

SIMULEO

Low Earth Orbit Satellites Simulator

Geoinformatics Project

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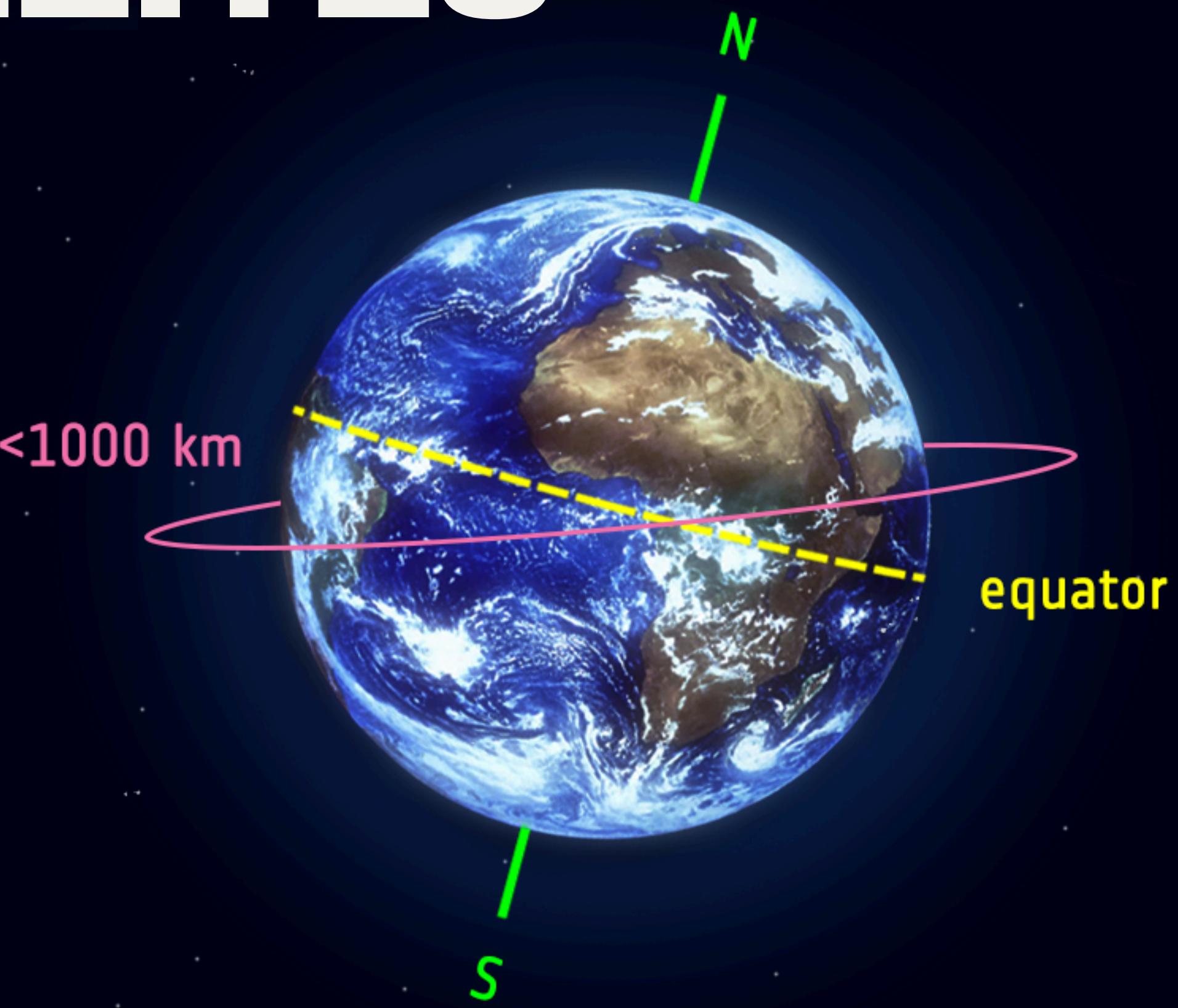
OUR PROJECT

SimuLEO is an innovative tool designed to simulate Low Earth Orbit (LEO) satellite orbits, offering a robust foundation for future positioning studies. The tool comprises a user-friendly dashboard developed in Python (Jupyter Lab), allowing users to design satellite constellations and graphically represent the ground tracks and visibility charts, and allows PDOP computation. The core computational work is handled by a group of functions written in Octave, responsible for accurately calculating satellite positions in the International Terrestrial Reference Frame (ITRF).

