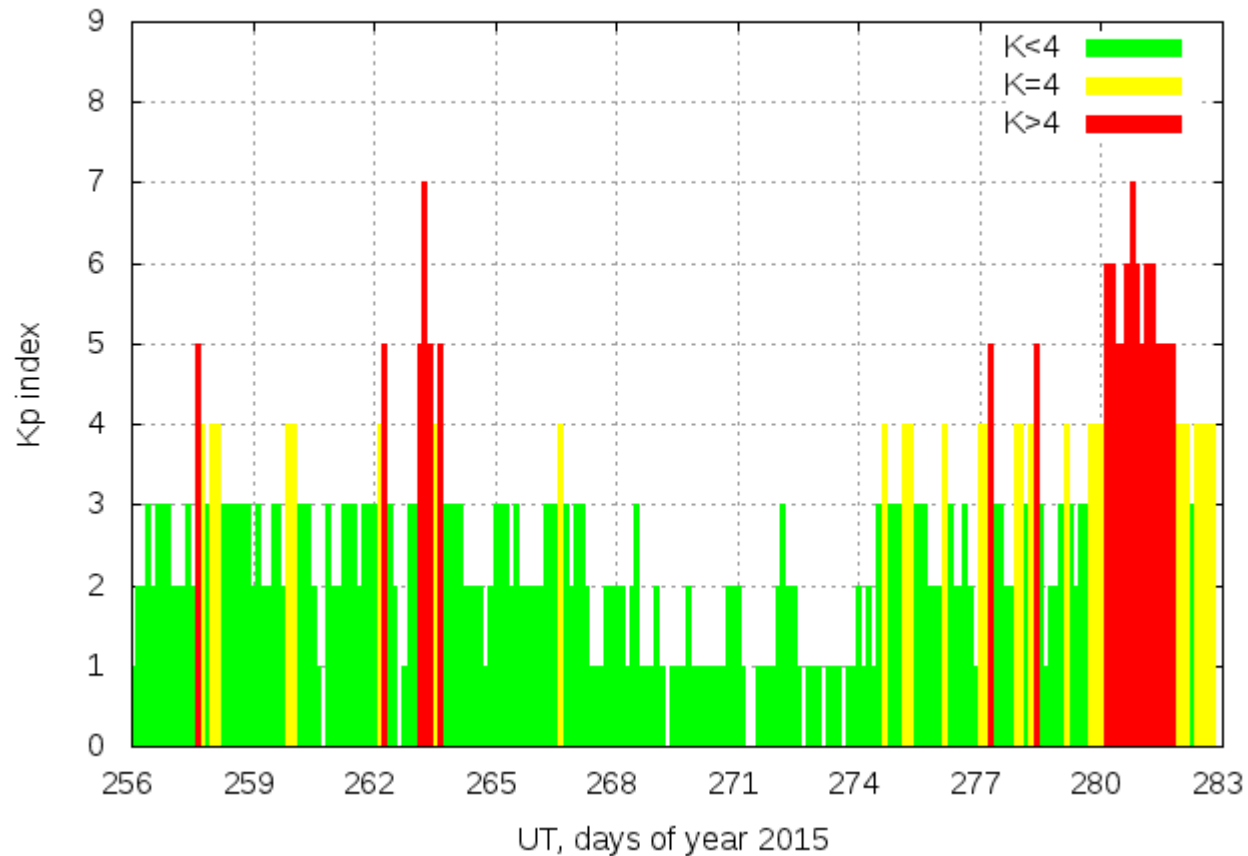
Period #7, 07/10/2015, 19:14:59 (doy 280), to 08/10/2015, 18:59:59 (doy 281): Availability maps

(from https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=apv1_availability)

