Characterization of physical and chemical parameters of Guiana shield surfaces
Application to geological & regolith mapping

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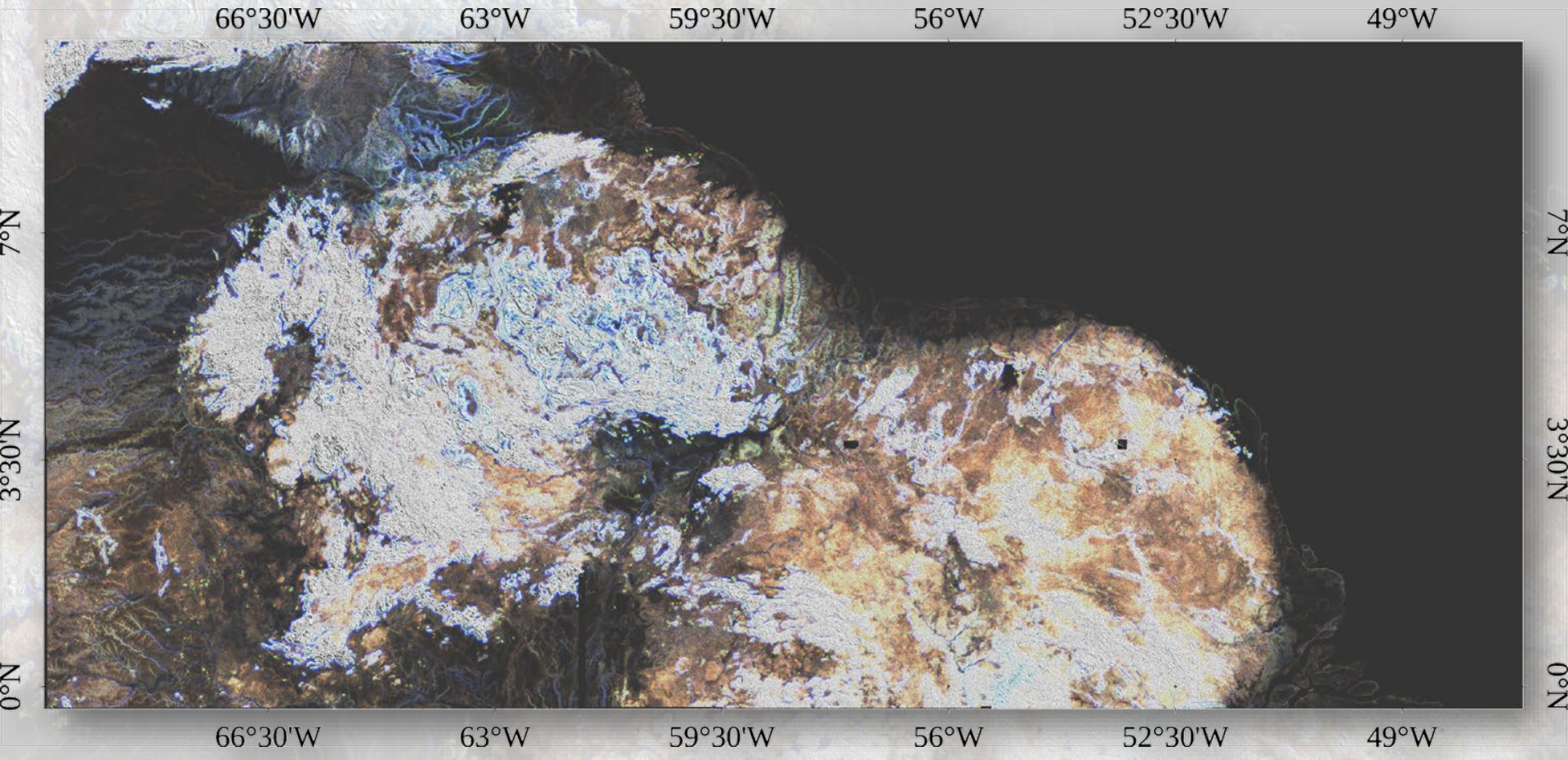
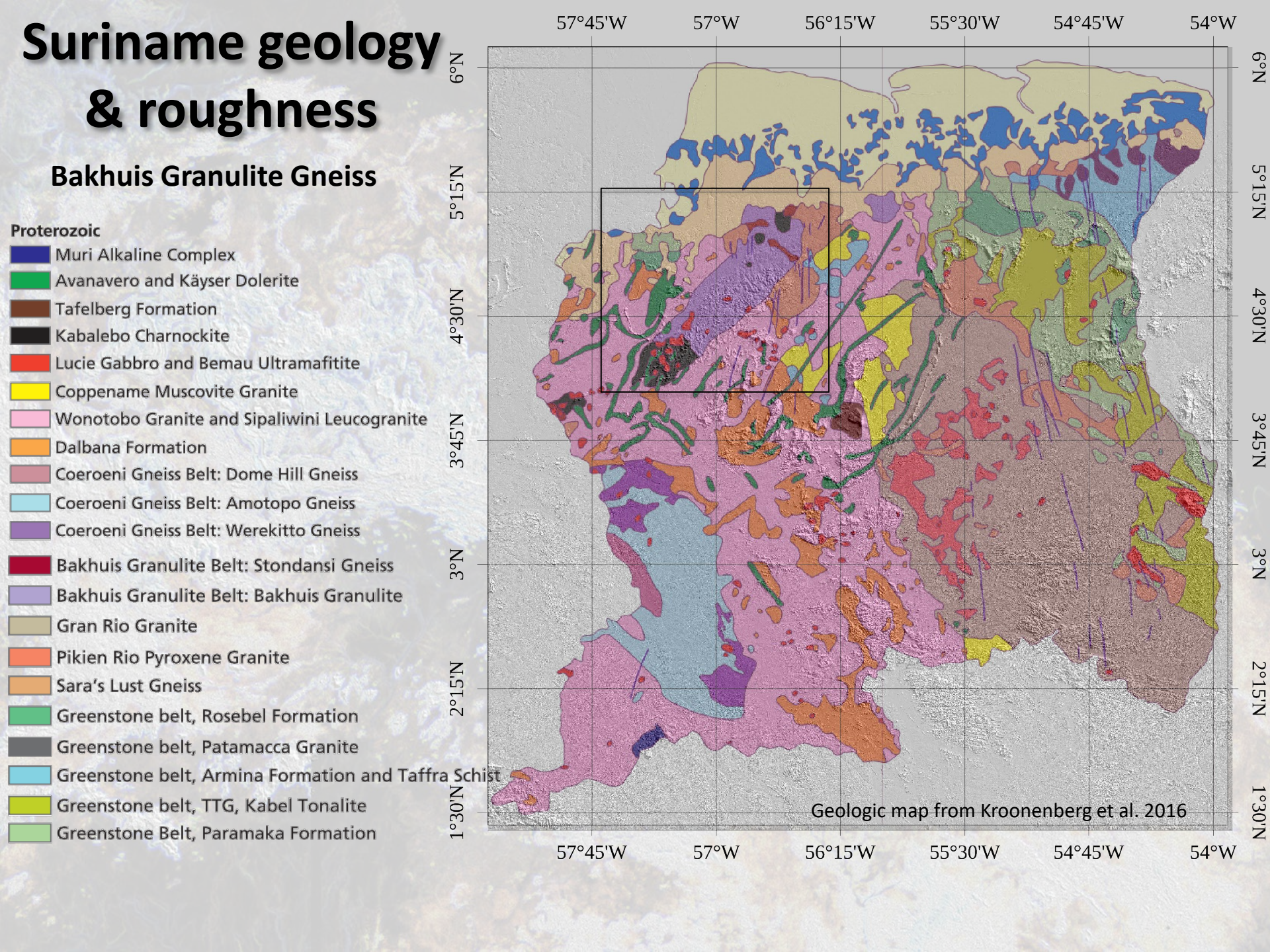
Motivations

