

Description and Examples of Typical VSWIR and TIR Image Collections

Robert G. Knox, for the HypsIRI concept study team

NASA's Goddard Space Flight Center,

Biospheric Sciences Branch, Code 614.4

Greenbelt, MD

HypsIRI Science Symposium on Ecosystem Data Products

May 4, 2010

Introduction

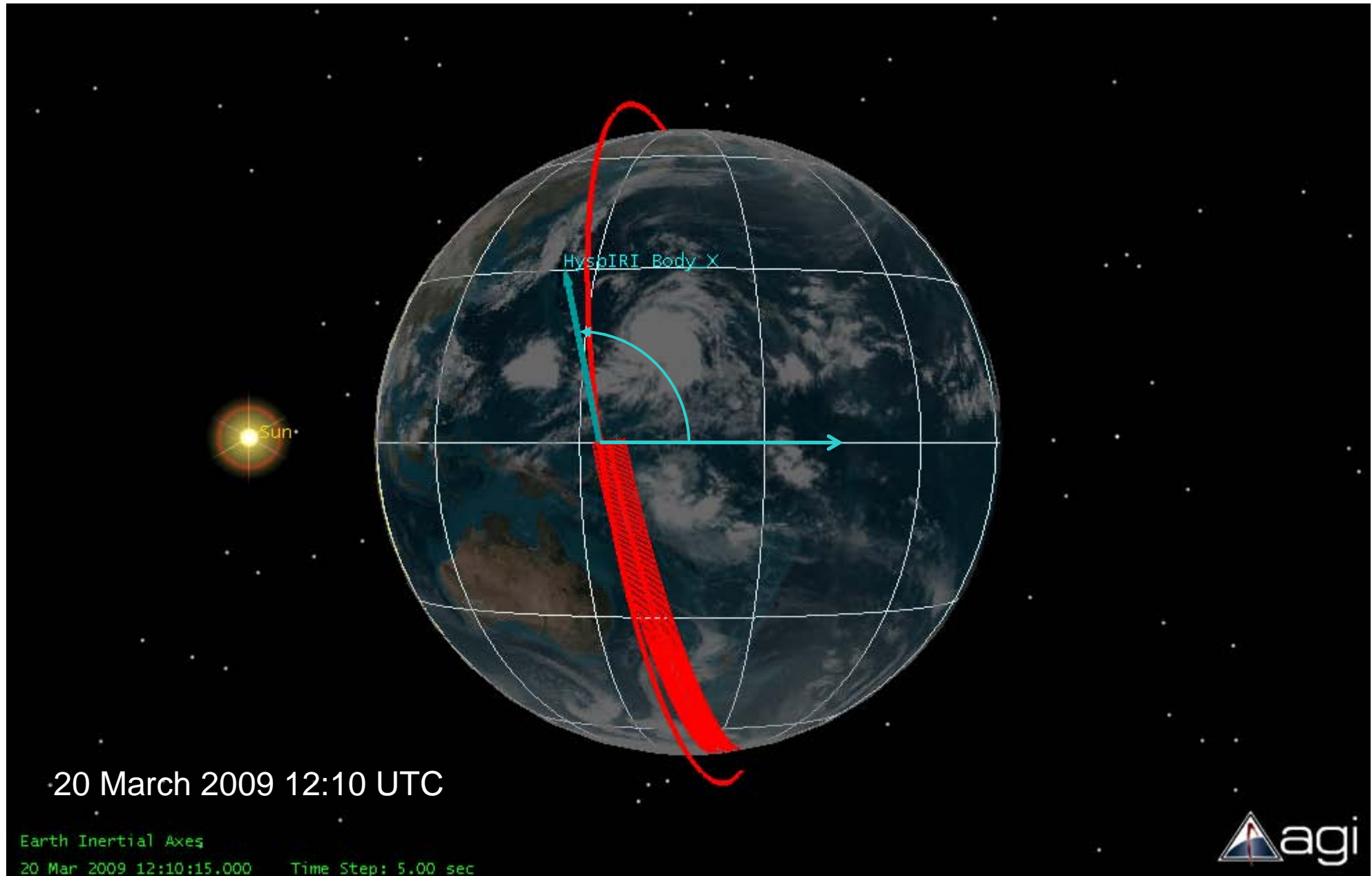
Context

- The HypsIRI mission, as budgeted, provides level 0, 1, and 2 products.
- Investigators, multi-investigator teams, or broad collaborations need to develop the level 3 or 4 data products that will meet HypsIRI's wider objectives.
- Level 2 data are provided at the native resolution (spatial and temporal) of HypsIRI's sensors.