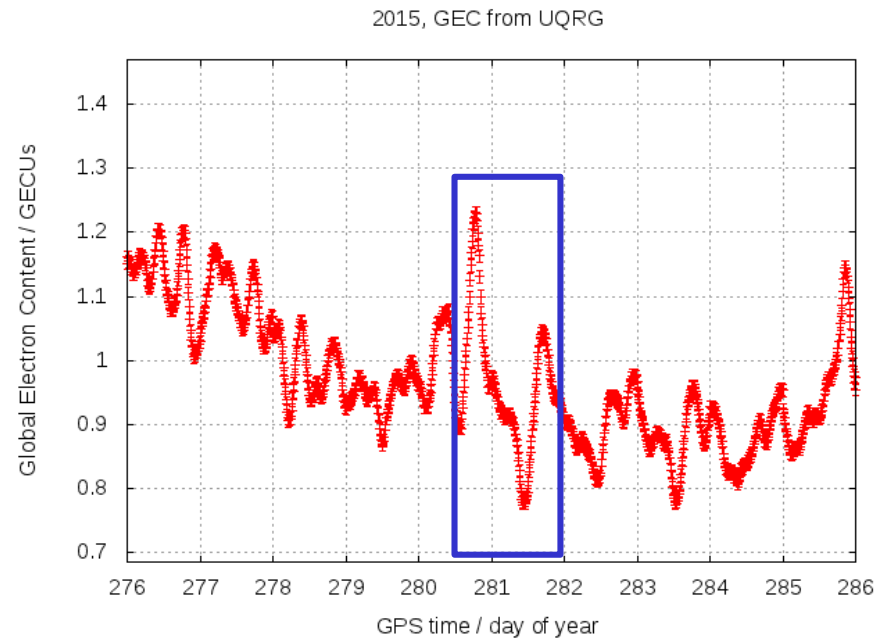
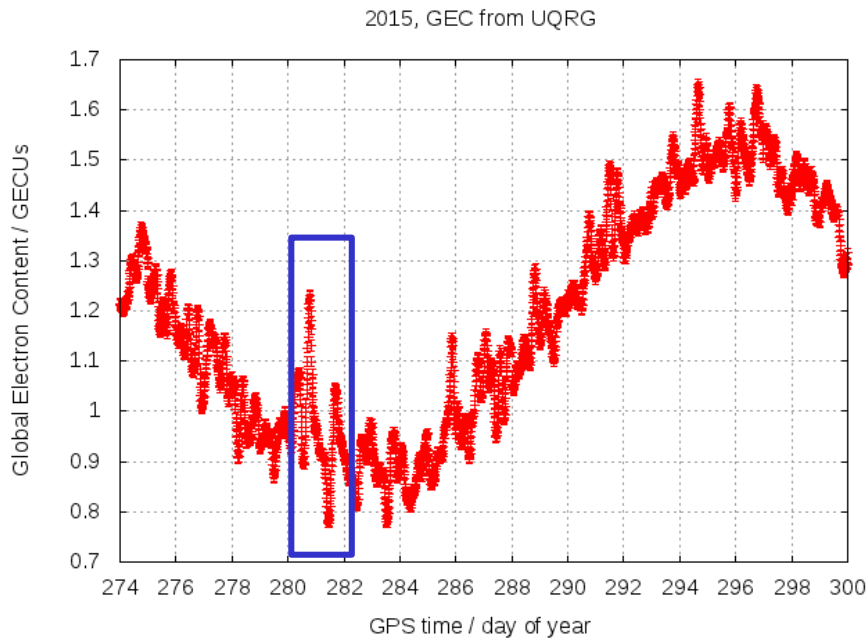


Period #7, 07/10/2015, 19:14:59 (doy 280), to 08/10/2015, 18:59:59 (doy 281): Kp

(Source: NOAA/SWPC - estimated Kp)



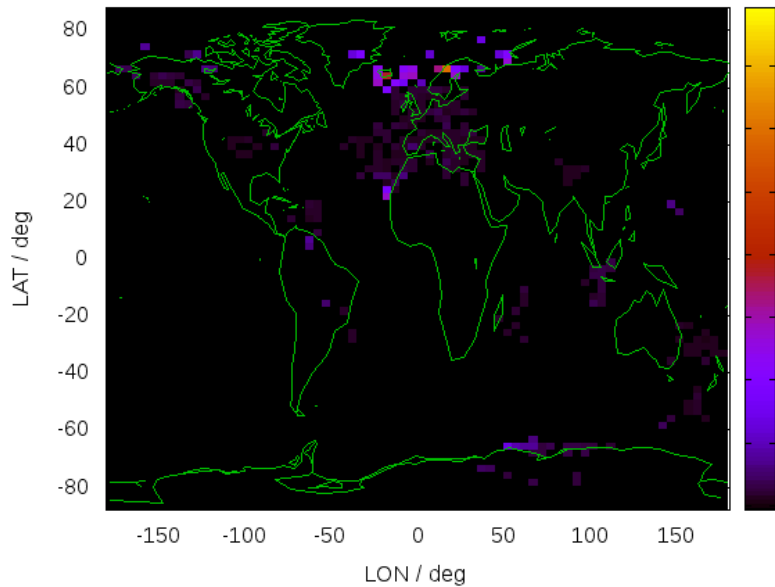
Period #7, 07/10/2015, 19:14:59 (doy 280), to 08/10/2015, 18:59:59 (doy 281): GEC



