

Sun activity influence on measurements in GNSS reference station system LatPos

Jānis Zvirgzds

Riga Technical University Geomatics department

Didzis Dobelis

Latvian Geospatial Information Agency

United Nations/Croatia Workshop on the Applications of GNSS, Baška, Croatia, 21 – 25 April 2013

Outline

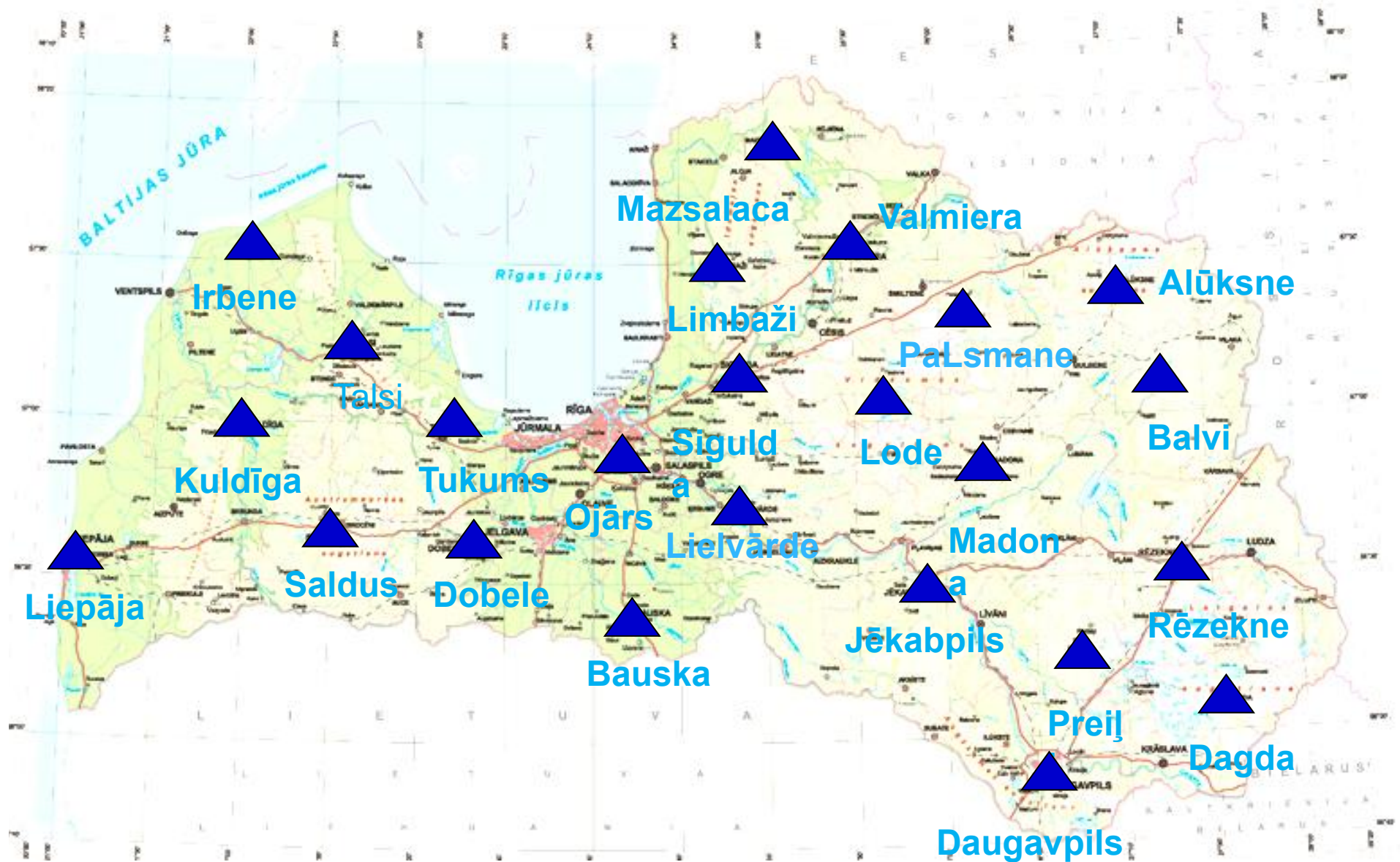
- * LatPos system
- * Coordinate re-calculations
- * System validation
- * Ionosphere influence



LatPos

established 2005,

improved 2010



Data used for calculation

Bernese GPS 5.0 software



- For LatPos stations:
daily RINEX data with rate: 30 sec;
- For G0 points:
two 4h sessions - Rinex data rate: 5 sec;

Precise orbits - SP3 format;

European Global ionosphere models;

Antenna phase center offsets.