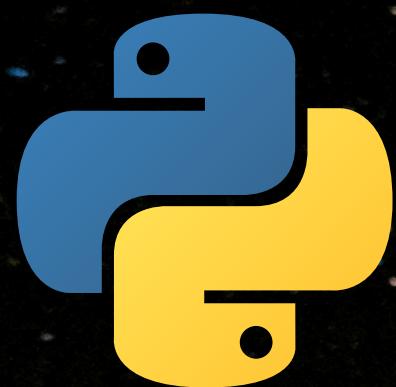
LEO SATELLITES

Low Earth Orbit (LEO) satellites are situated at altitudes lower than 1000 kilometers above the Earth's surface.

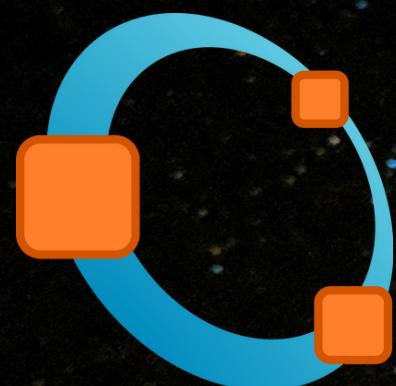
They are characterized by their rapid orbit times, often completing a full orbit in approximately 130 minutes. These satellites increasingly gain attention due to their reduced signal latency and stronger signal strength, enhancing the accuracy and reliability of positioning data.



REQUIREMENTS



Python 3.11.5



GNU Octave 9.1.0

Libraries	
ipython	8.20.0
ipywidgets	8.1.2
matplotlib	3.8.4
numpy	1.26.4
oct2py	5.6.1
pandas	2.2.1
plotly	5.19.0
tk	8.6.12