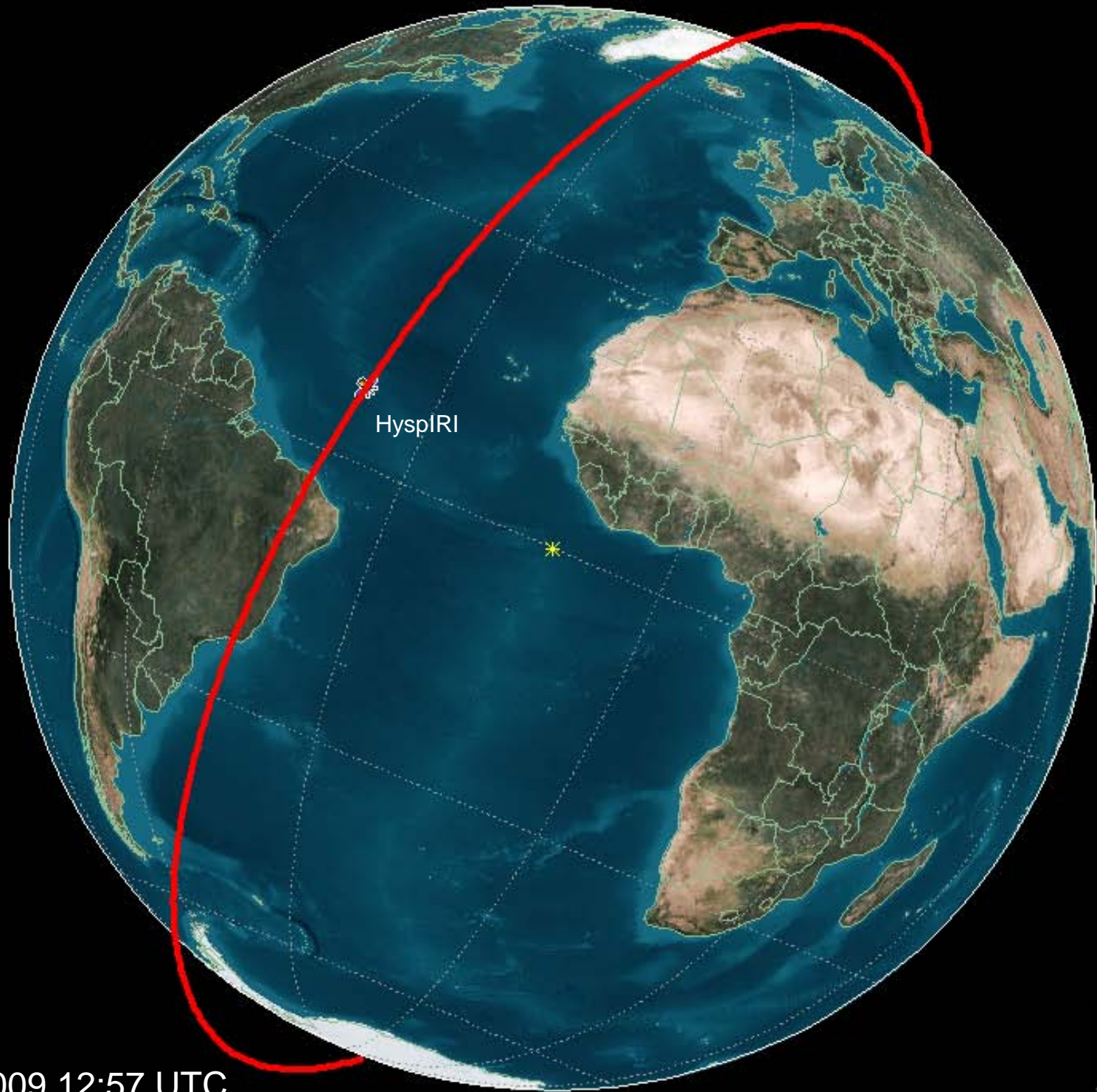
Outline

- Orbital geometry and repeat cycles for a suitable reference orbit
- Imaging opportunities for each sensor (TIR & VSWIR)
 - Variation in frequency with latitude
 - Overpass times/dates for example sites
- Issues for developers of level 3/4 data products.

Orbital inclination (97.9°) represents the angle between the Earth's equatorial plane, and the orbit plane, measured (by convention) at an ascending node.

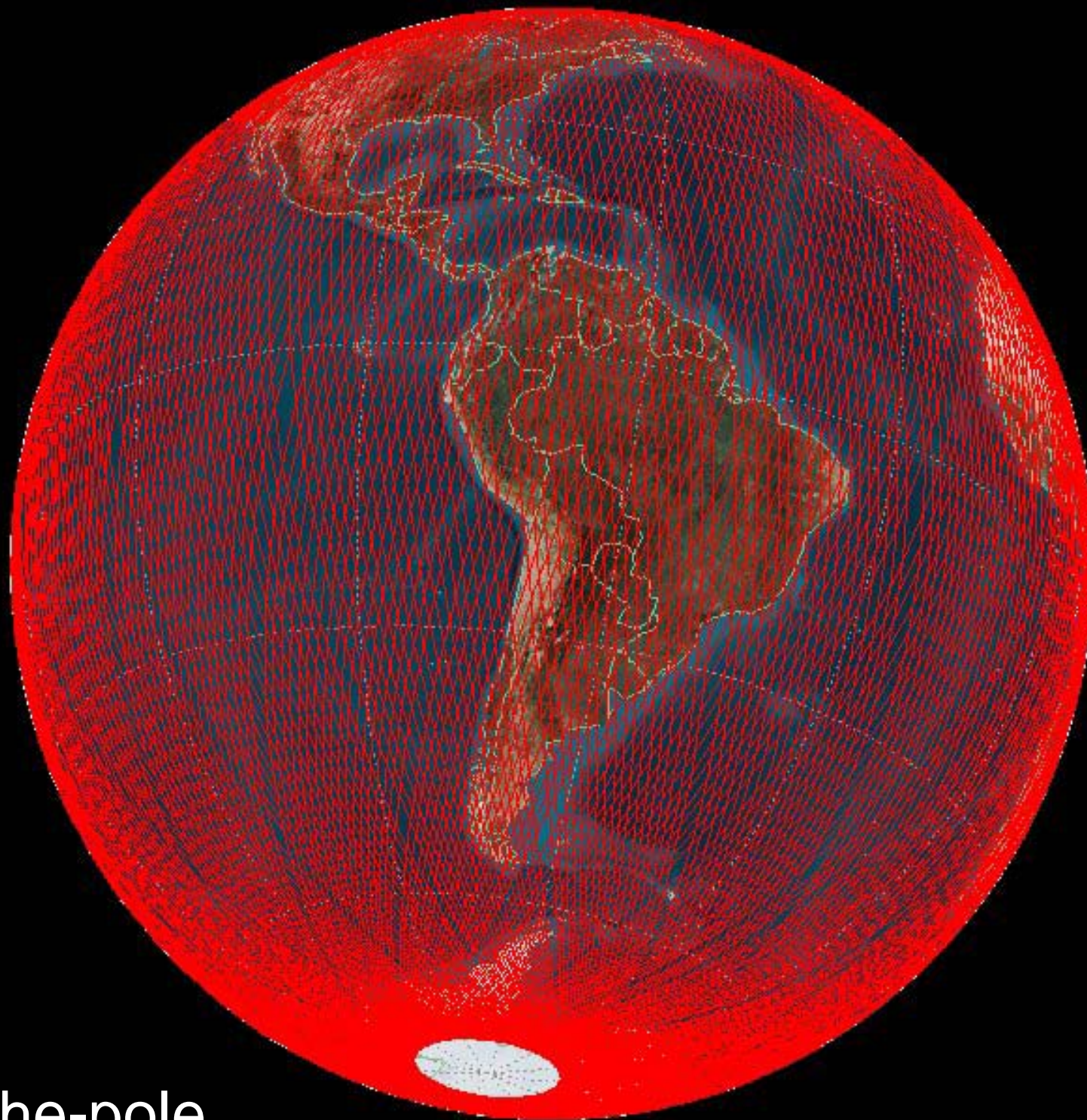


Night-side view, looking towards the Sun in the plane of the equator. Note spacecraft X axis in direction of along-track motion (blue), also see orbit track (red, 626.8 km altitude), spacecraft ground track & swath of TIR sensor (red).