Calculated baselines



Bernese calculation parameters

- Elevation cut off angle:
 - for LatPos stations: 15°
 - for Go point measurements: 20°
- Ambiguity resolution strategy:
 - QIF(Quasi-ionosphere-free) and SIGMA
- Maximum iterations: 10



LatPos validation

Software used:

Trimble Business Center 2.60

TopoNet 5.0

Alternative baseline combination

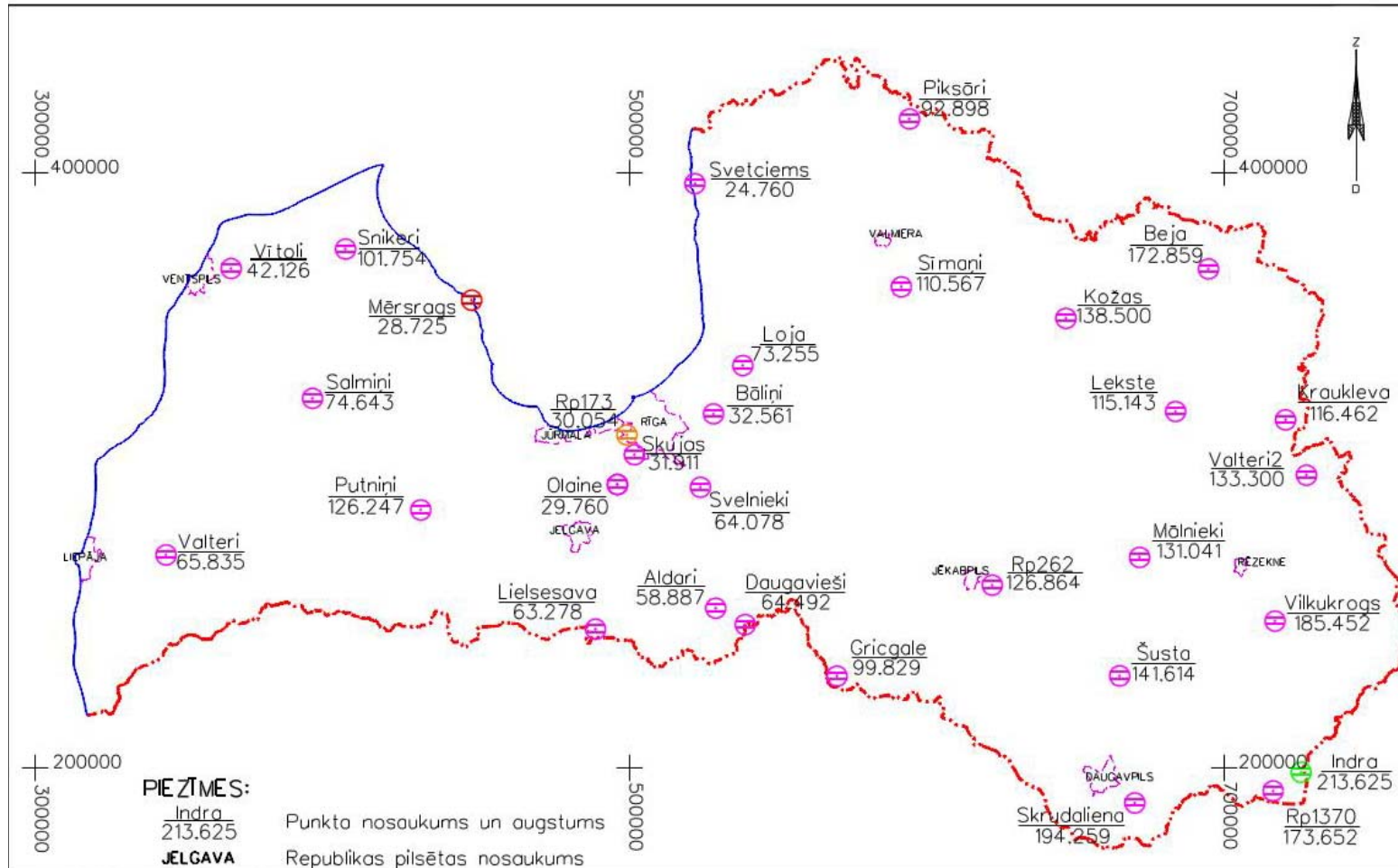
No ionosphere and antenna phase center models