HOW IT WORKS

01

Constellation
creation

02

Ground tracks
plot

03

PDOP
computation

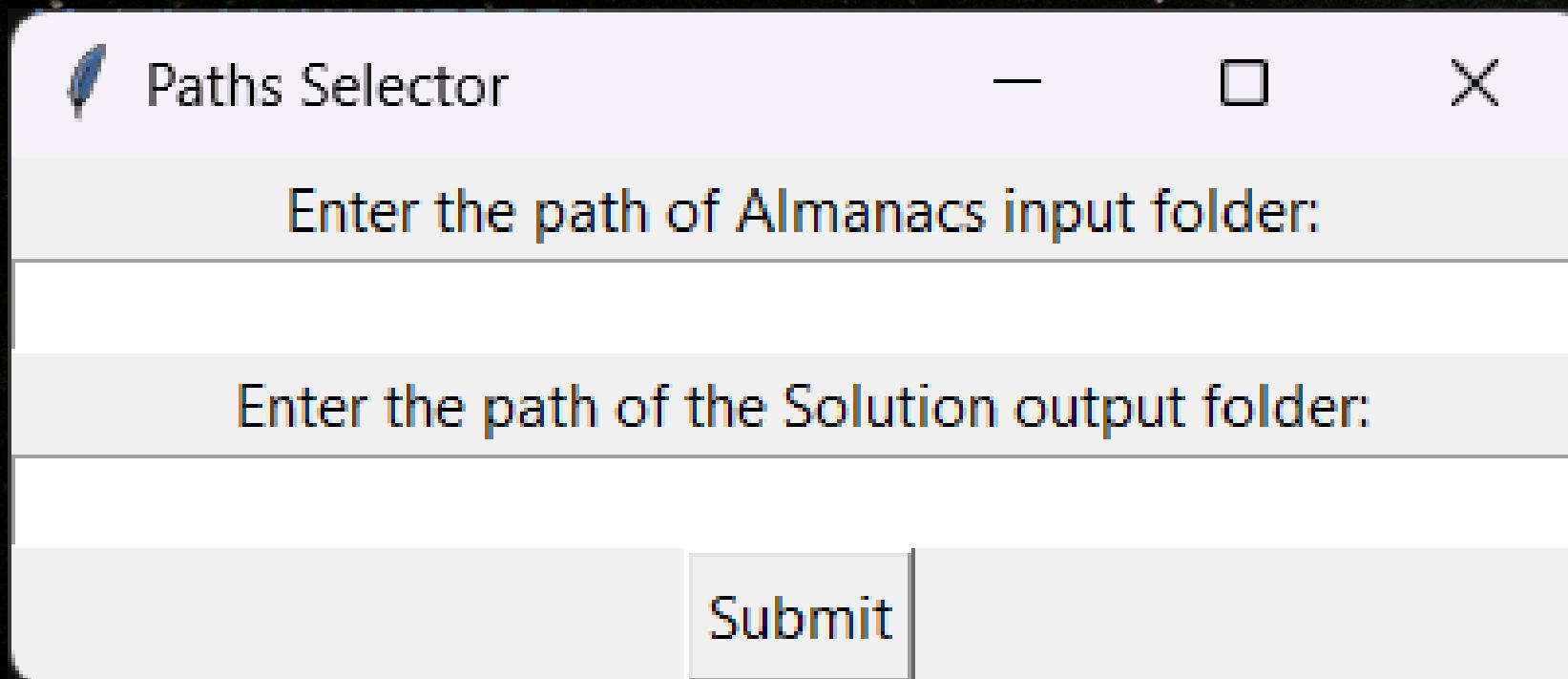
04

Satellites
Visibility Chart

FOCUS ON: CONSTELLATIONS SELECTION

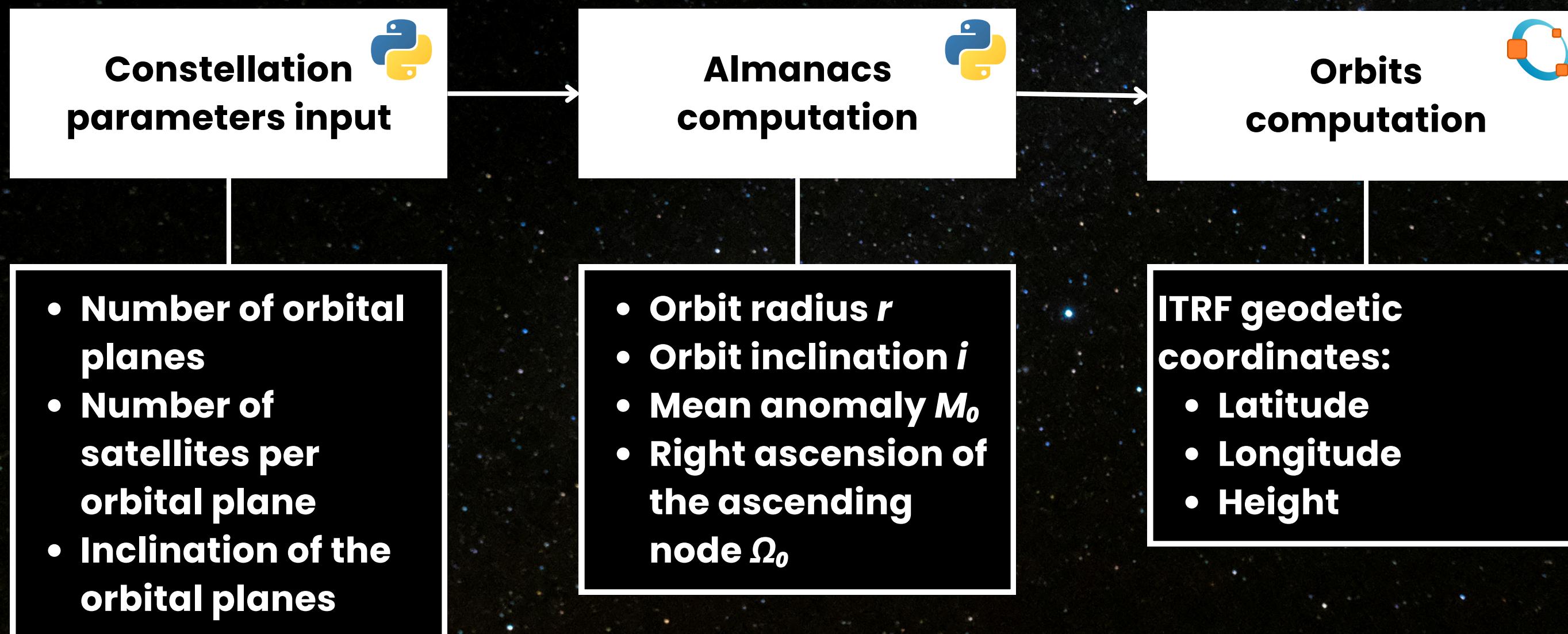
Tkinter path selector

The different functionalities of the tool can be accomplished in sequence, or independently. In each step, the user selects a constellation from the saved designs to perform the chosen task.



Tkinter path selector allows the user to select the path of the constellation folder among the designed ones for which he/she wants to compute the task.