- In the context of limited outcrops, new approaches may be developed to identify the nature of the bedrock from recent remote sensing data
- Geomorphology – Preliminary results in West Africa and previous works in the Guiana shields (Kroonenberg and Melitz 1983, Bugnicourt et al. 2018) indicate the potential of quantitative geomorphological approaches (=> multi-scale roughness mapping).

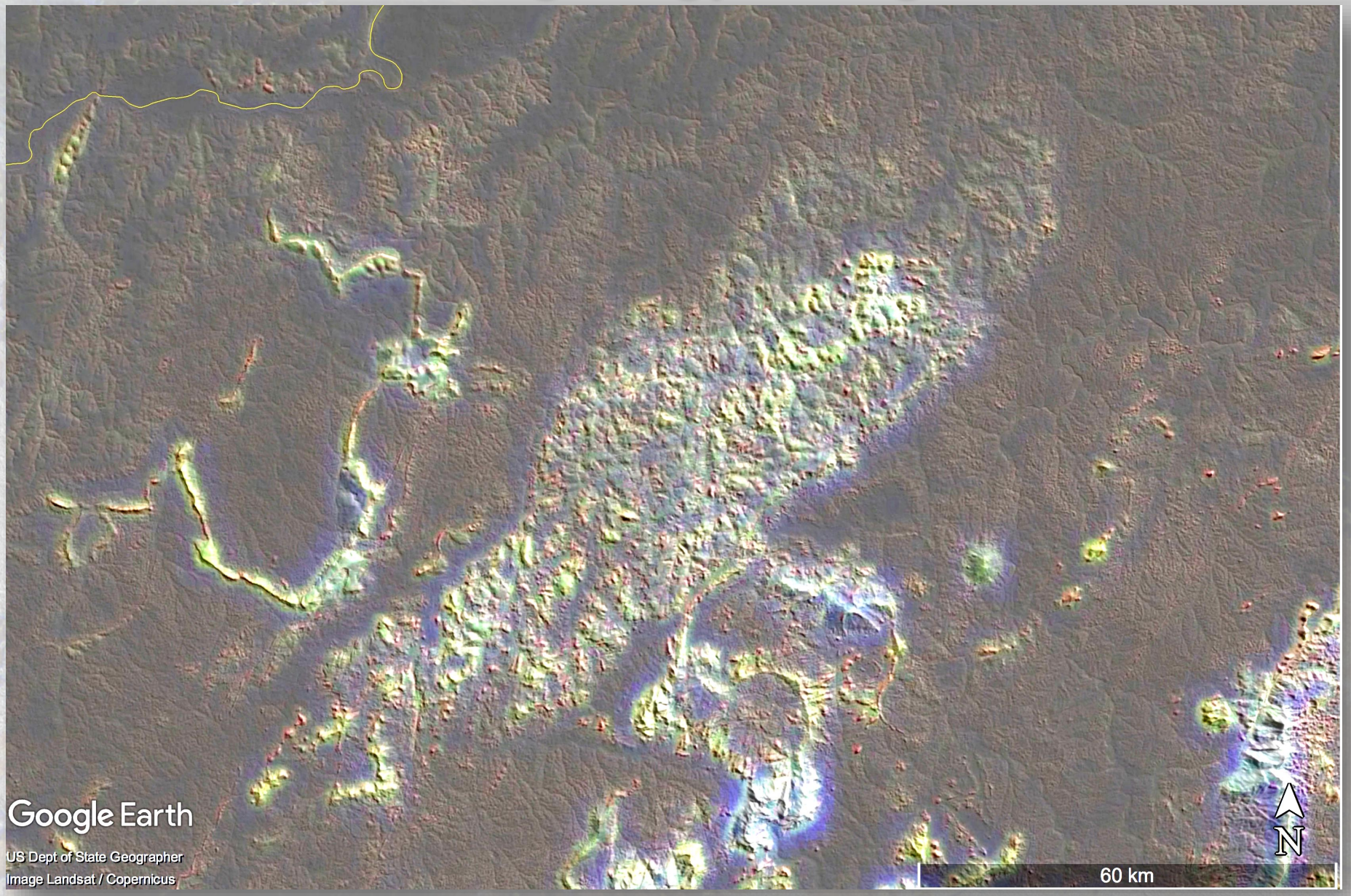


