Outlines

1. Introduction
2. Regional $T_m$ model
3. GPS Processing
4. Results
Introduction

"The Estimation of Atmospheric Water Vapour Using GPS Project“

The Scientific and Technological Research Council of Turkey (TUBITAK)

**Aims**

- the total zenith delay
- the precipitable water vapour
- the numerical models based on time and position

Regional $T_m$ model

$Istanbul, Ankara, Samsun and Diyarbakir radiosonde profile data$

$Radiononde analysis algorithm (Matlab)$

Linear regression method

Regional $T_m$ model

$T_r, T_{mr}, ZTD, ZWD, PW, Q$
Regional $T_m$ model

Introduction

<table>
<thead>
<tr>
<th>Researcher Name</th>
<th>$T_m$ model (K)</th>
<th>RMSE (K)</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bevis et al (1992)</td>
<td>$T_m=70.2+0.72T_s$</td>
<td>4.74</td>
<td>America</td>
</tr>
<tr>
<td>Liou et al (2001)</td>
<td>$T_m=1.07T_s-31.5$</td>
<td>1.67</td>
<td>Taiwan</td>
</tr>
<tr>
<td>Boutiouta et al (2010)</td>
<td>$T_m=14.7+0.96T_s$</td>
<td>4.89</td>
<td>Algeria</td>
</tr>
</tbody>
</table>
GPS Processing

- RINEX and meteorological data
- Bernese Processing Software 5.0
- Total tropospheric zenith delay
- Precipitable water vapor with the regional $T_m$ model (Matlab)

PW from GPS in comparison with radiosonde analysis algorithm

GANM PW differences 3 - 29 November 2013

- Avg = 1.07% mm
- Max. = -1.02% mm
- Min. = -1.33% mm
GPS Processing

ZWD from GPS in comparison with radiosonde analysis algorithm

![Graph showing GANM ZWD differences from 3 - 29 November 2013]

Conclusions

\[ T_m = 57.4 + 0.77 \cdot T_s \]
\[ m_{T_m} = \pm 2.57 \]

- The region between Istanbul, Ankara, Samsun and Diyarbakır radiosonde stations
- The remaining radiosonde stations (Izmir, Isparta, Adana and Erzurum) \( a T_m \) model for Turkey
- Istanbul and Ankara continuous GNSS stations (in the determination of the precipitable water vapour)
- ZWD and PW (to check accuracy and reliability of the radiosonde analysis algorithm)