Multipoint Continuous Doppler sounding system

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- Introduction, Doppler sounding
- Doppler sounding system in the Czech Republic
- International network of multi-point continuous Doppler sounding
- Data Collection in e-Science Centre and access to IAP data

Continuous Doppler sounding

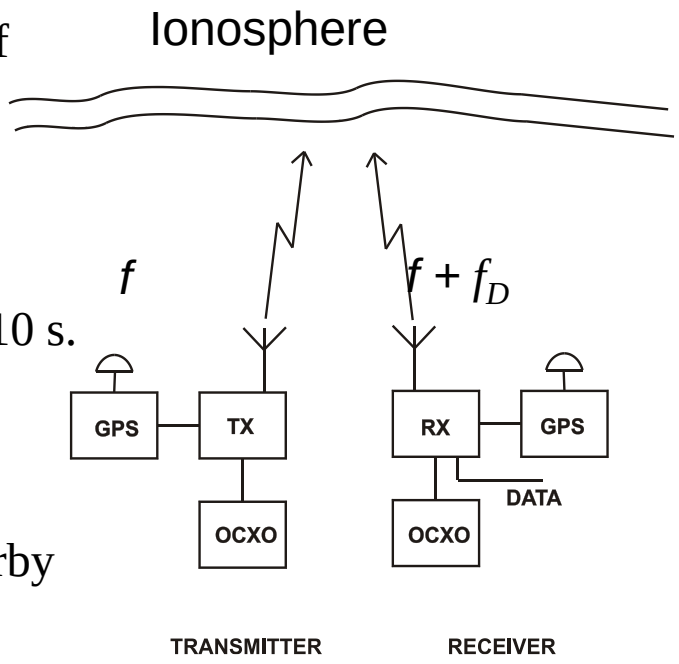
Continuous, highly stable sine wave of frequency f is transmitted. (That is different from the ionosonde, pulses of short (coded) waveforms are transmitted.)

Doppler shift f_D of the reflected wave is measured.

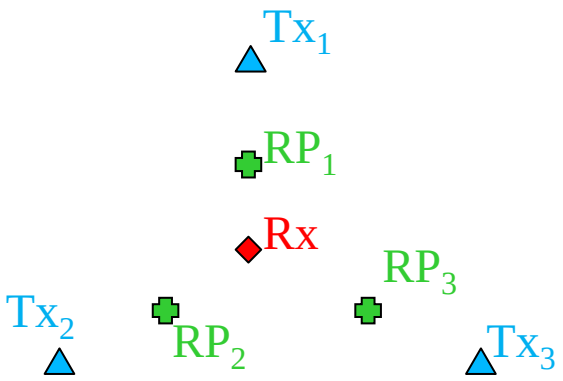
To study variability on short time-scales, time resolution ~10 s. (Ionosondes typically sample at 5 to 15 minutes rate.)

Reflection is from a specific height, $f=f_p$, which changes during the day. Reflection height can be obtained from nearby ionosondes.

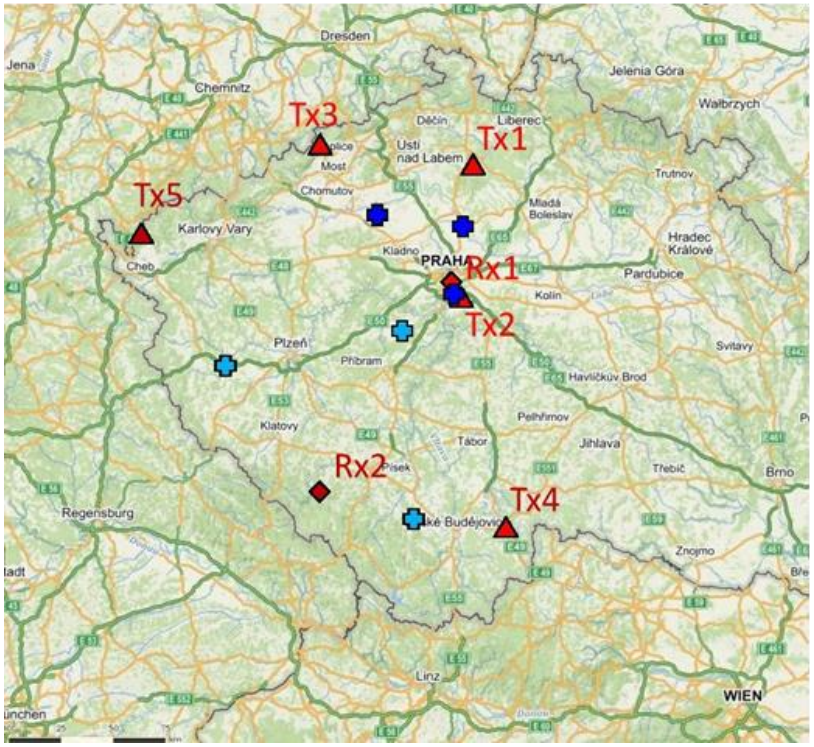
Movements of the ionosphere (reflecting level) and also increase/decrease of electron density cause f_D.



