ESTIMATING TROPOSPHERIC DELAYS FROM DORIS DATA IN A MULTI-SATELLITE MODE

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Summary: The goal of this poster is to assess the accuracy of DORIS-derived tropospheric delays by comparison with GPS/ION combinations. Results from 24 DORIS/GPS collocated sites show agreement of 0 to 10 mm for mean offsets per station, and about 10 mm for RMS for the total zenith tropospheric delay.

For mid-latitude and equatorial regions, the SPOT Passes (dicho-synchronous satellites) are almost oriented North-South. DORIS satellites passes are very short in time (typically 20 minutes for LEO satellites).

For each station, all partners of the sky are then well covered even with 1 day of data.

Actual GPS-DORIS collocations (Sep 1-7, 2003) (collocations in red, other DORIS stations in white)
Map courtesy of Pierre Faguel (IGN/ISKR)

Easter Island station (EASB/EEL)

Kerguelen station (KEESB/KEB)

Summary:
1. The tropospheric delay is highly variable during each satellite pass, allowing for excellent determination of the zenith total tropospheric delay.
2. DORIS tropospheric zenith delays are not estimated at regular intervals. DORIS-GPS instruments. As Kourou (KRUB) and Ascencion (ASDB) collocations are quite far apart (25 km in horizontal and more than 180 m vertically. There are then good reasons for a possible bias between GPS and DORIS due to the geographical variability of the atmosphere.
3. DORIS tropospheric zenith delays are not estimated at regular intervals.
4. GPS series are much more smoother (they are also a combination of several individual GPS solutions).
5. In any case, GPS series are much more smoother.
6. In our opinion, there is in this plot a common bias of about 5 mm that can be explained by the +25 mm (CIBB) offset, and this means that the observed mean bias between DORIS and GPS zenith tropospheric delay is much smaller when applying the height correction for the dry tropospheric delay.

Discussion on DORIS/GPS bias:
It must be noted that some collocated sites may have DORIS and GPS that could be rather far apart (see table below).

Day of Year in 2003

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Summary:
1. In order to get a GPS time, we have estimated the tropospheric correction per segment instead of using a random walk process for every measurement (typically every 10 seconds, when available). These segments (batch intervals) can only start at the beginning of a DORIS satellite pass (no need to estimate a new parameter when there is no available DORIS data). However, we do not reset the parameter if the time duration between 2 passes (from 2 different satellites) is less than a specific value (50 minutes).
2. DORIS tropospheric zenith delays are not estimated at regular intervals.

Discussion on individual results:
On those 4 sites (EASB, KESB/KEB and KRUB), GPS-derived Zenith Tropospheric delays are depicted in blue (every 2 hours). We have used in all our comparisons the IGS combined tropospheric products.

http://igscb.jpl.nasa.gov/ From DORIS data in a multi-satellite mode

Estimating the zenith tropospheric correction from DORIS data:
All our DORIS estimations were done using the GPSY-OASIS II software developed at JPL (http://gpsy.jpl.nasa.gov/corrections/).

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We have used in our estimation, all DORIS satellites except JASON - SPOT2, SPOT4, SPOT5, TOPEX and ENVISAT.

We have processed 7 days of DORIS data (from Sep 1 to Sep 7, 2003), on a daily basis (using 30 hours of data to avoid boundary problems).

Discussion on DORIS/GPS bias:
It must be noted that some collocated sites may have DORIS and GPS that could be rather far apart (see table below).

First we need to take into account the difference in height of the DORIS and GPS antenna to really compare the same tropospheric content. From the left figure we can see that the observed mean bias between DORIS and GPS zenith tropospheric delay is much smaller when applying the height correction for the dry tropospheric delay.

In our opinion, there is in this plot a common bias of about 5 mm that can be explained by the +25 mm (CIBB) offset, and this means that the observed mean bias between DORIS and GPS zenith tropospheric delay is much smaller when applying the height correction for the dry tropospheric delay.

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Conclusion:
We have shown that high quality tropospheric delays can be estimated from DORIS data (1 to 2 cm accuracy).

Actual DORIS-GPS collocations (Sep 1-7, 2003)