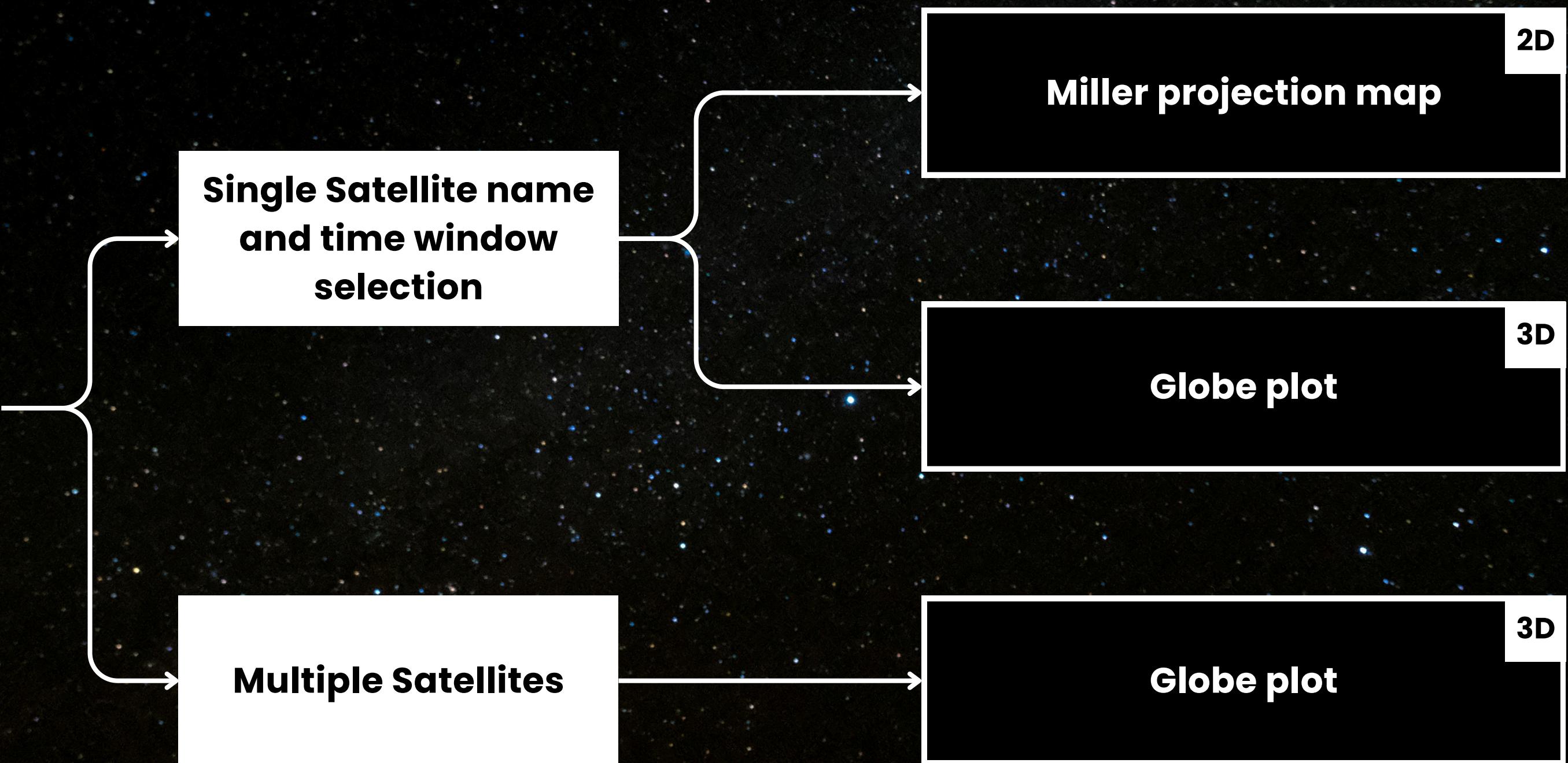
01 CONSTELLATION CREATION



02 GROUND TRACKS PLOT

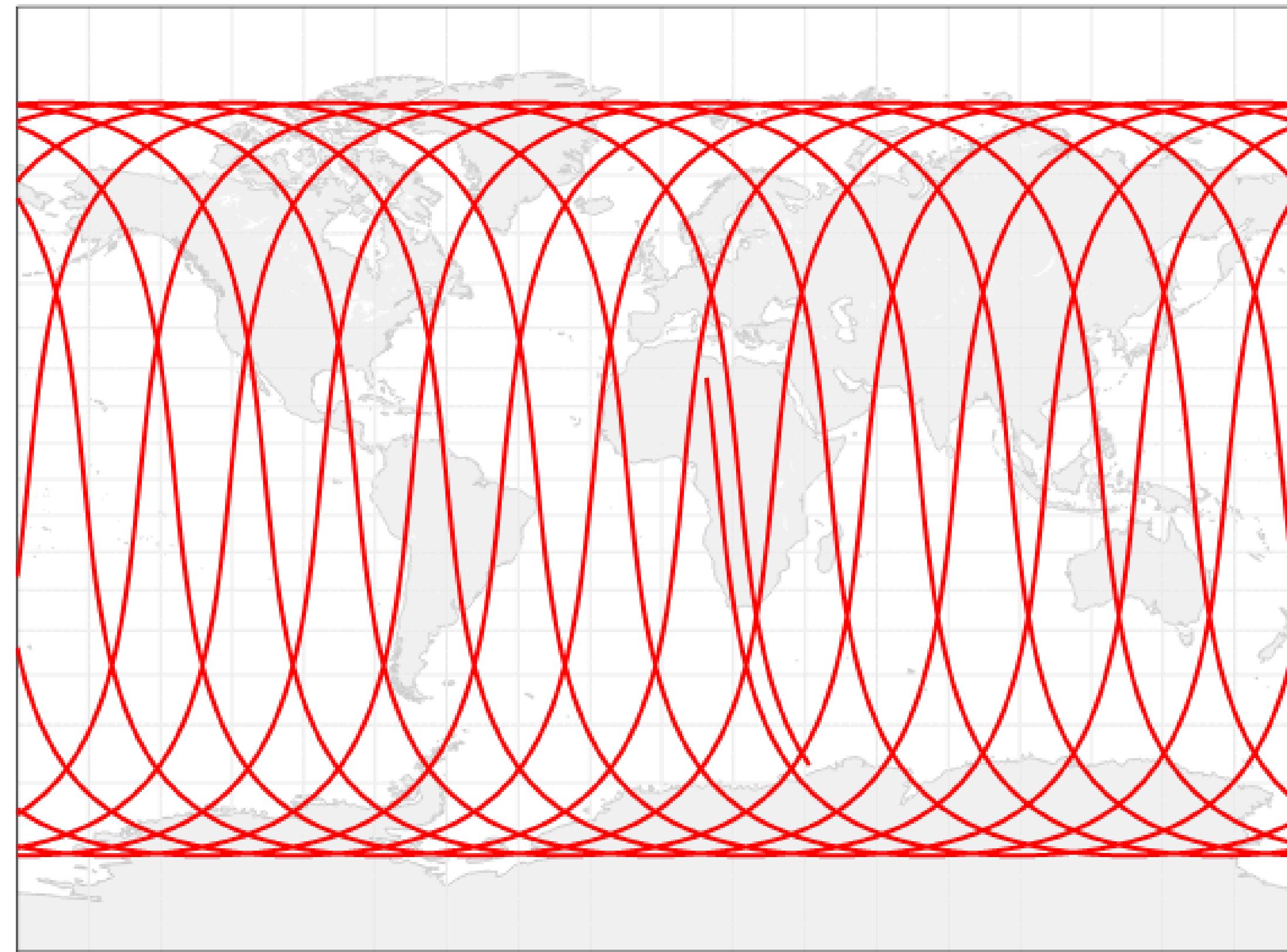