Max dx,dy = 8mm

Max dh = 13 mm

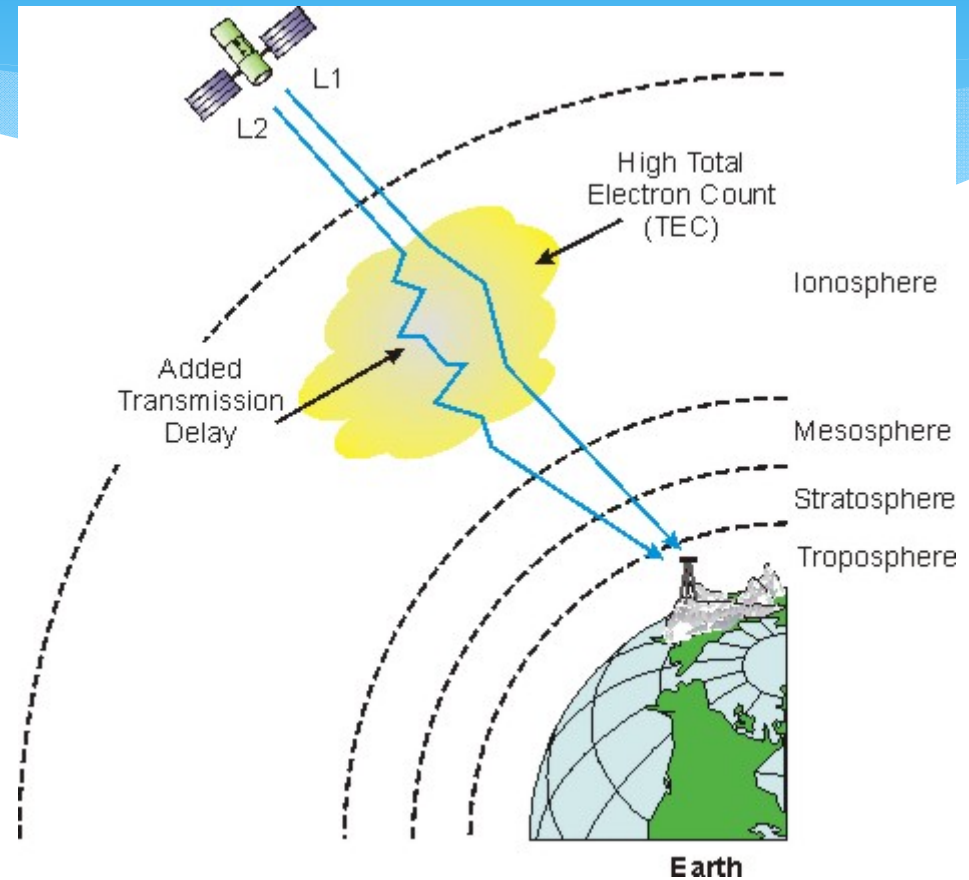
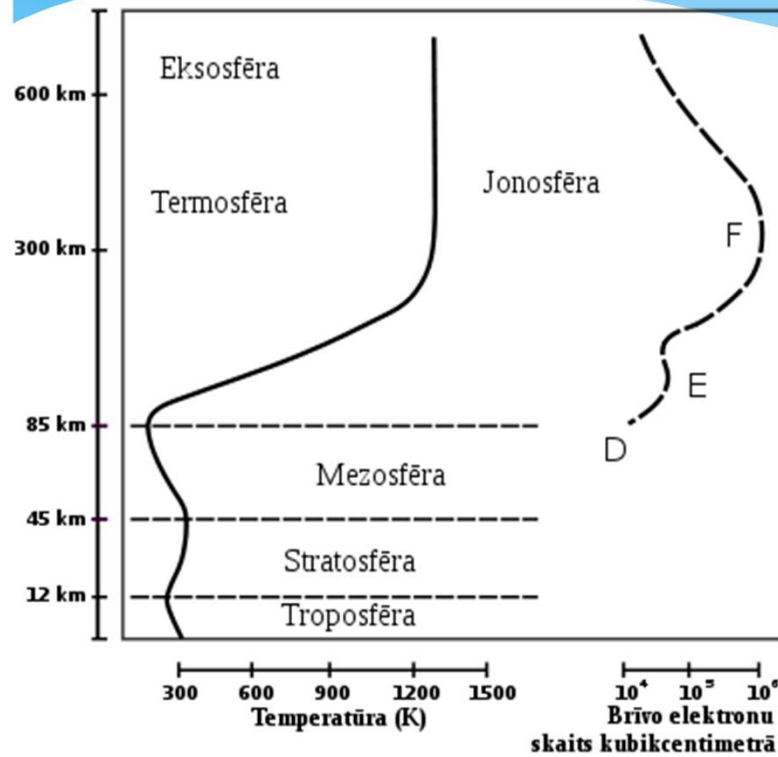


RTK measurements



$$\sigma_x = 0,016 \text{ m}, \sigma_y = 0,015 \text{ m} \text{ un } \sigma_h = 0,022 \text{ m}.$$

