

Tropospheric GRAS Data



C. Marquardt, A. von Engeln, Y. Andres, Y. Yoon, L. Butenko, A. Foresi, J.-M. Martinez



Outline

- Data gaps
- Deep occultations
- Eumetsat processing

Bis

- Upcoming
- Summary



Data Gaps



Bis

Low L2 SNR





To put that into perspective:

- 7% loss due to failed L2 tracking is excellent performance compared to other RO sensors...
- ...we are just a 95% organization, so we worry about stuff like this.

Data gaps are the major problem:

- CL > 35 km: 33% of all rising (16% total)
- RS: Majority of profiles

Common theme for all three issues:

- Loss-of-lock thresholds are overly conservative
- RUAG suggested to modify parameters in lossof-lock diagnostics, might improve the situation
- Made an attempt on 26th/27th October 2011



Parameter Update in October 2011 - Results

Low L2 SNRs:

- number of affected profiles dropped from 7% to less than 1%
- considered solved

CL gaps > -35km SLTA:

- number of affected rising profiles about halved
- more parameter tuning required

RS gaps / C/A code tracking:

- worked out for setting occultations; in particular, long continuous tracking periods throughout
- probably solved for setting occultations...

But:

- change in loss-of-lock thresholds and integration times for C/A code tracking caused increase in false acquisitions in rising occultations
- Number of available rising occultations with dual frequency data dropped by half



Next Steps

- Another attempt to improve parameter settings during Metop-B commissioning
- This time, we'll iterate over parameter settings for fine tuning; campaign over ~ 2 weeks during Metop-B commissioning, with daily parameter updates. If improvements can be demonstrated, both Metop-A and B will be updated. Magnus Bonnedal has more on this in his talk tomorrow.
- We'll also assess the option of raising RS measurements for rising occultations; another 2 week campaign during Metop-B commissioning
 - For checking ionospheric extrapolation algorithms implemented at EUM and DMI/SAF, and investigate Culverwell/Healy (talk later today) benefits in practice
- During these periods, Metop-B data will be affected; will announce test periods in our user emails



Deep Occultations (and Cross-PRN Tracking)

- Other GPS SVs visible in the antenna beam appear in the spectrum...
- ... as CA code orthogonality is not perfect (25 – 30 dB only)
- observed doppler offsets are consistent with actual GPS ephemeris



I/Q Spectrogram (Navbits demodulated)



Amplitude and Signal Attenuation



EUMETSAT

Amplitude (cont'd)



- Amplitude alone is not a reliable indicator for deep occultation signals
- Deep signals exhibit amplitudes which are in the order of (or even lower than) cross-PRN tracking events.
- We'll need to find ways to separate atmospheric from cross-PRN signals...
- ...and receivers need to be sensitive enough to catch those weak signals.



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Attenuation & Penetration Statistics



Penetration into the Troposphere (SLTA)





- By and large, observed attenuation and SLTA statistics agree with simulations (Axel's talk yesterday), but we need to understand some spatial aspects
- Attenuation and penetration results from GRAS are now considered in EPS-SG RO requirements.



Processing at EUMETSAT

- Legacy processing in operations
 - GO only, no raw sampling data
 - strange data formats
 - will continued to be used at least until end of Metop-B commissioning
- Prototype processing offline
 - FSI (surface to top), raw sampling data
 - Culverwell / Healy ionospheric correction (see Ian's talk)
 - Netcdf4 based products
 - operational implementation after Metop-B commissioning (+implementation delays...)
- Prototype data available for testing and feedback in netcdf4 and bufr (6hr rolling archive): <u>ftp://ftp.eumetsat.int/pub/EPS/out/Marquardt/nrt</u>
- Data quality & format details might change over time; it's best effort only, no commitment, no archive...
- Metop-B data will be available as well to support commissioning activities



RO Processing at EUMETSAT

Aspects of the new data format:

- Level 1a (amplitude/phase):
 - 1kHz raw sampling and 50 Hz coherently integrated "open loop" data
- Level 1b (bending angle):
 - Thinned bending angle profiles for NWP (also as bufr)
 - 247 levels between surface & 60 km, 4 points / Fresnel diameter
 - High res bending angle profiles for science
 - Level structure TBD
 - Filtering of bending angle data consistent with level structure

We want your feedback:

- Is everything in there you need?
- What level structure do you want for scientific use?

• ...

Note that reprocessed RO data from EUM (GRAS, COSMIC, CHAMP,...) will use the same format





Tropospheric Intercomparison

- First systematic cross-comparison of advanced tropospheric retrievals; part of ESA study on GRAS data quality (final report available from Josep Rosello; intercomparison part from me)
- Statistics includes UCAR retrievals of GRAS data from a EUM funded study



Bending angle bias (left), standard deviations (middle), and penetration depth (right) of GRAS raw sampling data processed by different centres. Statistics are against ECMWF forecasts. Number of occultations processed on sample day (30 Sep 2007) in brackets.



Tropospheric Intercomparison (cont'd)



~ Surface in impact height

Data from 30. Sep 2007

IROWG Workshop March/April 2012 Estes Park, USA Slide: 15 All retrievals are based on identical level1a data.

Profile-by-profile matching for tropospheric retrievals (< 10km) suggests:

- reasonable or good agreement (≤1% bias / ≤2-4% sdev) in mid/high latitudes, even better above altitudes affected by multipath...
- ...but significant structural uncertainties remain in the tropics
- Poster by Kjartan Kinch, talk by Stig Syndergaard



Metop-B

- Launch scheduled for May 23rd
- Satellite in Baikonour, with support teams from EUMETSAT, ESA, industry
- This week
 - Alignment
 - Solar panel integration
- If launch takes place as expected:
 - First GRAS data on May 30th
 - GRAS data products available a few days later for selected users (NWP, ROMSAF) if there are no unforeseen issues
 - prototype data via ftp as well





Reprocessing and 3rd Party Data

- Complete GRAS data set with new algorithms & data formats
- Preparations for COSMIC reprocessing (and later CHAMP).
 - Some work has been done on COSMIC POD (and the role of orbit and clock accuracy on RO product statistics); see talk by Yoke Yoon next week.
- Looking into ROSA performance on Oceansat 2 (see next talk), Megha Tropique, SAC-D(?) and possible processing options



GSN Navigation Bit Service

- Demonstration project successfully running since November 2011
 - 14 receivers from the existing GSN ground station network
- Joined effort by GFZ Potsdam and ESA/ESOC, cooperation with Lou Estey (teqc)
- Operational service to commence in mid 2012
- Aiming at triple coverage (or better) with 99% availability, 50 minutes latency
 - 19 receivers (9 as backup), with additional data from FUGRO and NRCan GSN stations
- ESOC and EUM currently negotiating operational costs
- Rene Zandbergen's talk on GSN will probably cover more details





Summary

Data gaps:

- partial success (but with unacceptable side effects) in October 2011
- another attempt to modify parameters during Metop-B commissioning

Deep occultations:

- signals as weak as cross PRN tracking...
- attenuated by 30+dB, down to -250 300km SLTA
- need to distinguish between cross-PRN and atmospheric signals in processing
- in current configuration (SLTA_{min} = -250km), GRAS gets 95+% of all atmospheric data

Tropospheric data from GRAS:

- test data available, want your feedback
- will continue to undergo development for a couple of weeks
- operational implementation expected for late 2012
- Metop-B data as soon as being available
- ROTrends-like assessment of tropospheric retrievals would be important

Metop-B: launch scheduled for 23rd May

GSN Navigation Bit Service: to become operational in mid 2012 (we hope...)