20 March 2009 12:57 UTC



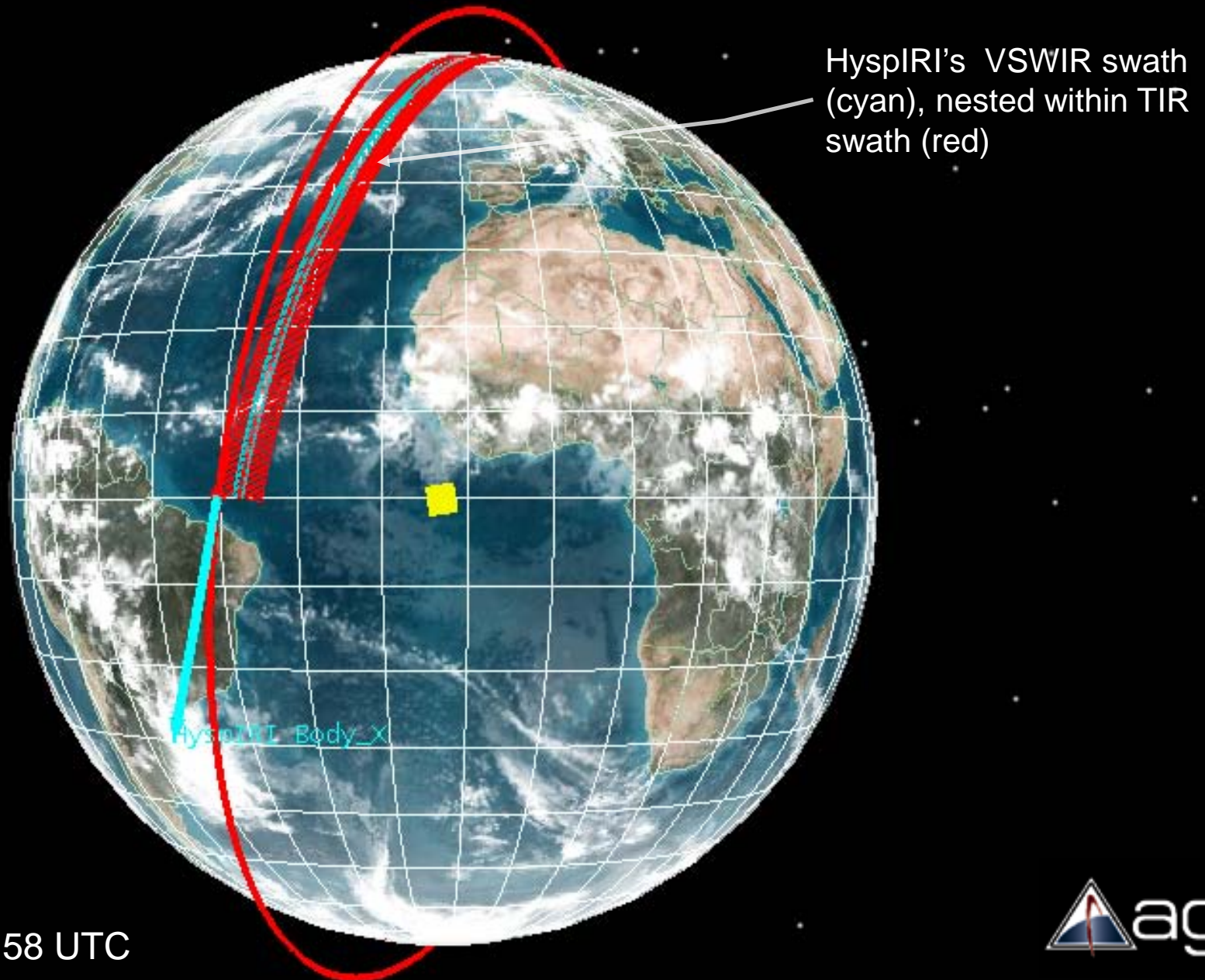


Sun
MyspIRI

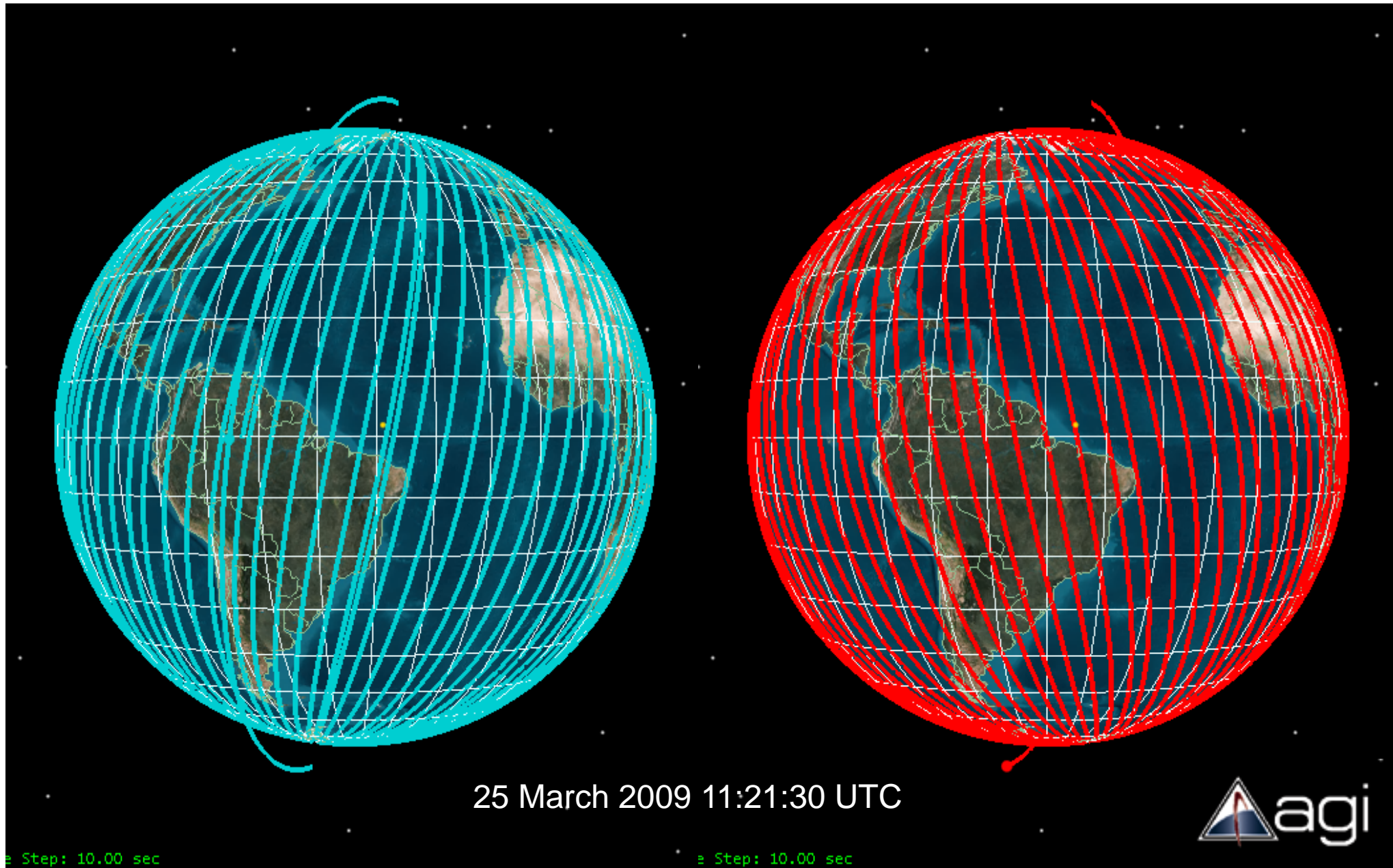
Hole-at-the-pole



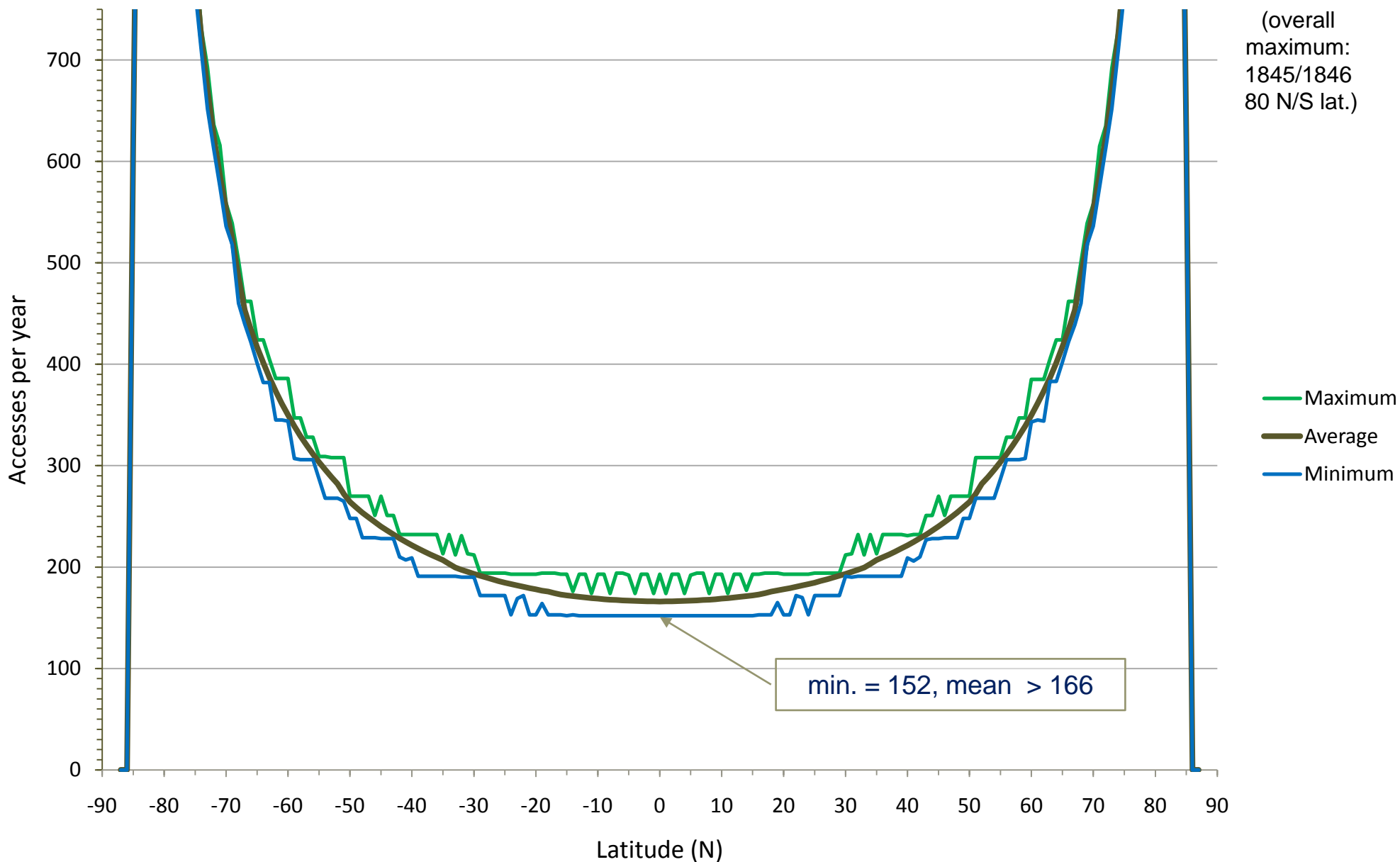
Daylight side of a sun-synchronous reference orbit, with 10:30 AM equatorial crossing (mean local time) at a descending orbit node. The sub-solar