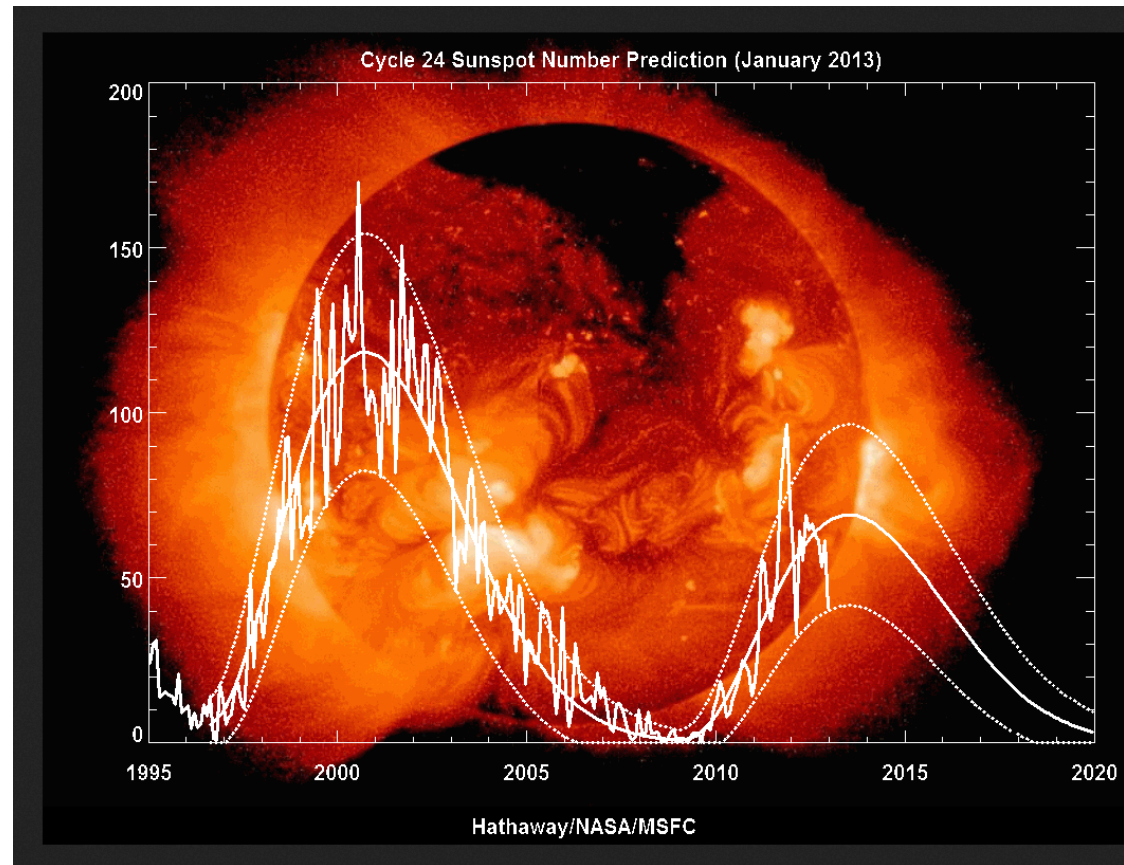
Ionosfera



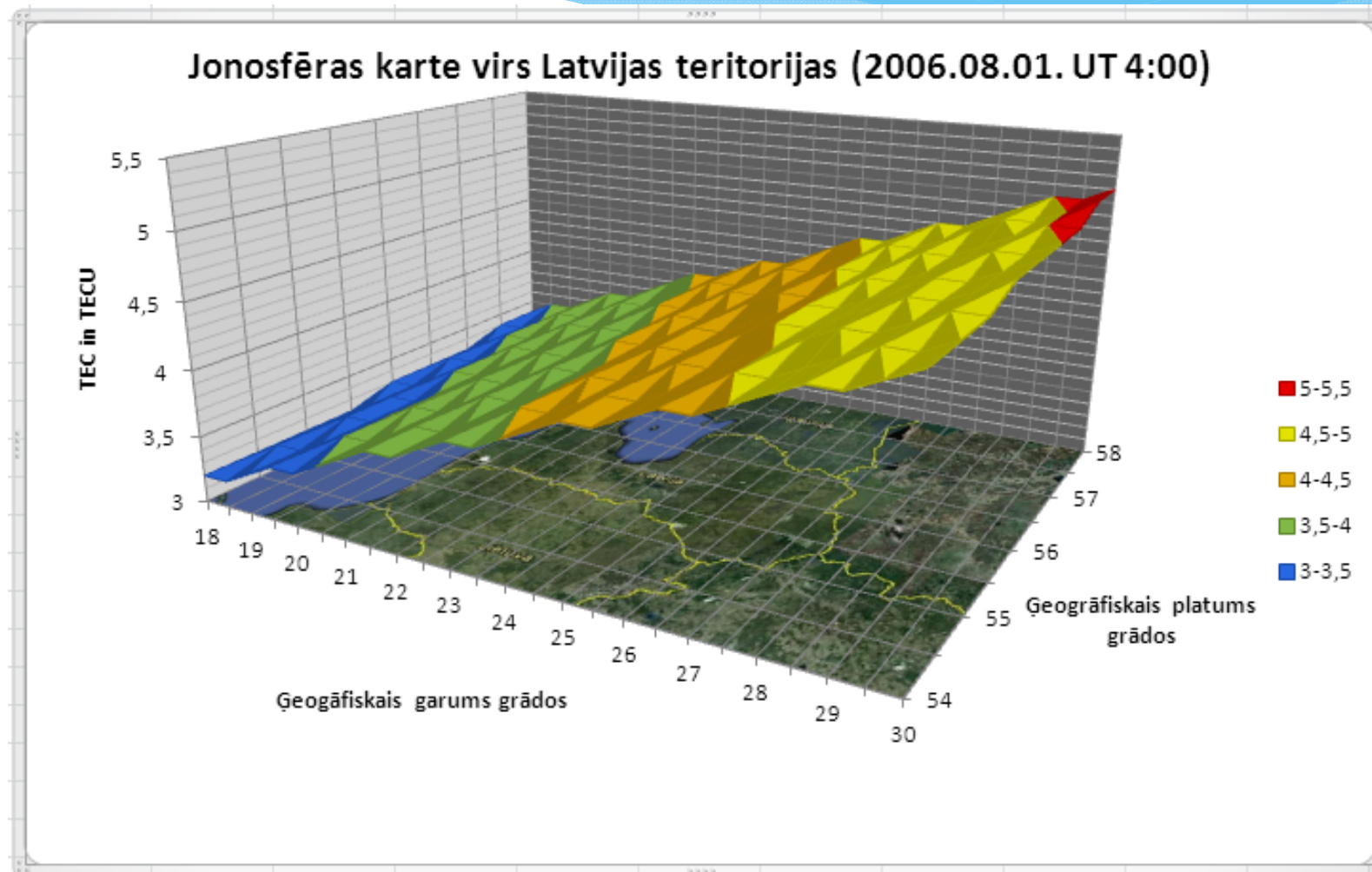
TEC (Total Electron Content)

