POS & LBS

EX03: Ionospheric Delay

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Exercise 3
Ionospheric delay

- Ionospheric delay is caused by the presence of free electrons between 100 and 1000 km altitude.
- Related to solar activity: TEC (Total Electron Content) is the free electrons superficial density along the ionospheric path of the signal (n / m2). It significantly varies according to the intensity of the solar activity and of the solar radiation.
- Availability of model to estimate the ionospheric delay
  - ***Klobuchar model!***
    - Infinitesimally thin spherical single layer at 350 Km of altitude
    - Ionospheric vertical TEC is described by an harmonic series in (ϕ ,λ) (6 coefficients), time dependent during the day (maximum at local 14.00).

Exercise 3
Ionospheric delay - task

1. Compute 4 maps of ionospheric error corrections:
   - Vertical: elevation 90 degrees
   - Latitude = -80 to 80 degrees (step 0.5 degrees)
   - Longitude = -180 to 180 degrees (step 0.5 degrees);
   - Time: 0:00, 6:00, 12:00, 18:00 (GMT)
   - Use the ionospheric parameters in “ionoparams.dat”
2. Compute 2 polar maps of ionospheric error corrections:
   - for an observer located in Milan
   - Elevation = 0 to 90 degrees (step 0.5 degrees)
   - Azimuth = -180 to 180 degrees (step 0.5 degrees);
   - Time: 0:00, 12:00 (GMT)
   - Use the ionospheric parameters in “ionoparams.dat”

Exercise 3
Tips

To compute the correction for one point you can use the function “iono_error_correction.m”:
SYNTAX:

```
[corr] = iono_error_correction(lat, lon, az, el, time_rx, ionoparams, sbas);
```

INPUT:

- lat = receiver latitude [degrees]
- lon = receiver longitude [degrees]
- az = satellite azimuth [degrees]
- el = satellite elevation [degrees]
- time_rx = receiver reception time
- ionoparams = ionospheric correction parameters
- sbas = SBAS corrections <optional if available>

OUTPUT:

- corr = ionospheric error correction [m]

DESCRIPTION:

- Computation of the pseudorange correction due to ionospheric delay.
- Klobuchar model or SBAS ionosphere interpolation

Exercise 3
Tips

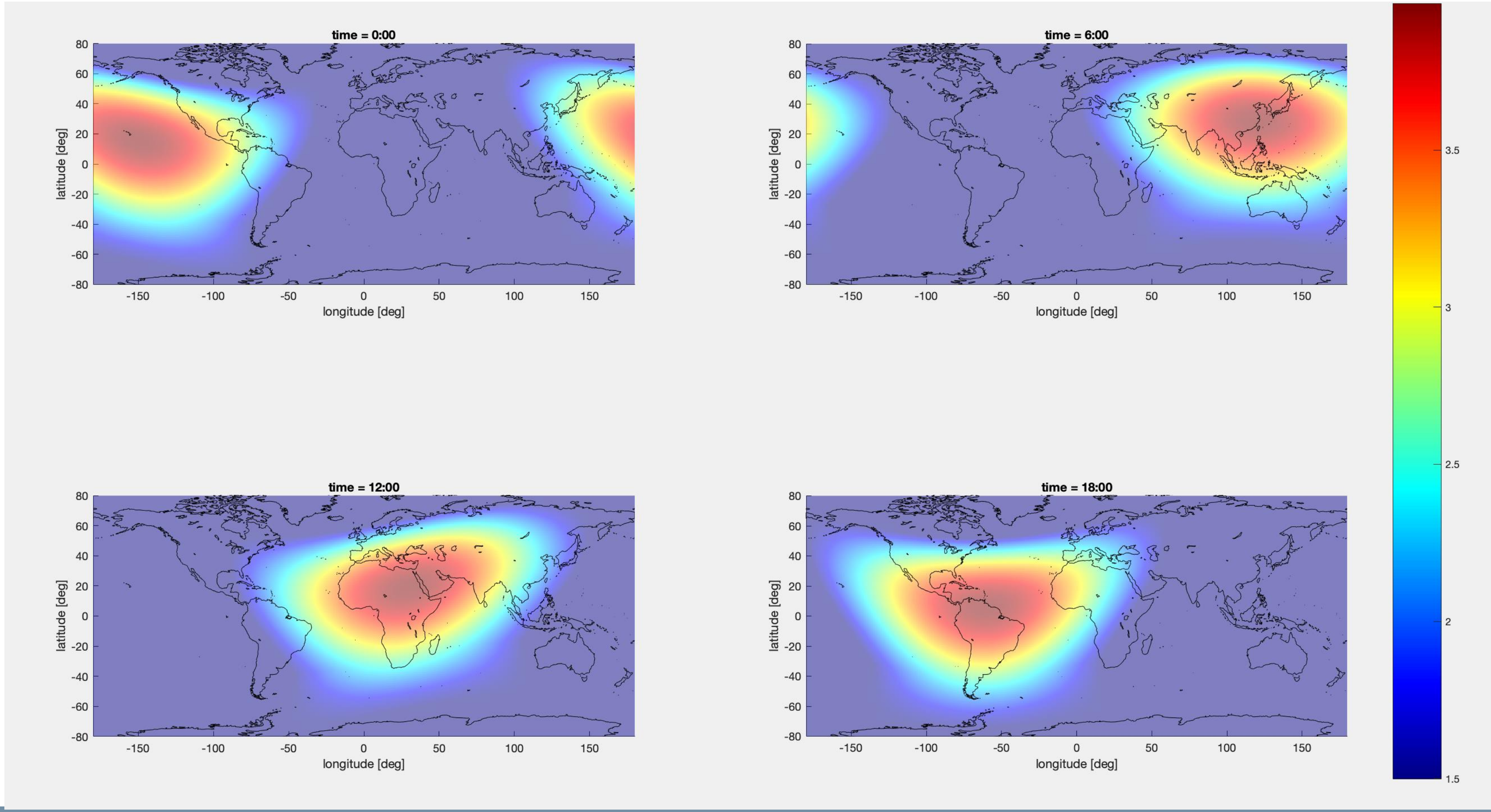
Compute 4 maps of ionospheric error corrections