point (yellow) shows the location on Earth where the Sun is directly overhead, east of the ground track.



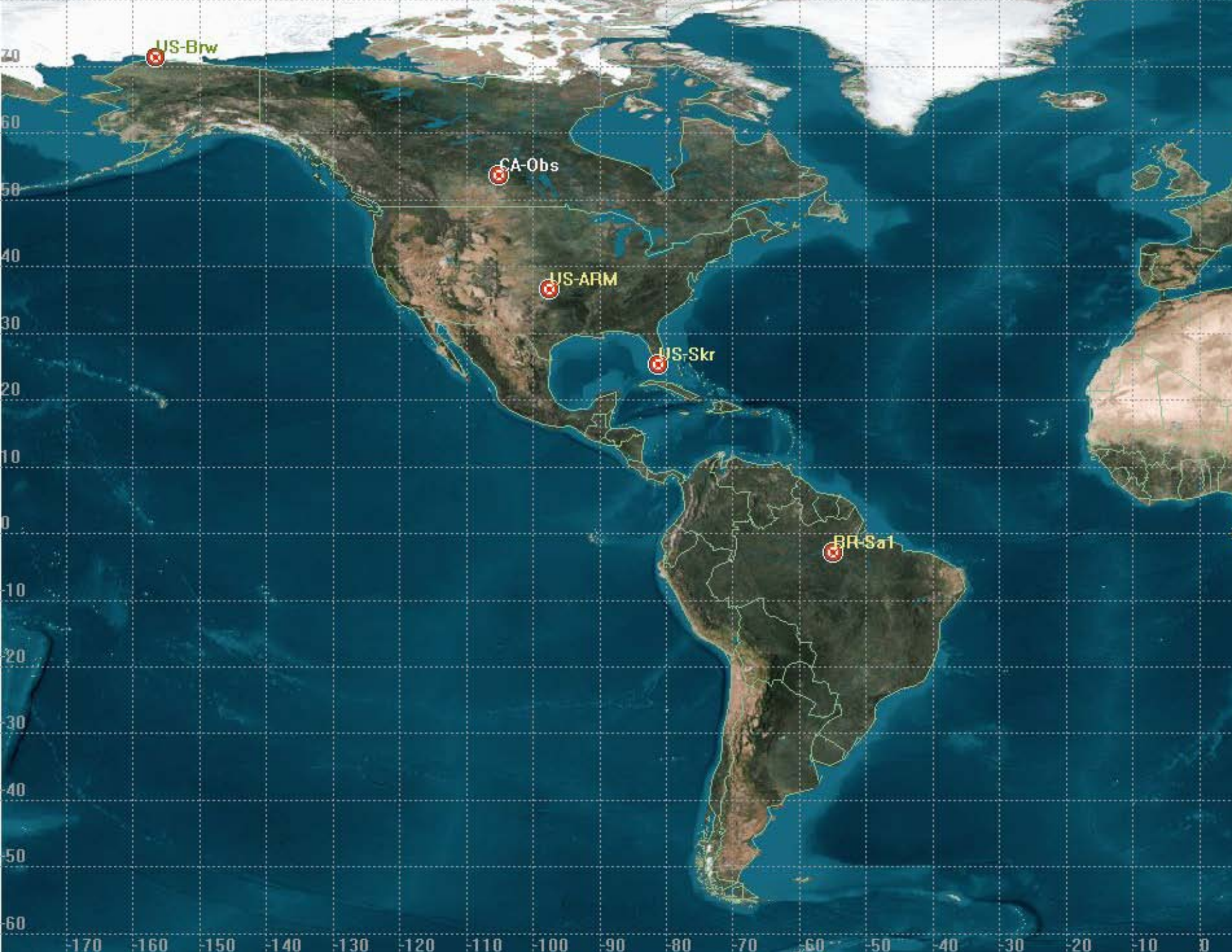
HyspIRI ground tracks shortly after completing a 5-day near repeat pattern:
(a) blue – descending (day) passes and orbit track;
(b) red – ascending (night) passes and orbit track.