$$1 \text{ TECU} = 10^{16} \text{ el/m}^2$$

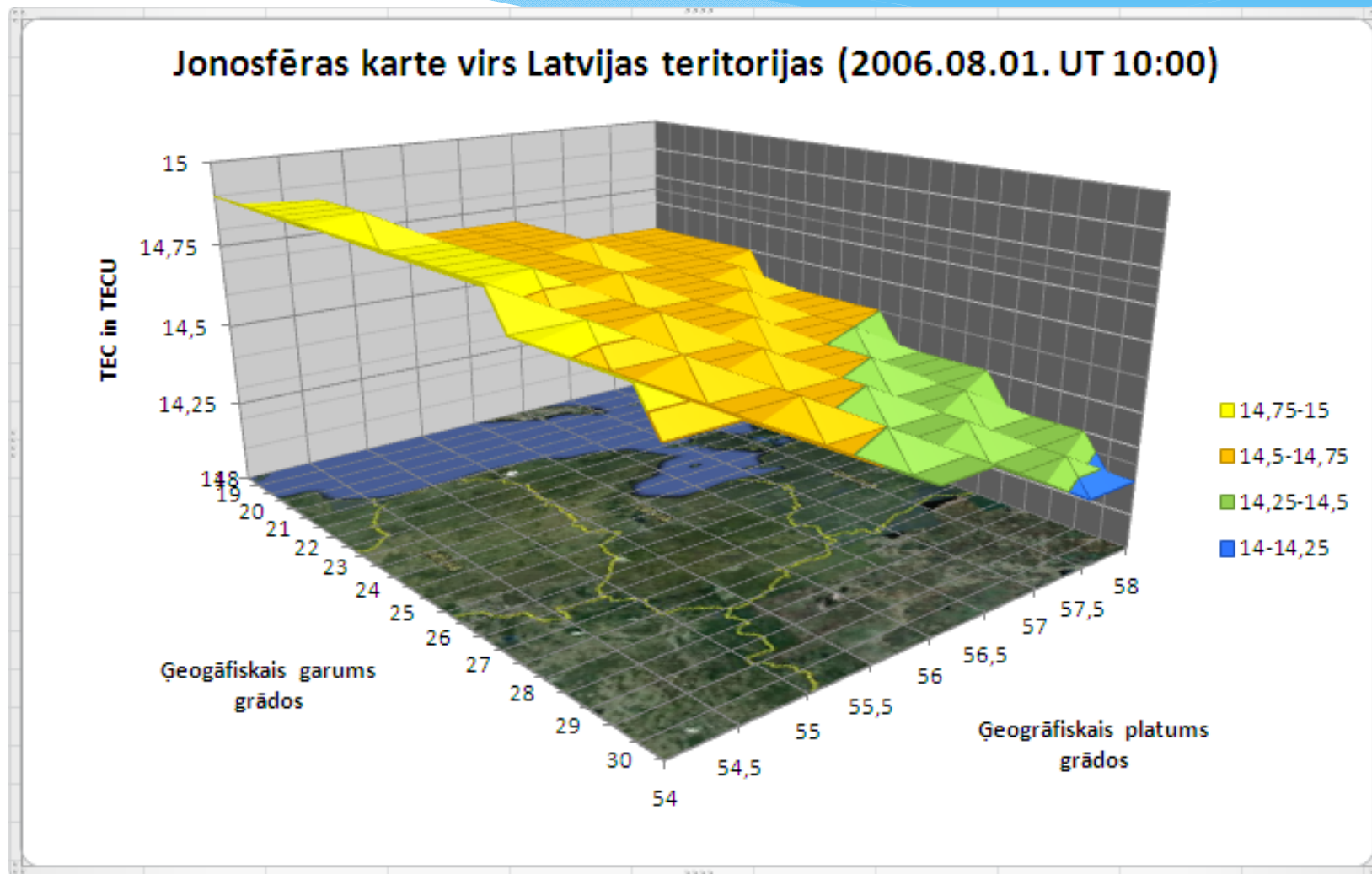
Sun spot changes



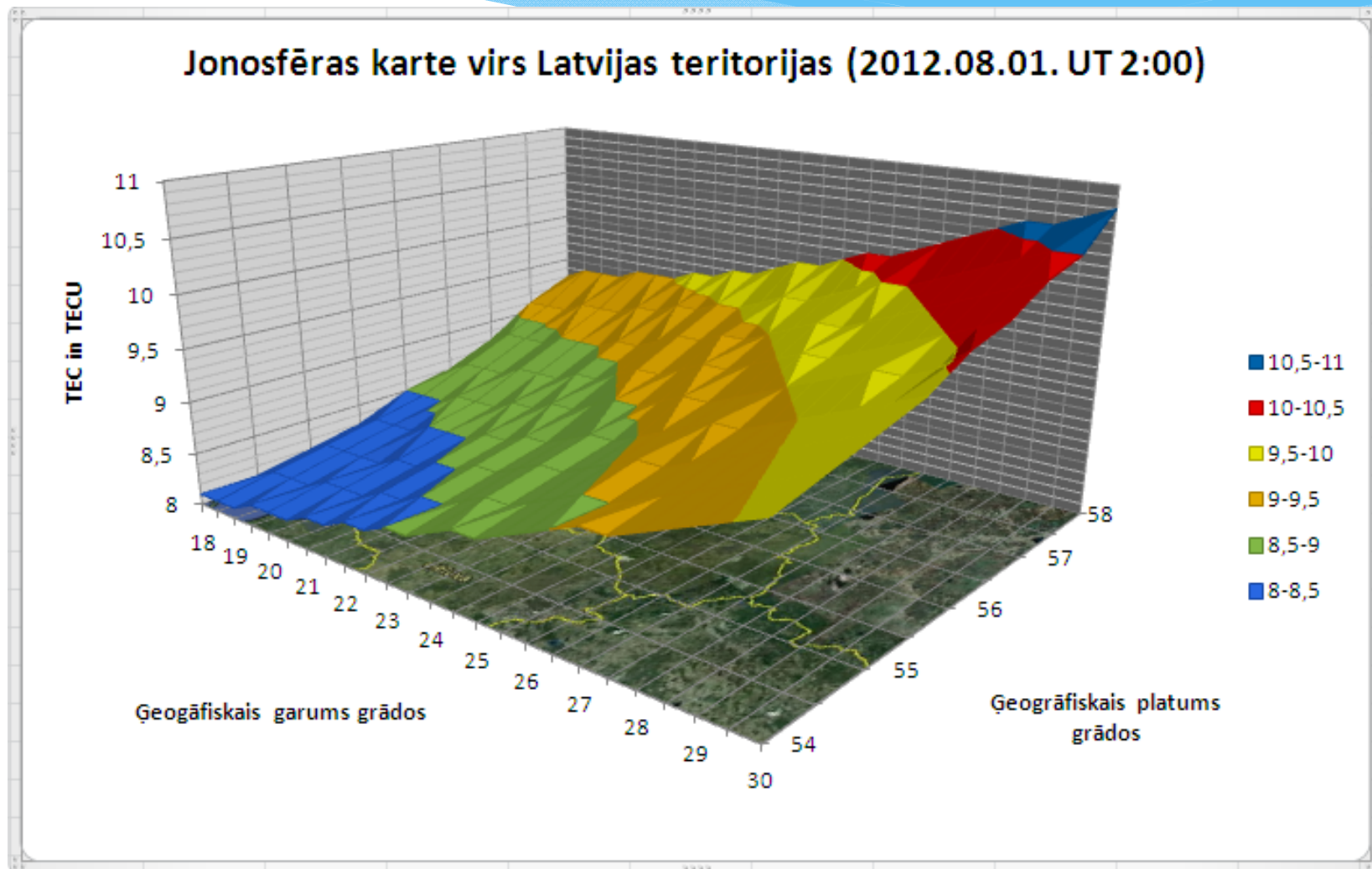