Ground
tracks
plot



Groundtrack of satellite LEO0203 in 24 hours

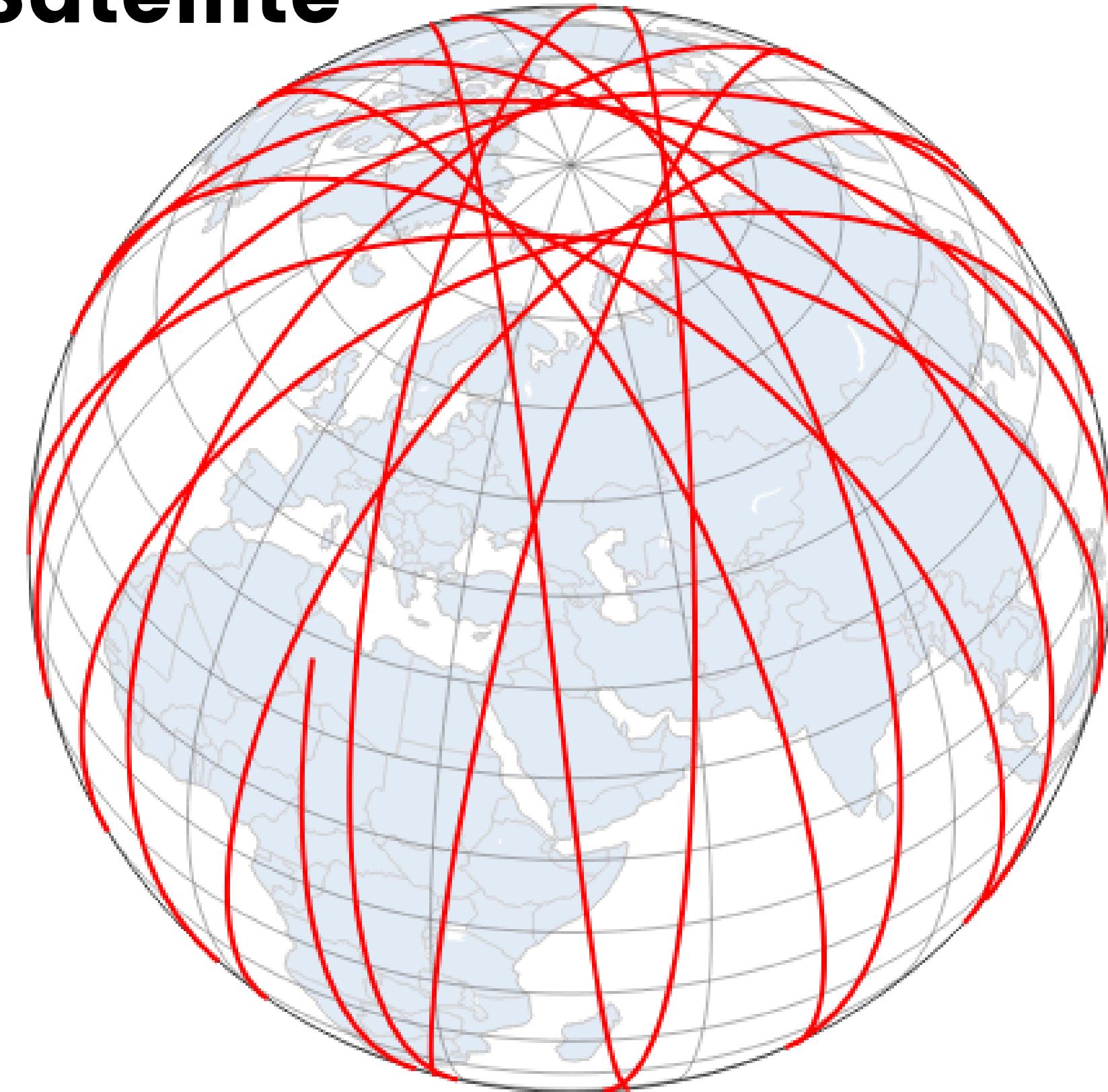