Suriname geology & roughness

Bakhuis Granulite Gneiss



Suriname geology & roughness



Suriname geology & roughness

Geologic map from Kroonenberg et al. 2016

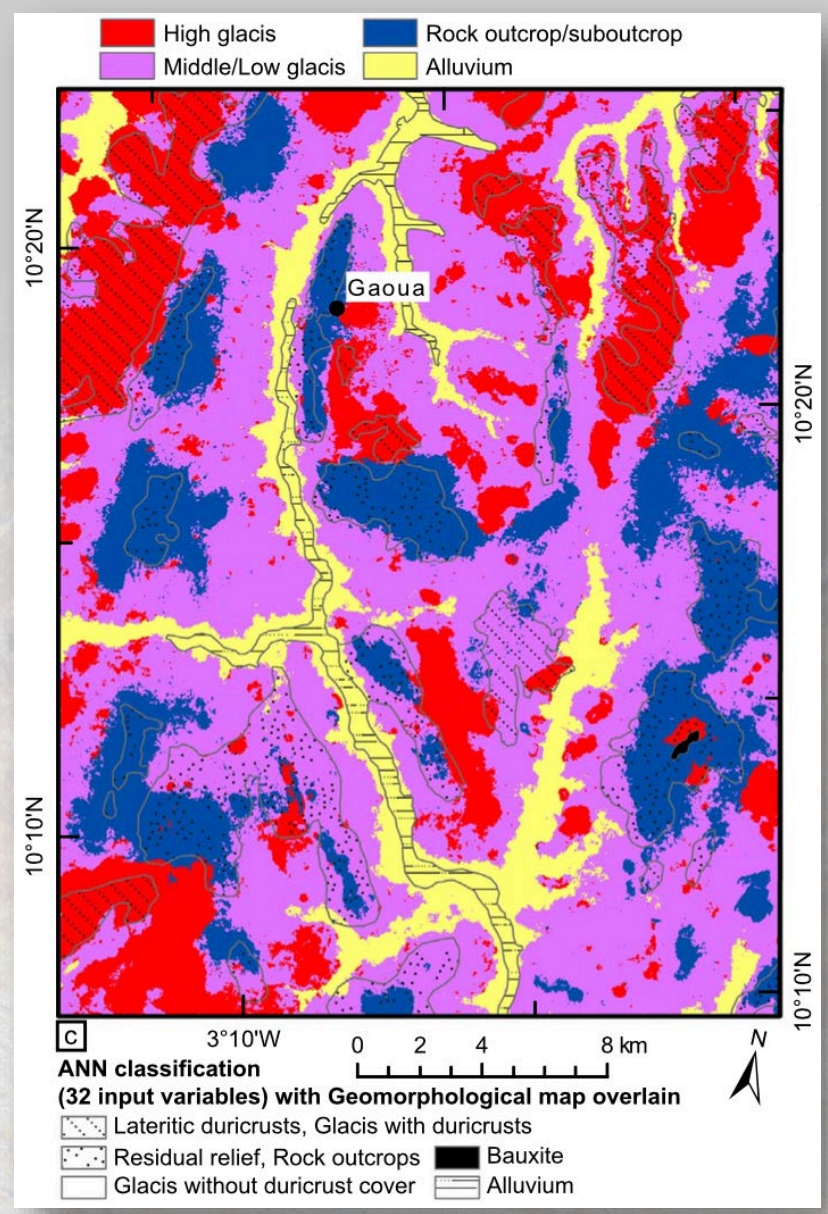
Motivations

- Geostatistical analyses of radiometric data – WAXI experience in the WAC
  Variograms modified by superfical processes
  Potential to distinguish in-situ from transported regolith