Impact on GEC wrt general trend can be clearly seen

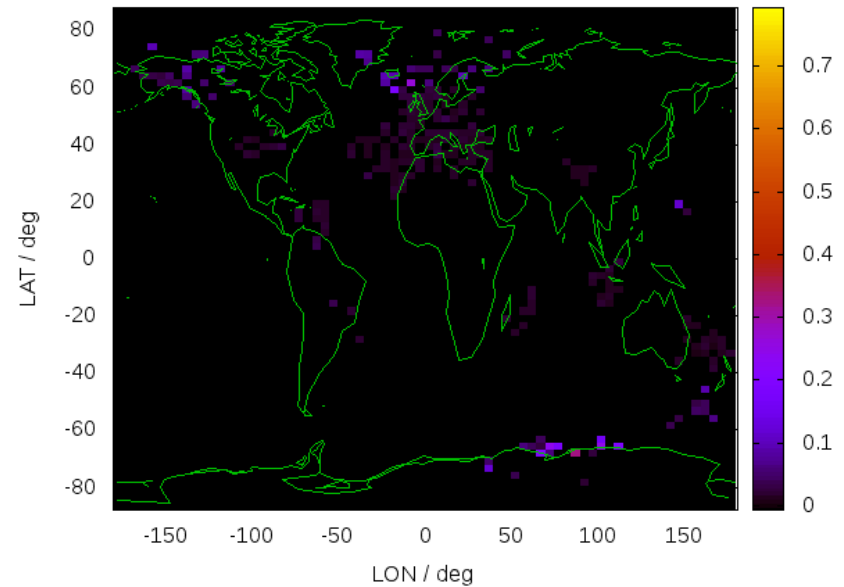
Period #7, 07/10/2015, 19:14:59 (doy 280), to 08/10/2015, 18:59:59 (doy 281): ROTI

ROTI_from_VTEC_fixed_range / TECU 2015-280_00780-2015-280_00870



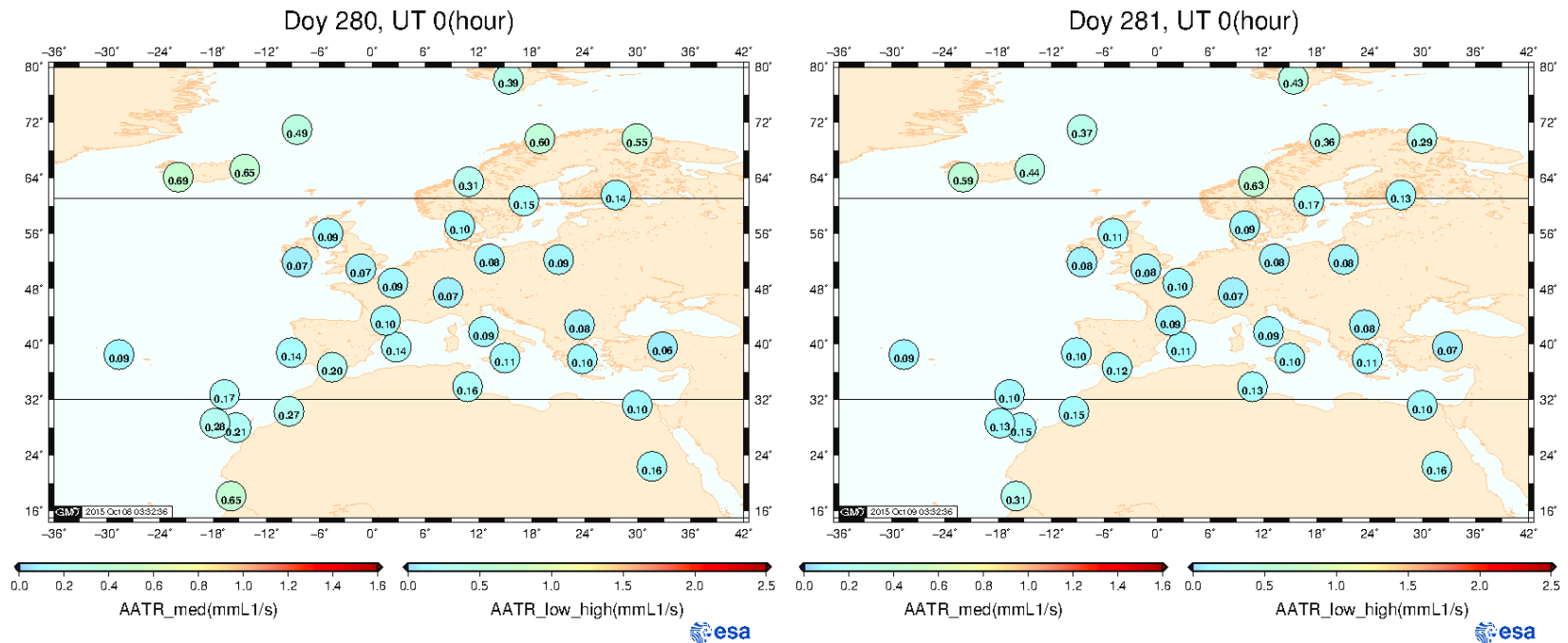
280

ROTI_from_VTEC_fixed_range / TECU 2015-281_00540-2015-281_00720



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Period #7, 07/10/2015, 19:14:59 (doy 280), to 08/10/2015, 18:59:59 (doy 281): AATR



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