Miller Projection Map



02

Groundtrack of satellite LEO0203 in 24 hours

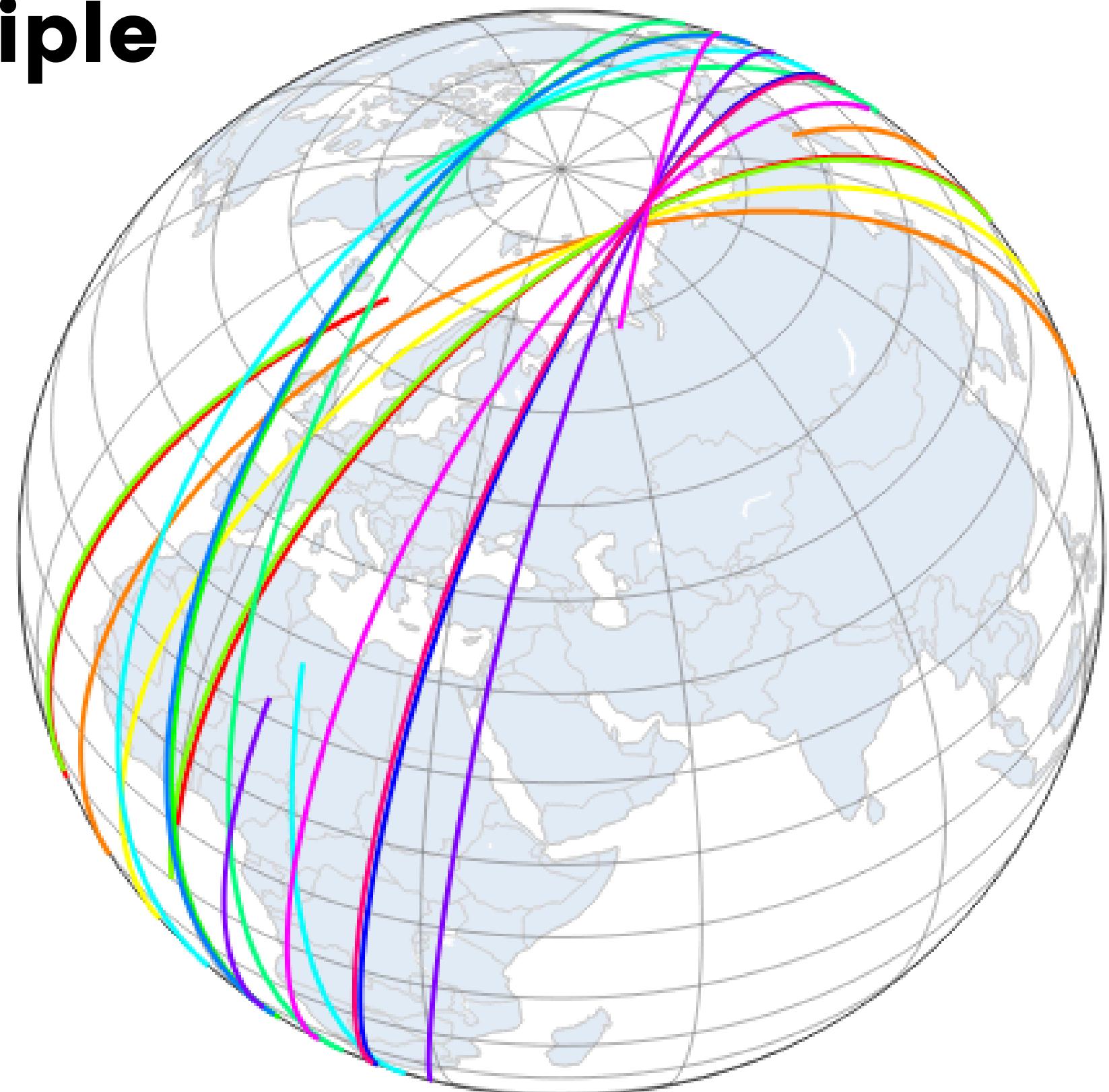
Globe: Single Satellite