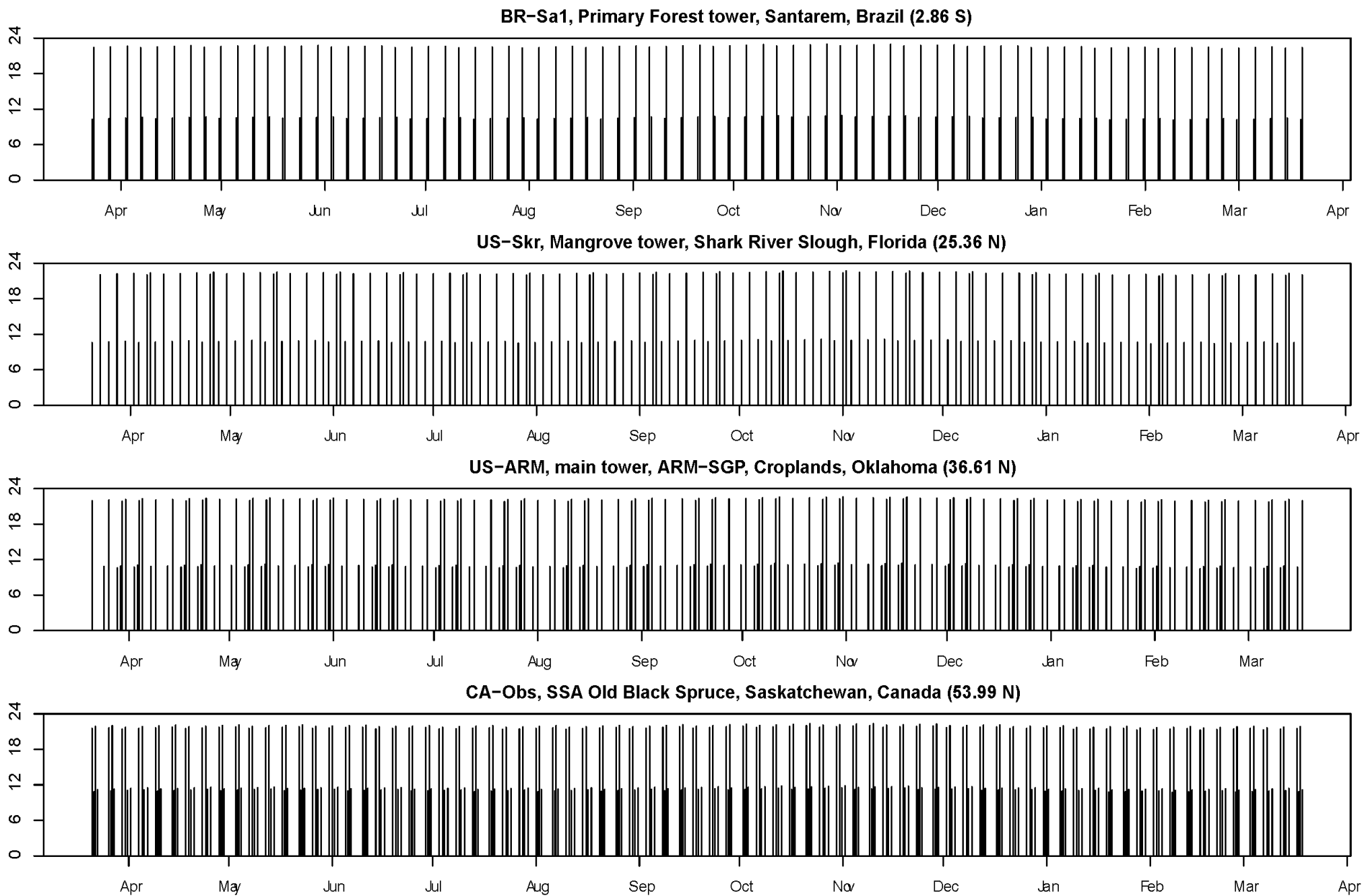
Annual TIR imaging opportunities in a 19/5-day repeat HypsIRI reference orbit
Swath: 50.92°, symmetric about nadir. Sampled using a 1 by 1 deg. coverage.



Nominal orbit: average alt. 626.8 km, inclination 97.8°. TIR imager FOV: +/- 25.46° (60 m pixel GSD at nadir, 9272 cross-track pixels).
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 7, 2010.

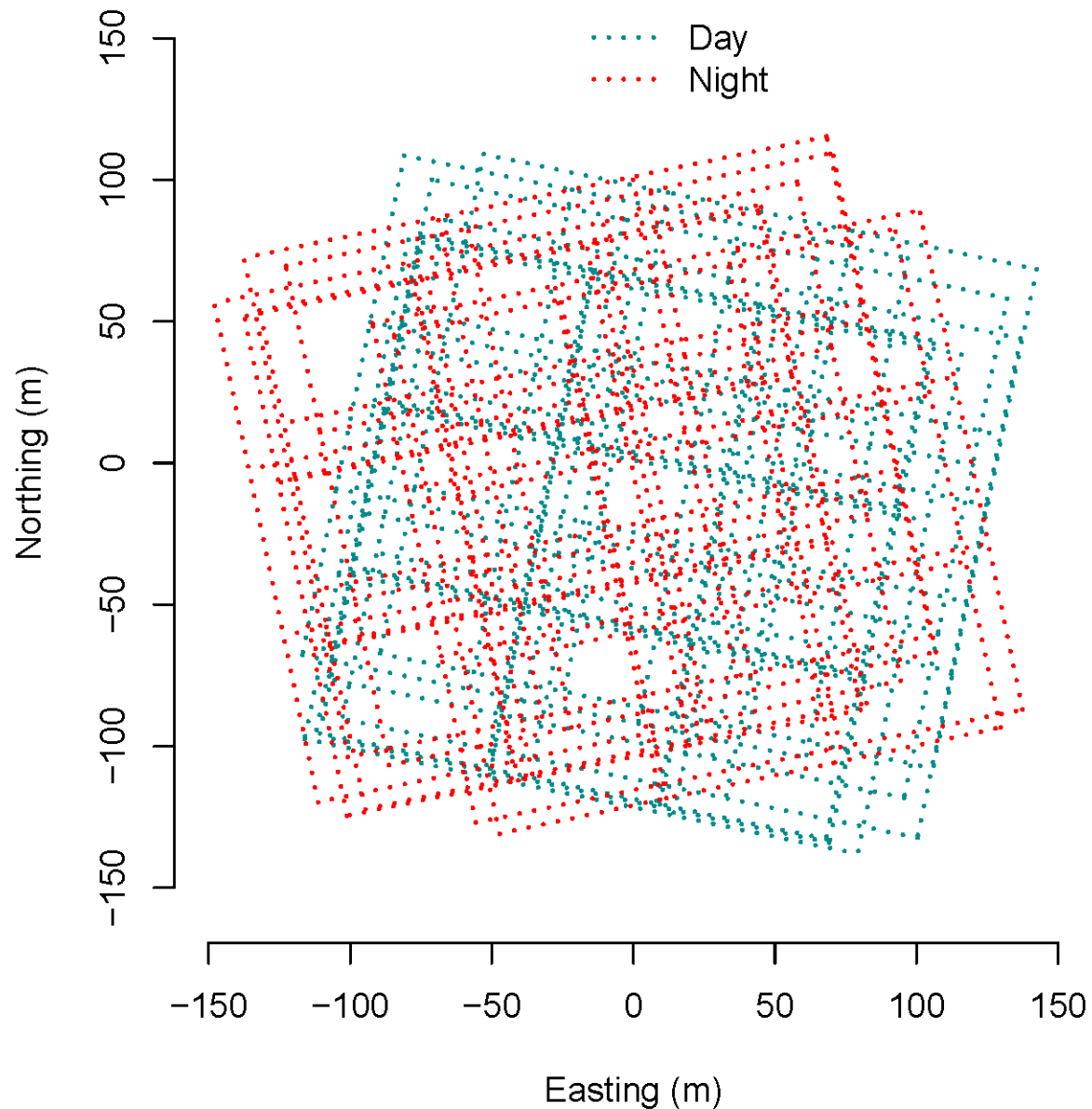


TIR imager accesses to four selected FLUXNET sites 1 simulated mission year: date & local apparent time