1. Set the elevation of the hypothetic satellite to 90 degrees (Note: At 90 degrees the azimuth is not relevant for the computation of the ionospheric map)
2. Set the time steps for the computation of the maps (in seconds)
3. Define the step of the grid
4. Preallocation of the ionospheric error correction maps
5. Cycle 'for' (3 cycles for) to estimate for each epoch and each point of the map the ionospheric error correction
6. Plot the computed maps (for example with 'geoshow' function)

Compute 2 polar maps of ionospheric error corrections

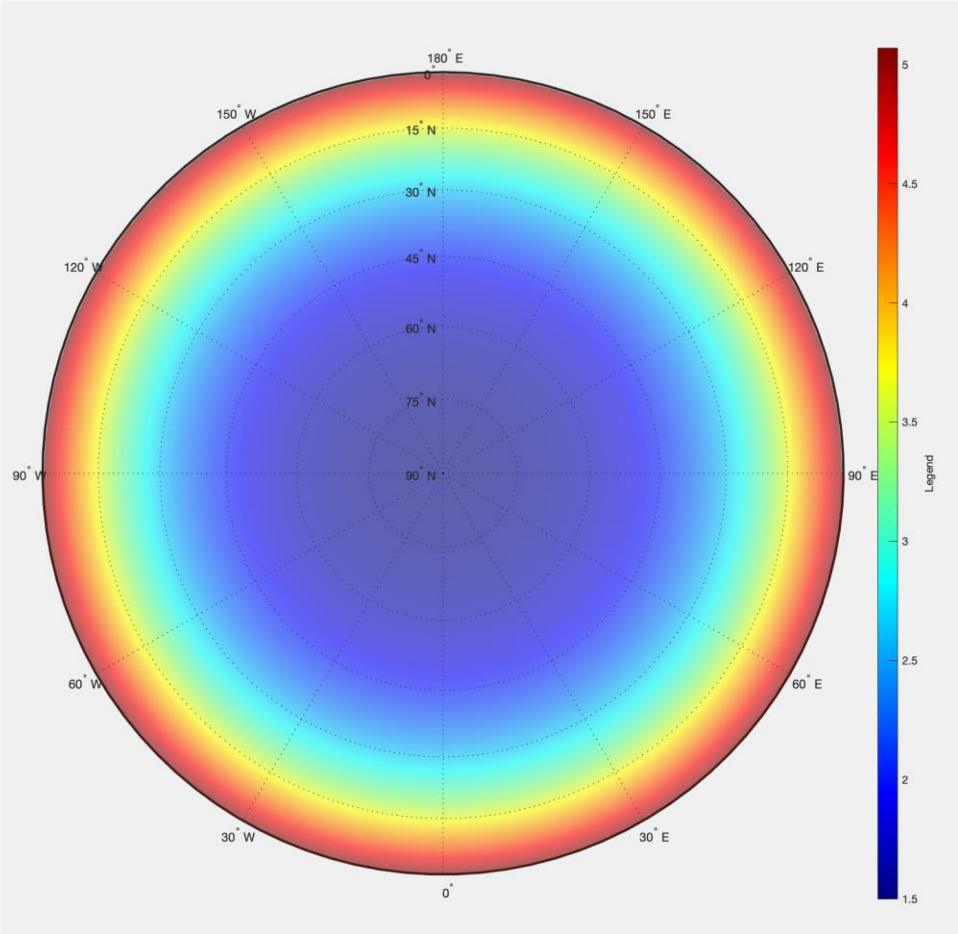
1. Set the time steps for the computation of the maps (in seconds)
2. Define the step of the grid
3. Set the geodetic coordinates of an observer located in Milan
4. Preallocation of the ionospheric error correction maps
5. Cycle 'for' (3 cycles for) to estimate for each epoch and each point of the map the ionospheric error correction
6. Plot the computed maps (for example with 'geoshow' function)

