Combined VSWIR/TIR Products Overview: Issues & Examples

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Introduction

Context

- VSWIR data collected at 19-day intervals for most areas.
- TIR data collected day & night on a 5-day cycle (more frequent at higher latitudes).
- TIR swath is 4X as wide as VSWIR (.: wider range of view angles).
- 5-day orbit repeat is approximate (.: same locations viewed from different angles and different GSD).

Outline

- Nested swath geometry for reference point design.
- Coverage simulations for example FLUXNET tower sites
  - Re-visit frequency varies with latitude
  - Overpass times vary with latitude
  - Between VSWIR collects, TIR overlap geometry and timing varies with latitude (broadly) and location.
HyspIRI observatory crossing 40 N in the central U.S.

VSWIR swath (light blue) is nested within TIR swath (red), with a swath center offset west of the satellite's ground track. (Cross-track rectangles drawn for simulated 5 s time-steps.) 20 March 2009, 17:40:10 UTC
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.

What is FLUXNET?
VSWIR accesses for 1 simulated year

Brazil - Santarem km 67 (LBA), Primary Forest (2.86 S)

US - Florida Everglades, Shark River Slough, Mangrove Forest (25.36 N)

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

Canada - Saskatchewan - (BOREAS) SSA Old Black Spruce (53.99 N)

US - Barrow, Alaska, Moist Tundra (71.32 N)

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Local time of VSWIR overpasses of 5 FLUXNET sites, simulated for 1 year

Local apparent time, for a fixed mean local time, varies with the Earth’s orbit.

As the N latitude of the site increases, the local apparent time of potential VSWIR accesses also increase.

Near the north orbit pole (82.1 N) the local time of potential accesses may be nearly 6 hours later than when crossing the equator (not shown).

Moving toward the south orbit pole local times are progressively earlier in the morning (not shown).

BR-Sa1, Primary Forest tower, Santarem-Km67, Brazil (2.86 S)

US-Skr, Mangrove tower, Shark River Slough, Florida (25.36 N)

US-ARM, main tower, ARM-SGP, Croplands, Oklahoma (36.61 N)

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

US-Brw, Moist tundra flux site, Barrow, Alaska (71.32 N)
TIR accesses for 1 simulated year

BR-Sa1, Primary Forest tower, Santarem, Brazil (2.86 S)

US-Skr, Mangrove tower, Shark River Slough, Florida (25.36 N)

US-ARM, main tower, ARM-SGP, Croplands, Oklahoma (36.61 N)

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

US-Brw, Moist tundra flux site, Barrow, Alaska (71.32 N)
Local time of TIR overpasses of 5 FLUXNET sites, simulated for 1 year

Near the equator, overpass times are separated by 12 hours, on average.

As the N latitude of the site increases, potential TIR collects are more frequent and less tightly clustered in local time.

Also, moving toward the north orbit pole (82.1 N) daytime collects are later and night collects earlier, whereas moving south the reverse is true (not shown).
Example of potential HyspIRI TIR data within 10 days of VSWIR coverage, for a near-equatorial study site in Brazil

Daylight accesses (cyan) include 1 coincident with the SWIR coverage and 3 other dates. Potential night data (red) include 5 overpasses, 1 within 13 hours of the SWIR coverage.

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Example of potential HyspIRI TIR data within 10 days of VSWIR coverage, for a mid-latitude study site in Oklahoma

Daylight accesses (cyan) include 1 coincident with the SWIR coverage and 5 other dates. Potential night data (red) include 6 overpasses.

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Example of potential HyspIRI TIR data within 10 days of VSWIR coverage, for a boreal study site in Saskatchewan.

Daylight accesses (cyan) include 1 coincident with the SWIR coverage and 7 other dates. Potential night data (red) include 9 overpasses.

Some issues & options: Combined VSWIR & TIR data

- Level 2 pixels are geolocated but not re-sampled.
- Single-instrument level 3/4 data products might already be spatially re-sampled or composited across multiple overpasses.
- Providers of global combined data products may need to handle data volumes equivalent to both level 2 data streams.

Questions:

- How might combined data products be affected by the overpass time-of-day differences or variation in view azimuths shown in these simulations?
- Will HyspIRI need standard grids for multi-temporal data products?
- What options for producing and distributing level 2/3/4 data products will be viable in 5+ years?

Regional processing & re-distribution nodes? Release code to run at central, regional, or end-user sites? Peer-to-peer distribution of high interest data?