Ionosphere map for Latvia Year 2006 4:00am



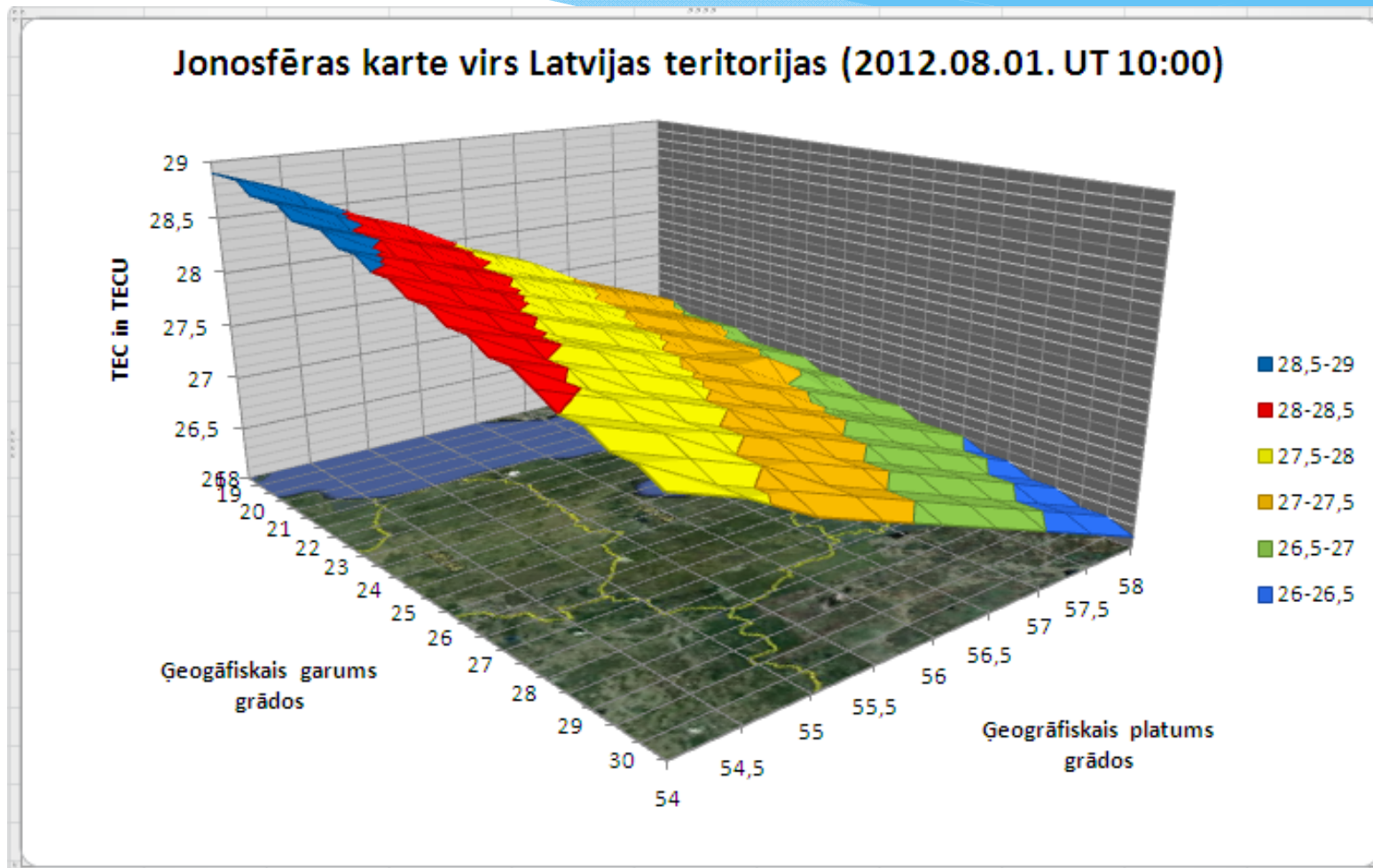
Ionosphere map for Latvia Year 2006 10:00am