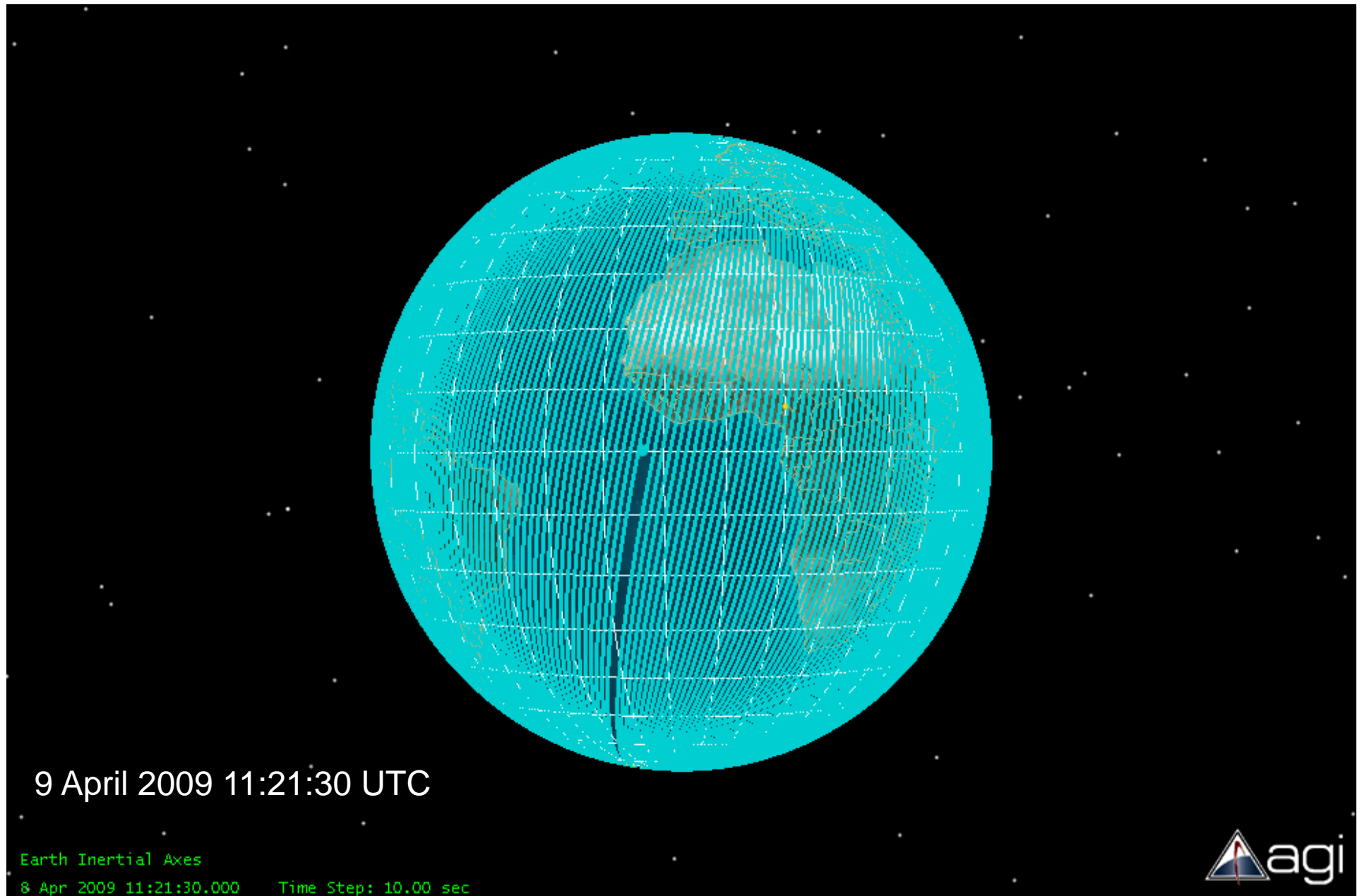


14 potential image collects for 1 simulated month (equatorial site)

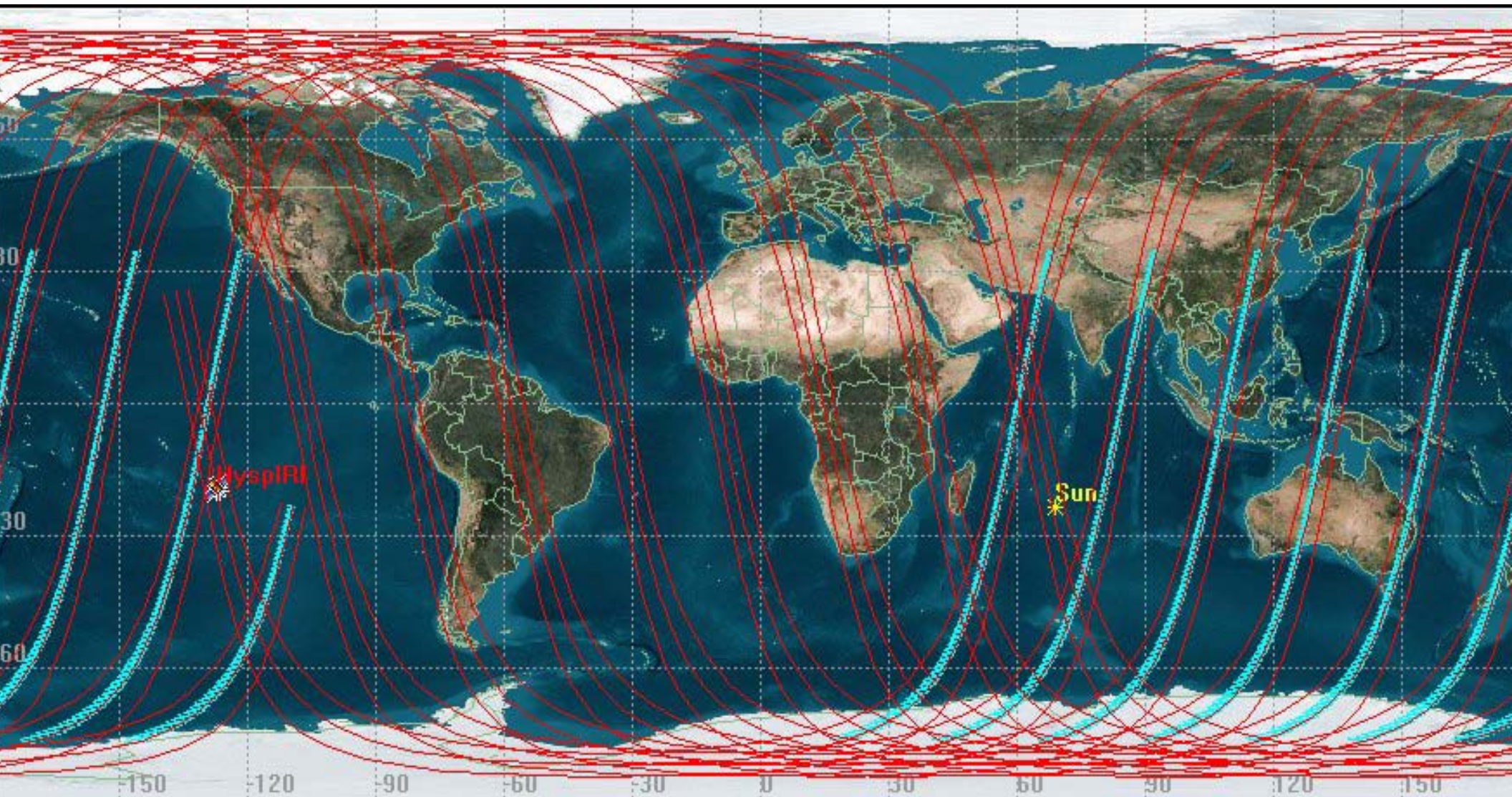
1 Month of TIR Accesses to BR-Sa1, 3X3 pixels (GSD)