08

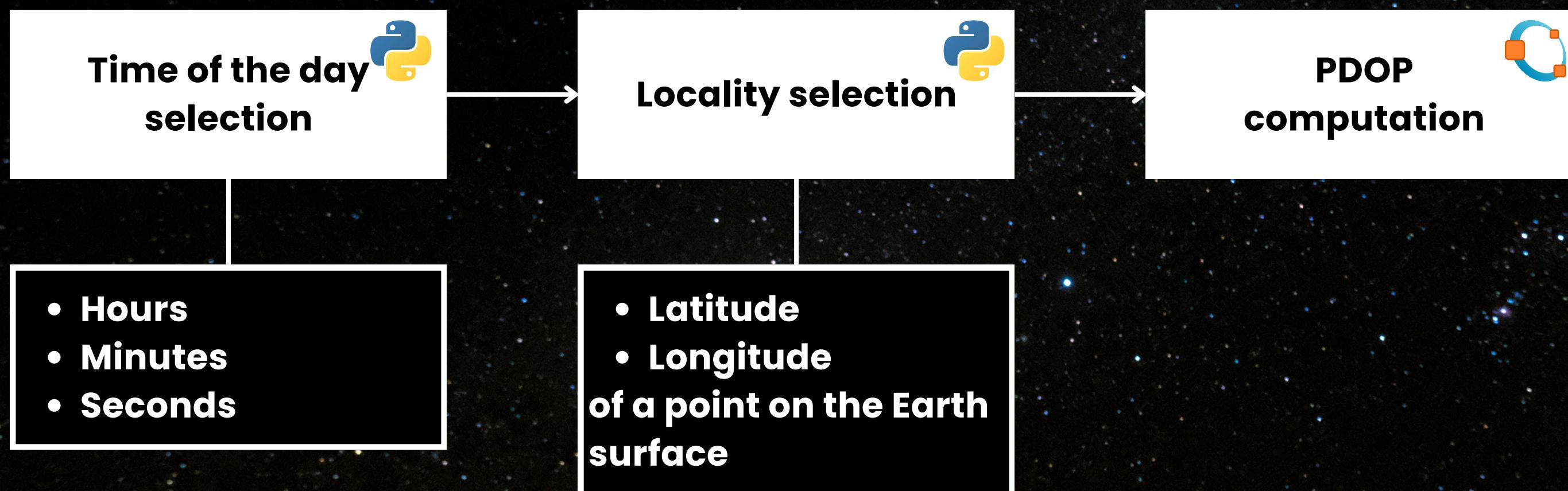
Groundtracks of all the satellites of the constellation in 2 hours time span