Ionosphere map for Latvia Year 2012 4:00am

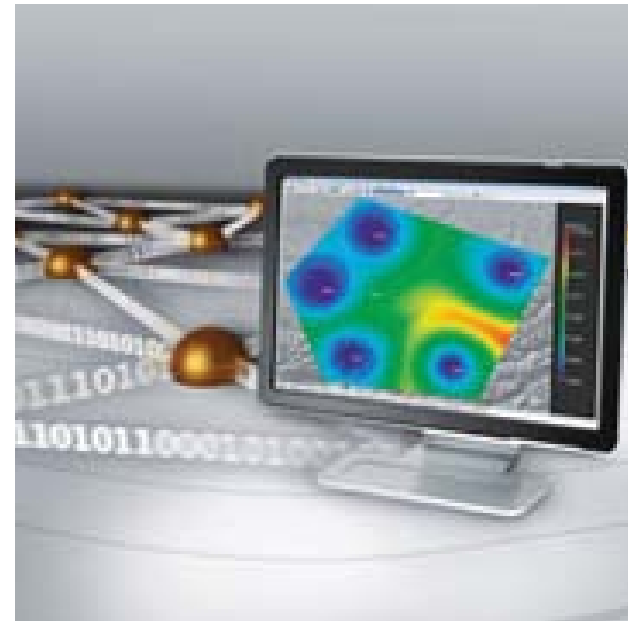


Ionosphere map for Latvia Year 2012 10:00am



RTK analysis

- * Spider QC software;
- * NMEA log files for each user;
- * Time span 30.07.12 – 3.08.12.