Multi-point sounding
- scale about 100 km
- minimum 3 reflection points (RP) to study horizontal propagation



Doppler sounding system in the Czech Republic



Distribution of the Doppler transmitter sites (Tx1-Tx5) by red triangles and receiver sites (Rx1, Rx2) by red diamonds in the Czech Republic. Blue crosses show projection of anticipated reflection points between Tx1, Tx2, Tx3 and Rx1. Cyan crosses show projection of anticipated reflection points between Tx1, Tx4, Tx5 and Rx2. Tx1, Tx2, Tx3, Rx1 operated frequency: 3.59, 4.65 and 7.04 MHz
Tx4, Tx5, Rx2 operated frequency 3.59 and 4.65 MHz (in operation since the end of 2019)

Technical information and frequencies used in the Czech Republic

Transmitters

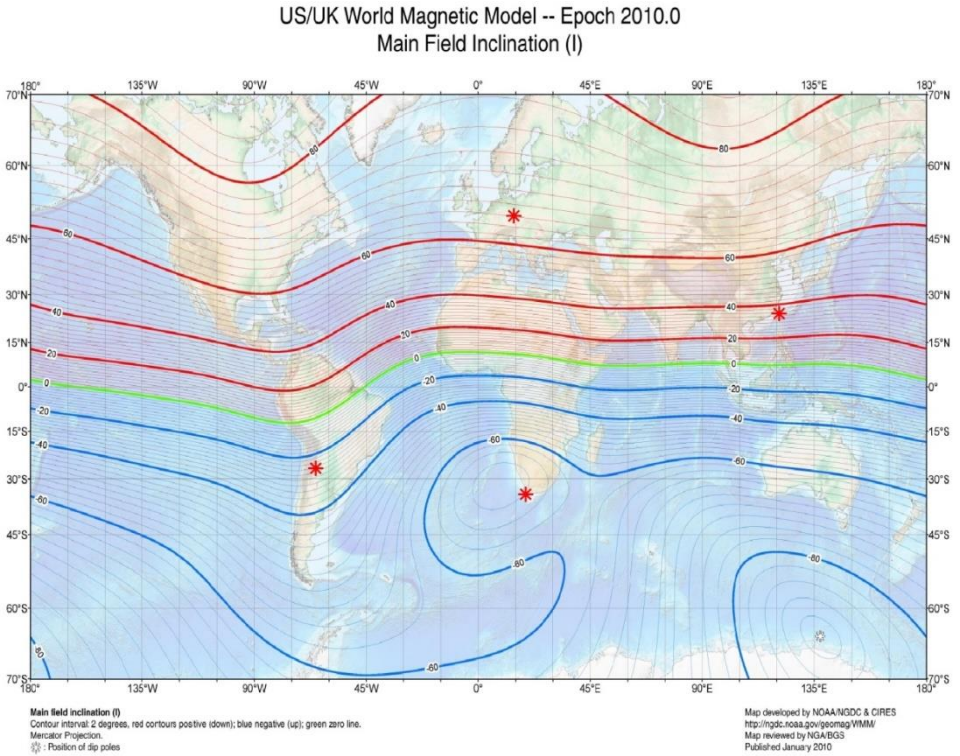
- 5 transmitter sites
- 3 frequencies 3.59, 4.65, and 7.04 MHz
- frequencies of the individual transmitters are shifted by about 4 Hz
- transmitted power for each sounding path : ~1 W,
- half wavelength dipole or broad antenna
- carrier frequency ~ 54 s each minute
- identification (call mark in Morse code) is sequentially transmitted each minute for ~6 s
- GPS receivers are used for the time synchronization

Receiver

- 2 Receiver sites
- Magnetic loop antenna: ~ 1 m of diameter
- power supply and internet connection required

International network of multi-point continuous Doppler sounding

Czech Republic
3.59, 4.65 and 7.04 MHz
Belgium
4.59 MHz
Slovakia
3.59 MHz
Northern Argentina, Tucumán
4.63 MHz, 6.80 MHz
Taiwan
4.66 MHz
South Africa
3.59 MHz



IAP-P Doppler sounder spectrograms Data Collection e-Science Centre

esc.pithia.eu/data-collections/DataCollection_IAP-P_DopplerSounder_Spectrogram/

- the **latest Doppler shift spectrograms** and **archive**
- images in **jpg** format
- direct link to data collection
- free access without registration