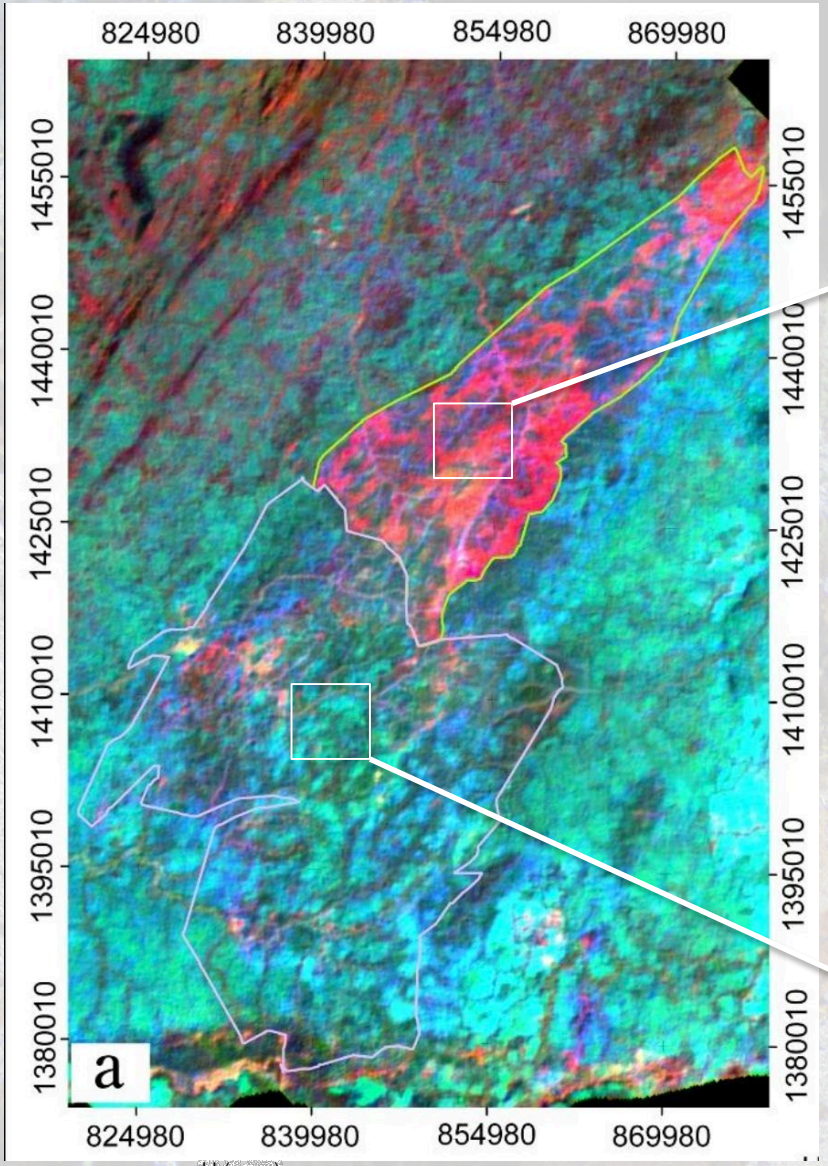
Metelka et al. (2018) Automated regolith landform mapping using airborne geophysics and remote sensing data, Burkina Faso, West Africa. Remote sensing of Environnement.

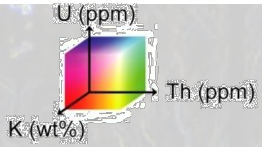
Slope
Roughness
K, Th, U maps
Radar data
Imagery
Geophysics