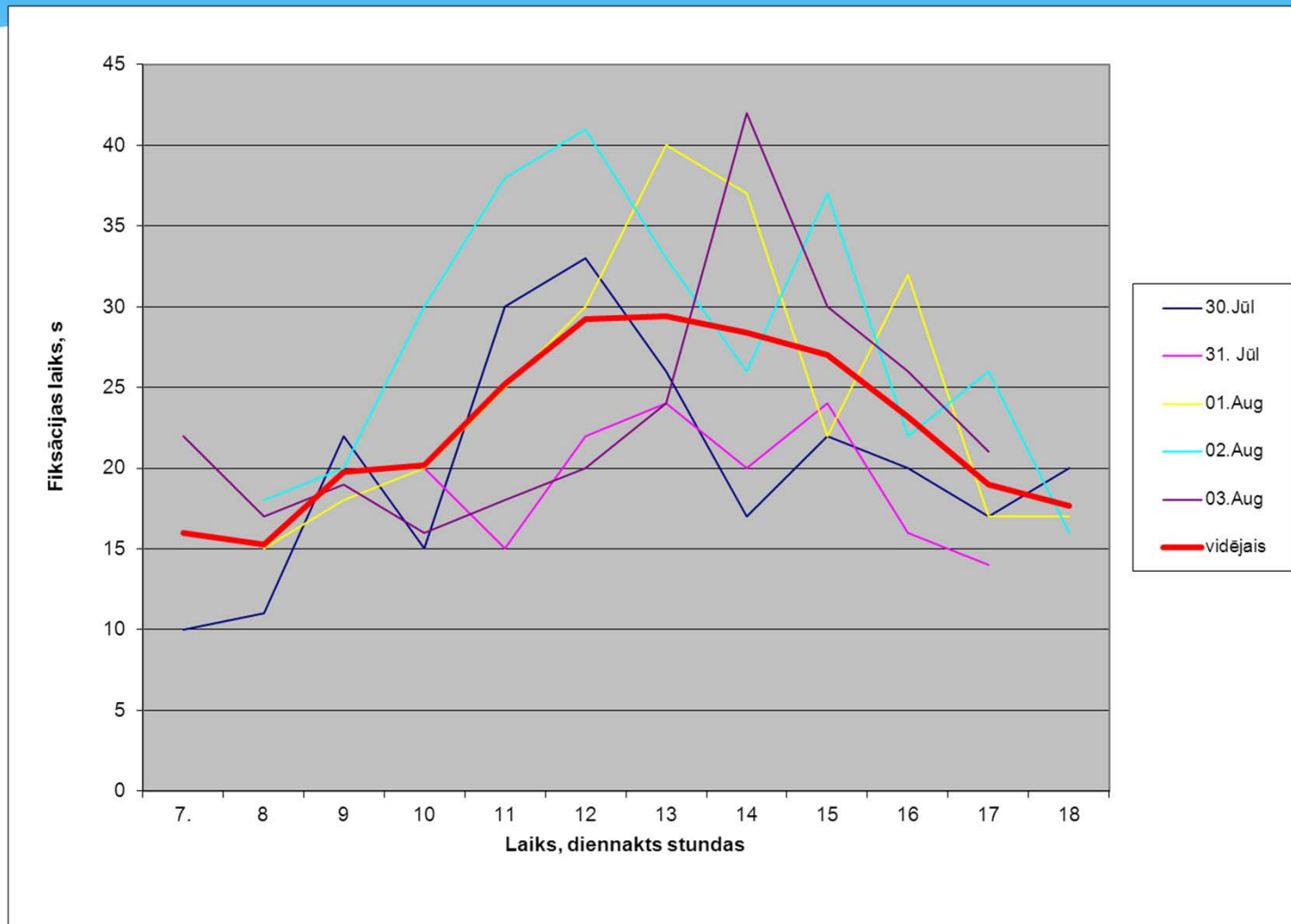


Time to fix

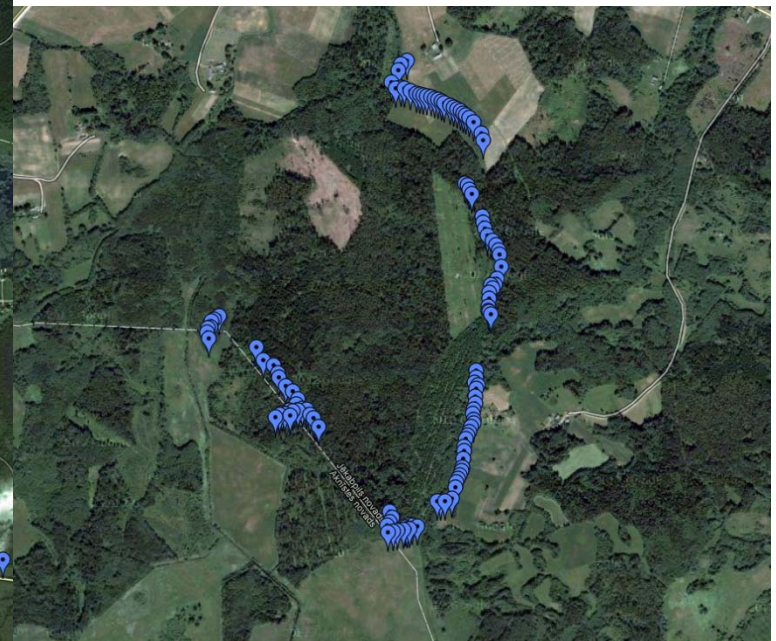
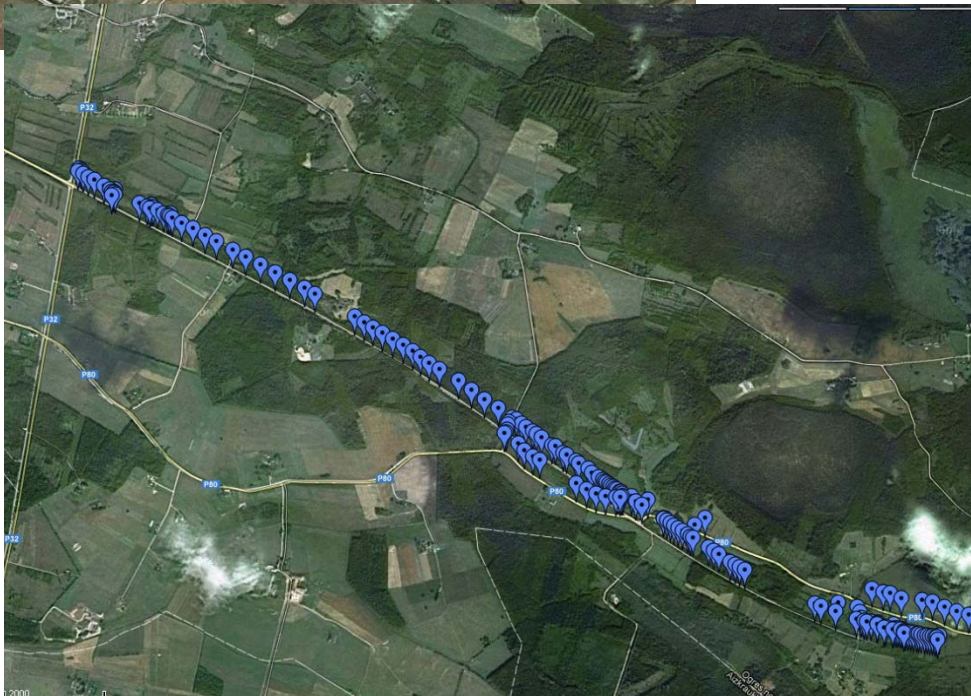
- * Average connections/day ~ 150
- * FIX time to 30 seconds = 65,3 %
- * FIX time from 30 sec to 2 minutes = 20,2 %
- * FIX time over 2 minutes = 14,5 %



RTK field instrument Time to fix



User track



Conclusions

- * Higher ionosphere activity – longer time to fix;
- * User need plan measurements;
- * Take a brake from 11:00 till 15:00.



Questions?



Lost geodetic point