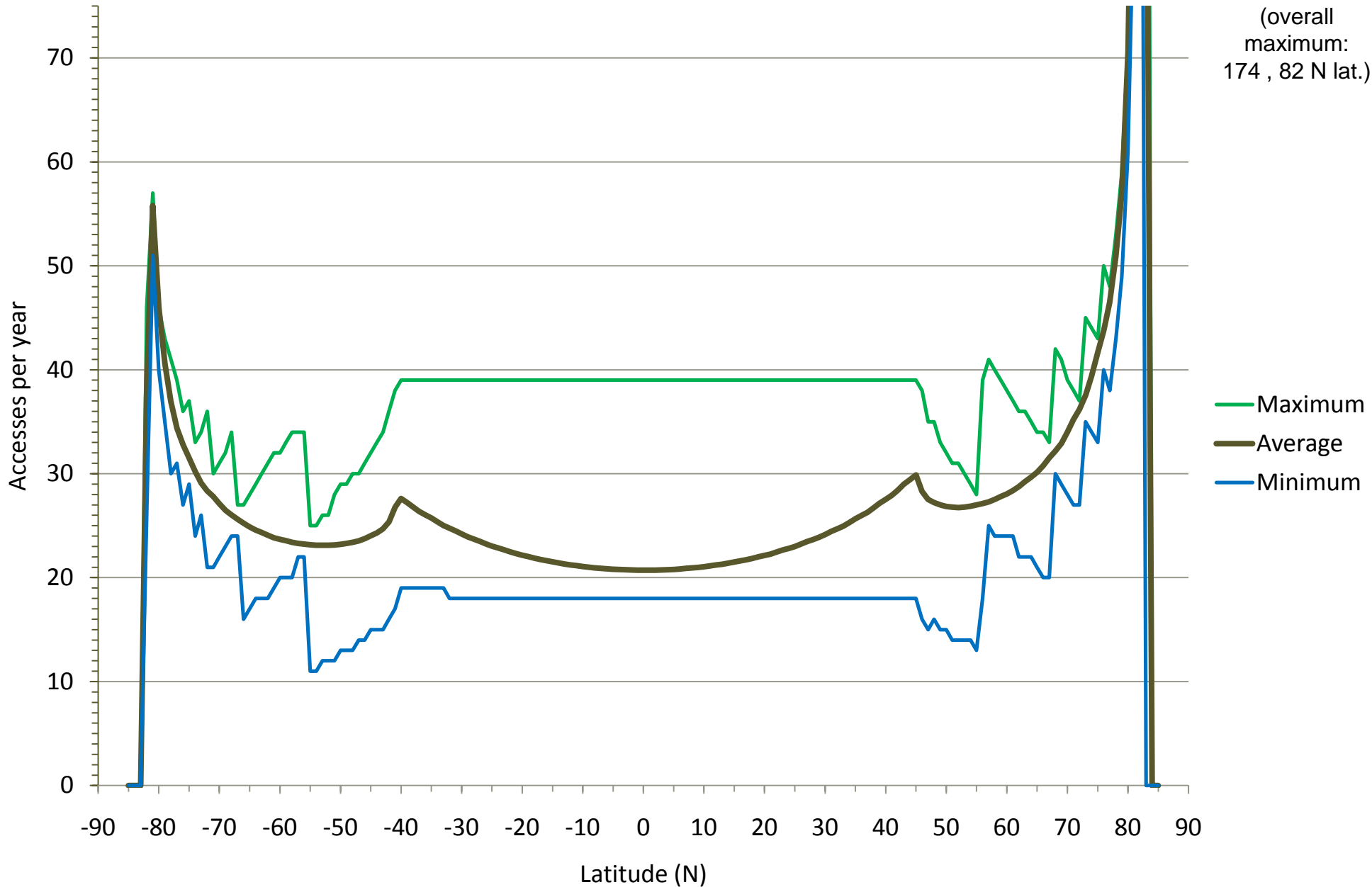
HyspIRI ground-track pattern when a 19-day repeat cycle is almost complete, showing only ground tracks with descending nodes. (VSWIR swaths overlap.)



VSWIR's Local solar illumination constraint (SZA < 70 deg.) Northern Hemisphere Winter Solstice



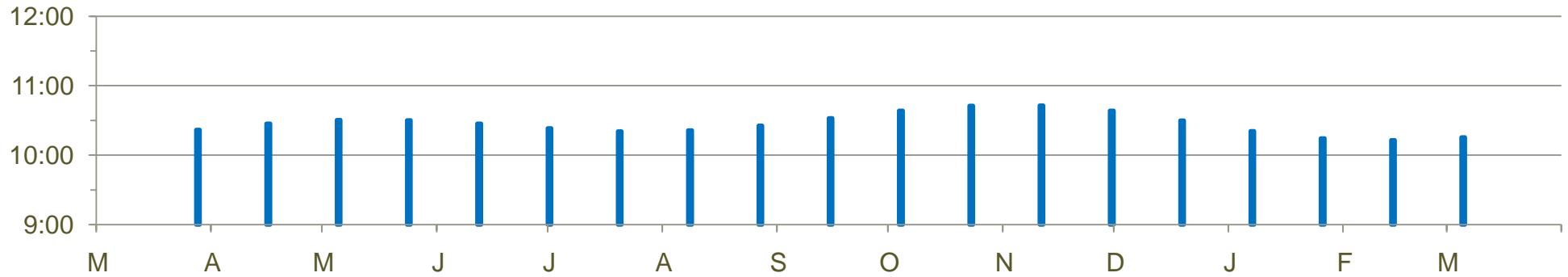
Annual VSWIR imaging opportunities in a 19-day repeat HypsIRI reference orbit
Swath: 13.62°, pointed 4° west; local solar elevation angles > 20°; 1° by 1° coverage



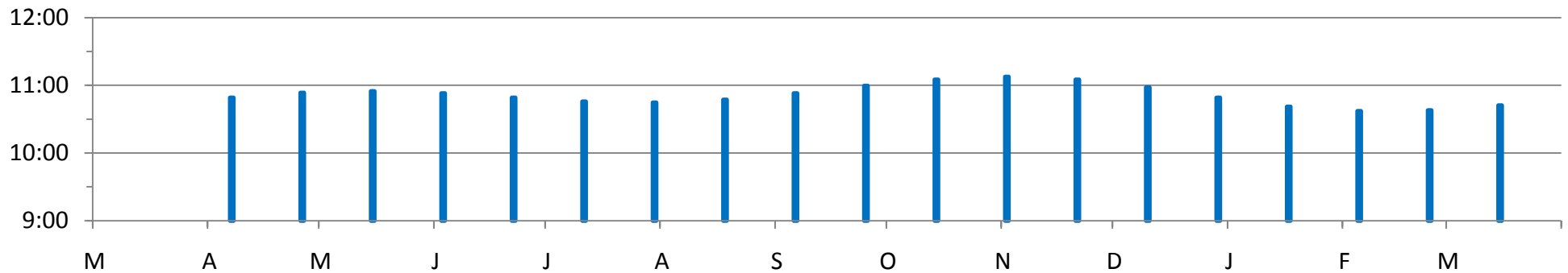
Nominal orbit: av. alt. 626.8 km, incl. 97.8°. VSWIR spectrometer FOV: 2.8° E, 10.8° W (60 m pixel GSD at nadir, 2480 cross-track pixels).
R.G. Knox, NASA GSFC, Biospheric Sciences Branch, Code 614.4. Simulated with STK v8.1.3, March 7, 2010.

