Detection of archaeological sites hidden by a forest canopy using Sentinel-1 time-series
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Introduction

- Airborne Laser Scanning (ALS) effective at discovering new structures on known sites covered in vegetation.
- Costly, use for detecting fully unknown sites discouraged.
- Requires an additional way to find probable sites location.
- Objective: detection of archaeological sites hidden by a forest canopy, through:
  - Temporal speckle filtering
  - Diversity of points of view provided by Sentinel-1

Conclusion

- Green is both
- Blue is East
- Red is West
- Arbitrary colormap

Application: archaeological site of Lamanai, Belize

- Mayan archaeological site, northern Belize
- Map found in an archaeological article [4]
  - Projected over optical (fig. 8 top) and SAR ratio (fig. 8 bottom)

Figure 9: a) Optical image [1] of the High Temple (structure N10-43), with archaeological map overlaid in red. b) Output of the technique over the same area, with the map in white.

Figure 10: a) Optical image [1] of the two hidden structures (P9-25 and P8-1), with archaeological map overlaid in red. b) Output of the technique over the same area, with the map in white.

Method

1. Temporal Speckle Filtering

- Spatial speckle filtering degrades spatial resolution [2]
- Impacts detection of small targets
- Temporal speckle filtering degrades temporal resolution [3]

2. Ascending / Descending Ratio

- Sentinel-1 satellite: heliosynchronous orbit (fig. 5)
- Two points of view: Ascending and Descending
- Projection of the images to a common geographical grid
- Ratio of Ascending images over Descending images

- Highlights East-West dissymmetries
- Q° = σ°_{dub}/σ°_{des} (or in dB: Δσ°_{dub} = σ°_{dub} - σ°_{des,dub})
- Arbitrary colormap

- Here, red is West, blue is East, green is both.
- Process presented in fig. 6 and 7, and applied to an archaeological site surrounded by jungle in the next part.

References