Machine learning

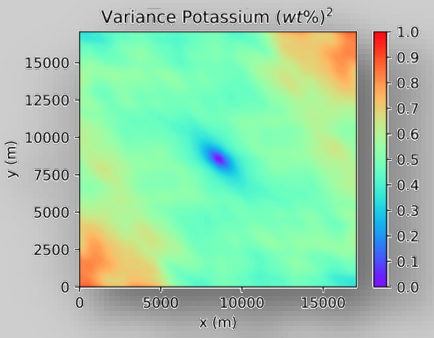


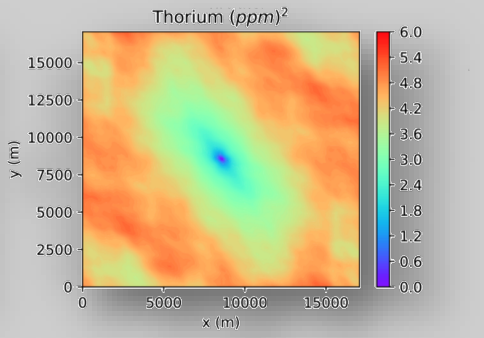
Motivations

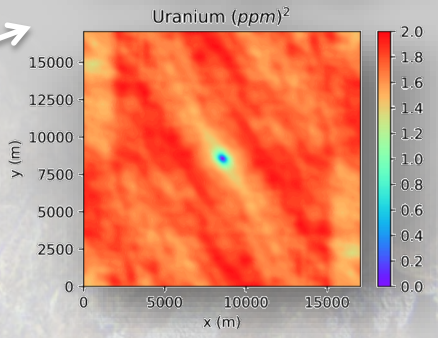


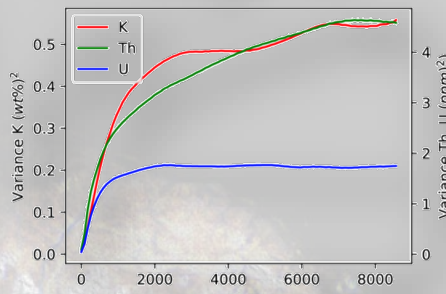


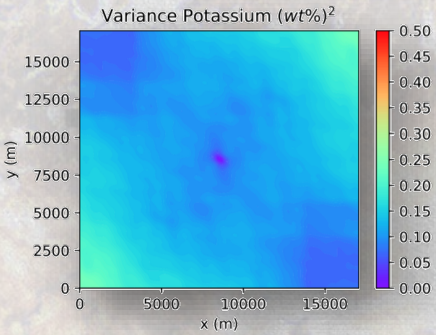
K = 0 - 2 wt%
Th = 0 - 20 ppm
U = 0 - 10 ppm

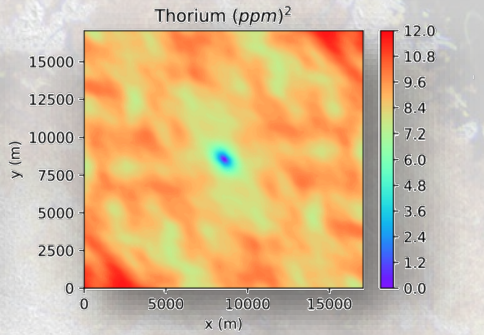


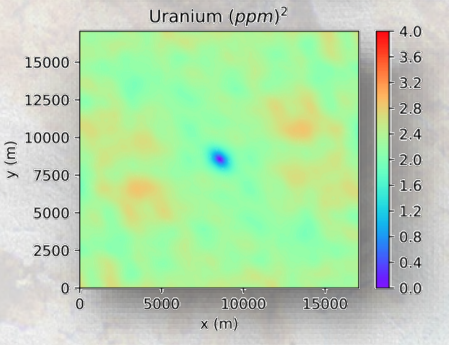


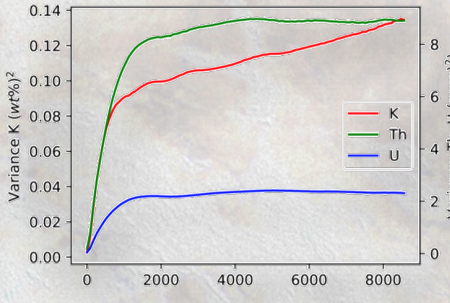












Module objectives - methodological developpements

- Regional quantitative morphology (multi-scale roughness maps)
  Based on SRTM data 1”/pixel and 3”/pixel denoised

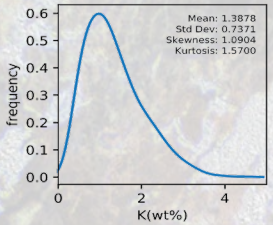
- Regional geostatiscal analyses of radiometric data

Chemical dispersion indices
Geostatistical analyses from airborne radiometrics

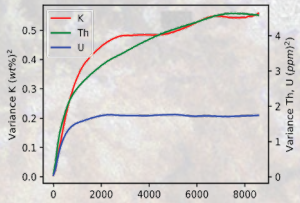
Multi-scale automatic extraction of geostat. parameters

Maps + interpretation

Aiborne radiometrics



Freq. distribution parameters → Map of freq. distribution parameters



Variogram parameters (range, sill, anisotropy) → Map of variograms parameters

- Multi-scale regional roughness maps + geostatistical analyses of airborne radiometrics & comparison with other geophysical data > support for geological & regolith mapping

- Application of similar approaches for high-resolution mapping using high-resolution geophysical data + high-resolution topographic data (Lidar)

Module Deliverables

- **Multi-scale roughness map of the Guiana shield (up to 10 different baselines)**
- **Mapping products based on geostatistical analyses of airborne radiometrics**
- **Regional Interpretations and lessons for the use of similar approaches at the local scale**
- **Multi-scale roughness maps and mapping products based on geostatistical analyses of airborne radiometrics on key localities base on high-resolution data, and interpretation**

This module may be an independent module or part of a module on structural geophysics.

Budget

- High-performance computer: 3000 €
- Software licence (ENVI): ~1000 €/y
- Field work
  Validation of remote sensing interpretations: 4000 €/y
- Participation to annual meeting and other traveling costs 5000 €/y
- Ph.D. student from South America: ~ 40 k€

Total: ~ 73 k€