VSWIR spectrometer accesses to three selected FLUXNET sites 1 simulated mission year: date & local apparent time

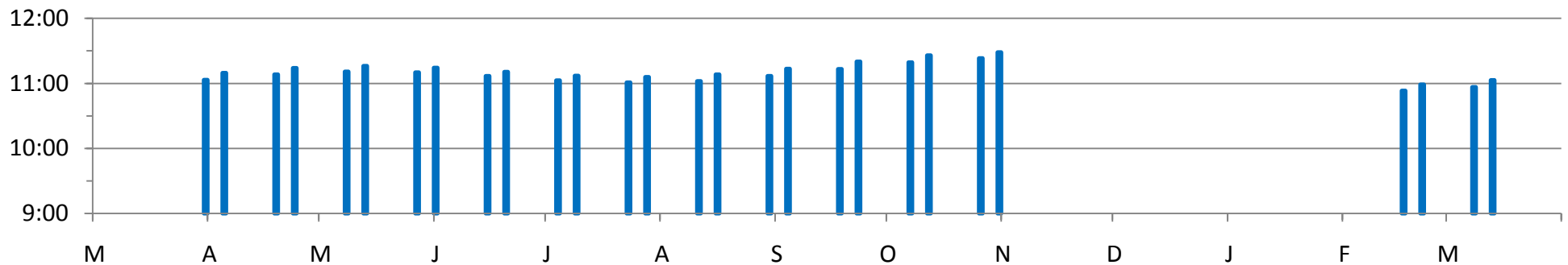
BR-Sa1: Brazil - Santarem km 67, Primary Forest (2.86 S)



US-ARM: Southern Great Plains, Oklahoma, Main Tower, Croplands (36.6 N)

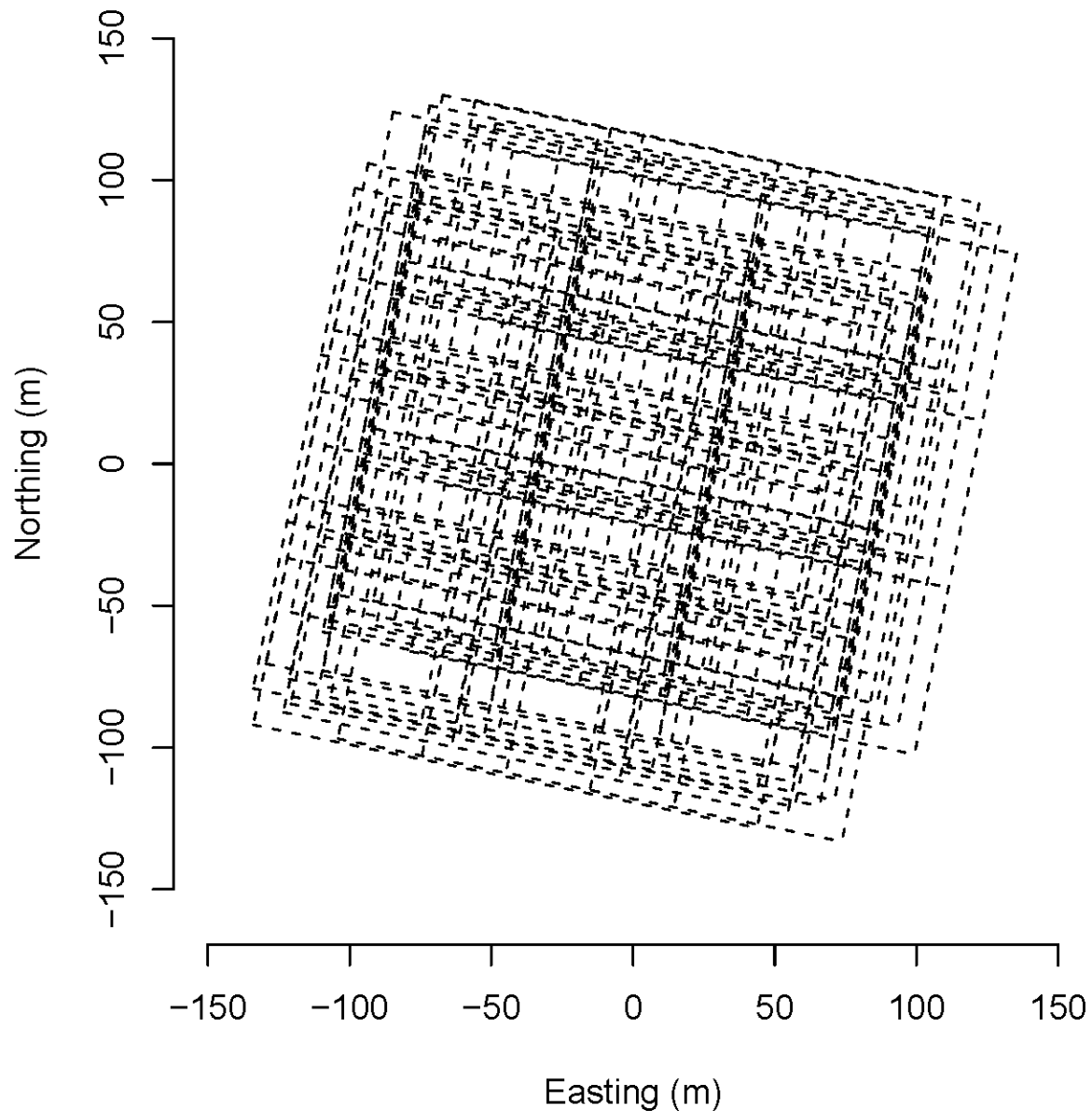


CA-Obs: Canada, Saskatchewan, BOREAS SSA - Old Black Spruce (53.99 N)



19 potential image collects for 1 simulated year (equatorial site)

3X3 pixels (GSD) for BR-Sa1 VSWIR Accesses



Some issues & options: VSWIR or TIR data products

- Providers of **global** level 3/4 data products will see full level 2 data stream(s).
- Where cloud cover is common, compositing will produce more complete seasonal and/or annual global data products.
- Level 2 products feeding multi-temporal level 3 and 4 products will have their pixels geolocated but are not re-sampled to a fixed resolution or grid.
- Questions:
 - *When will it be more appropriate to composite results of intermediate level 3 algorithms, rather than level 2 products?*
 - *What level 3 VSWIR products can be derived directly from level 2 pixels, before spatial re-sampling?*
 - *How critical is data latency for particular level 3/4 products? (For which time-critical products is it viable to use on-board processing and direct broadcast?)*