Exercise 3
Results

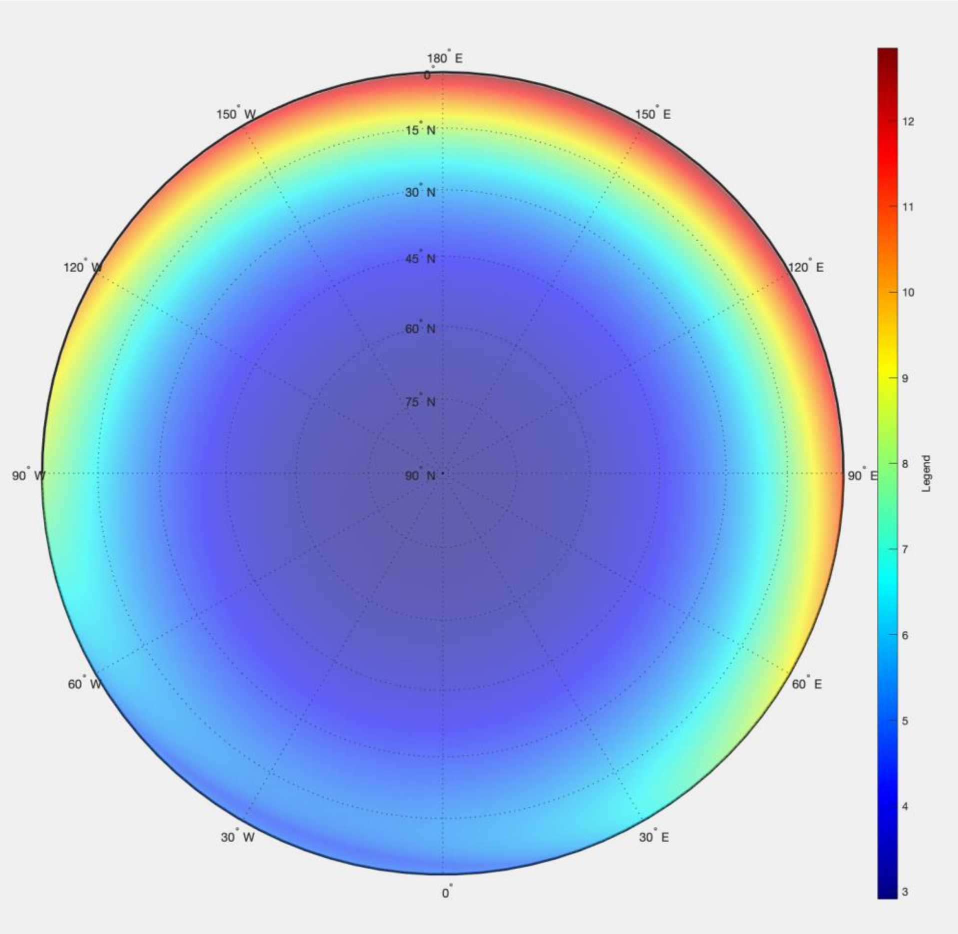


Exercise 3
Results

00:00



12:00



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