Globe: multiple satellites 2 hours

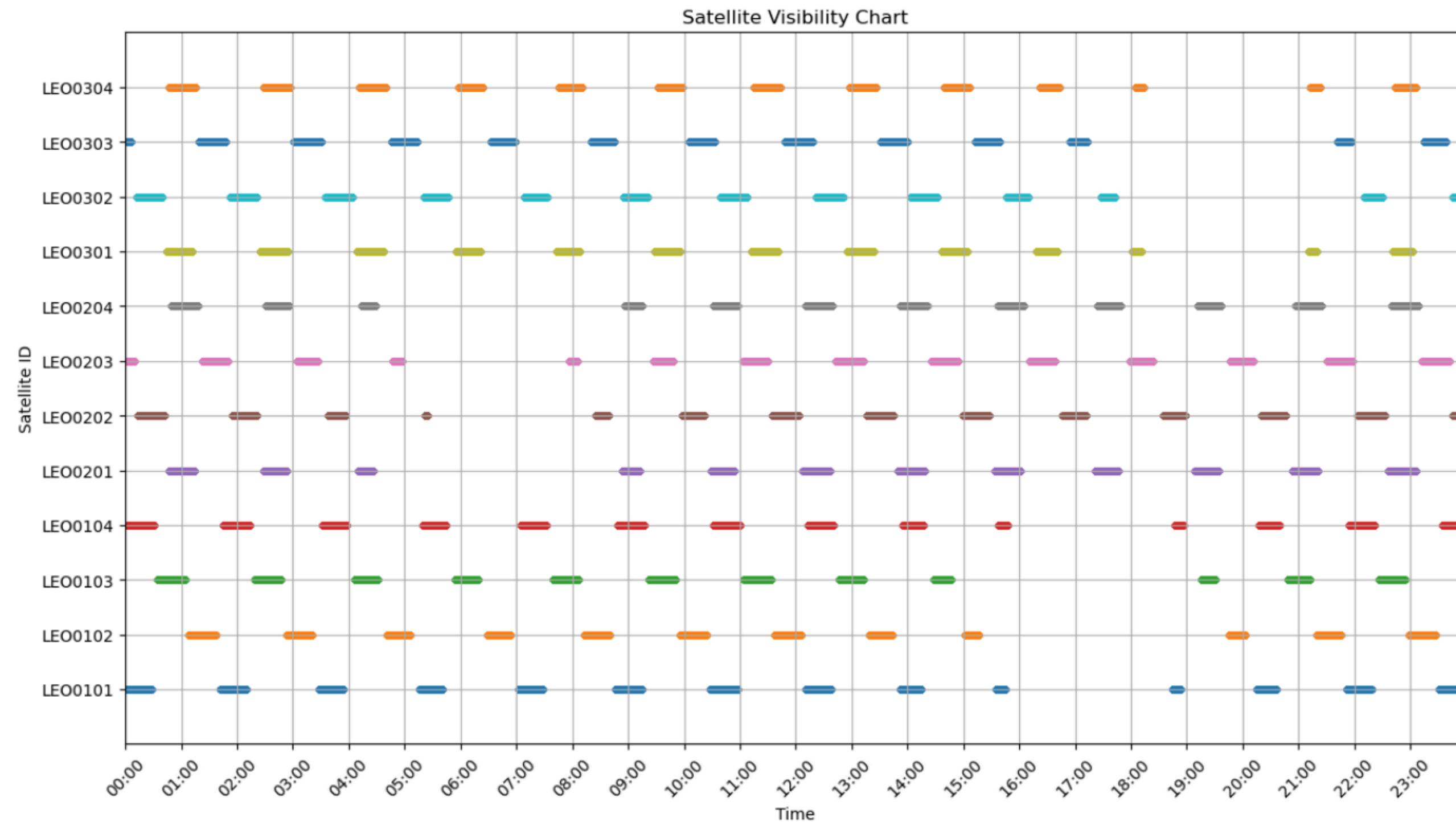
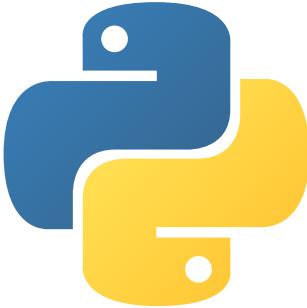


- LEO0101
- LEO0102
- LEO0103
- LEO0104
- LEO0201
- LEO0202
- LEO0203
- LEO0204
- LEO0301
- LEO0302
- LEO0303
- LEO0304

03 PDOP COMPUTATION



04 SATELLITE VISIBILITY CHART



Thank you for the attention!

Geoinformatics Project - 2024

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