

Updating century old Congo River navigation maps and revealing their geomorphological secrets

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Abstract

River transport, with more than 17,000 km of navigable channels in the Congo, is a crucial part of the economy for many of the countries sharing the river basin and allows the transport of many goods (timber, charcoal, minerals etc.) and enables access to many areas where roads do not exist. However, river transport falls short of the role it could play in development of the region and has actually declined since the Congo basin countries became independent in the 1960s. This is in part due to years of civil unrest, aging equipment, a lack of infrastructure maintenance, and the poor support and operation of public waterway agencies. River navigation maps are a specialist form of map specifically designed to allow safe navigation of river traffic such as for barges carrying cargo. Boat captains use them as they travel along the river to follow the advised navigation route and avoid hazards such as submerged rocks and shallow channels. The navigation maps for the 1,700 km of river between Kinshasa and Kisangani are issued by RVF (Régie de Voie Fluvial), the state river navigation authority, and are therefore used by all boat captains. These maps originate from the early 1900s and have not been updated since colonial times. As part of the CRuHM project we are exploring the possibility of updating these maps using modern remote sensing methods, together with RVFs experienced input. As part of the update process, RVF have provided us with detailed digital scans of the original navigation maps and we are geo-referencing these to modern geospatial projections, in line with the remote sensing data. This provides us with a unique opportunity to compare snapshots of the river system geomorphology separated by nearly 100 years. We will show the current state of the project and some of the river secrets we have discovered so far.

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Introduction

- River transport relies on > 17,000 km of navigable channels
- A crucial part of the economy for river basin countries
- Development of the region held back as river transport has declined since the Congo basin countries became independent in the 1960s

Navigation Maps

- River navigation maps are a specialist map for safe navigation
- Captains use them for the advised navigation routes and avoid rocks and shallow channels
- Navigation maps between Kinshasa and Kisangani (1,700 km) are issued by RVF (Régie de Voie Fluvial), the state river authority
- There are 60+ maps each showing a 30km long reach
- These maps originate from the early 1900s and have not been updated since the early 1900s (Note, there is a PANAV project to update them)
- For the CRuHM project we are using remote sensing to study the river
- This provides us with a unique opportunity to compare snapshots of the river system geomorphology separated by nearly 100 years.

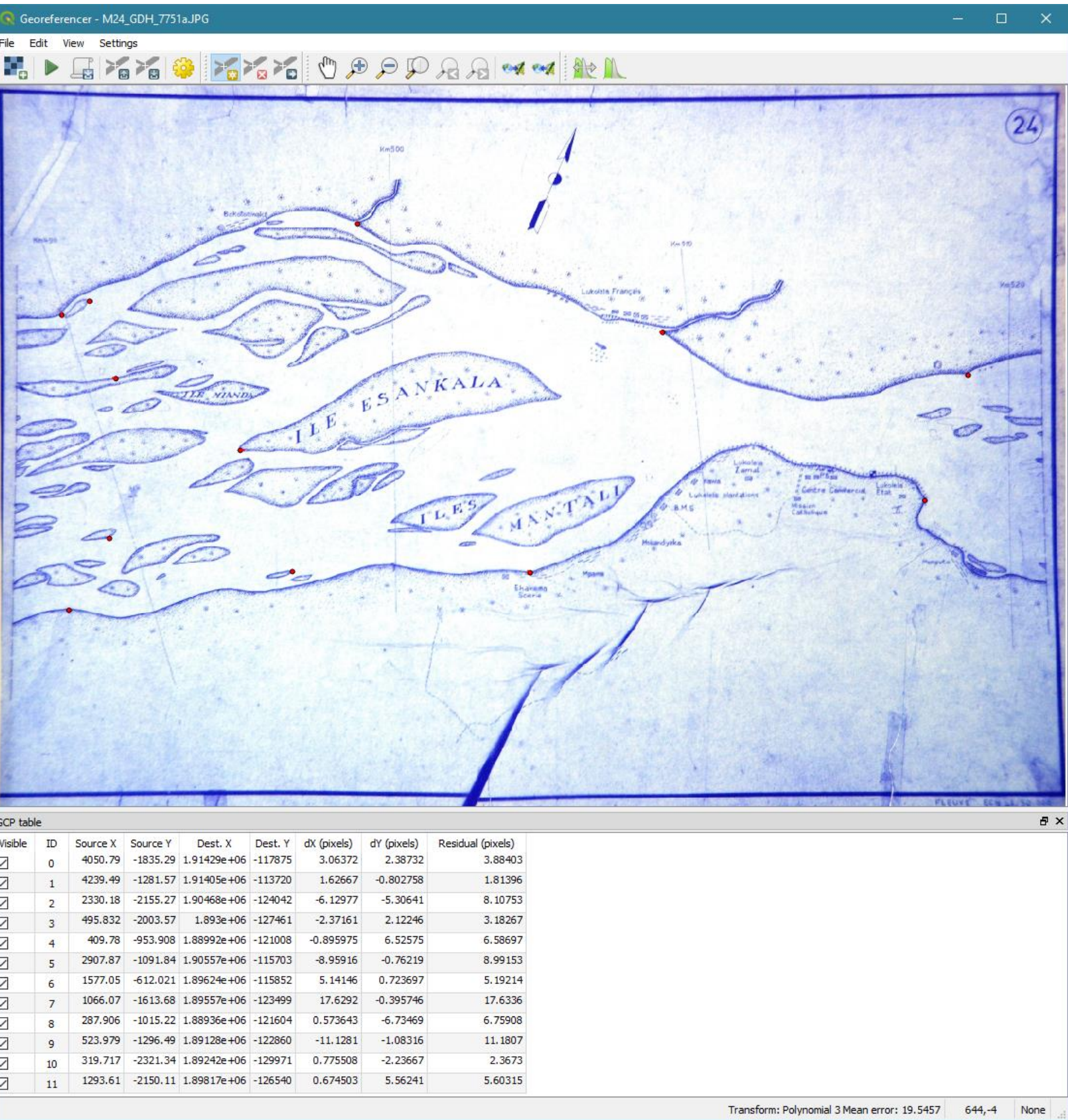


Figure 2: Geolocating maps with stable geographical locations

Funding

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Methodology

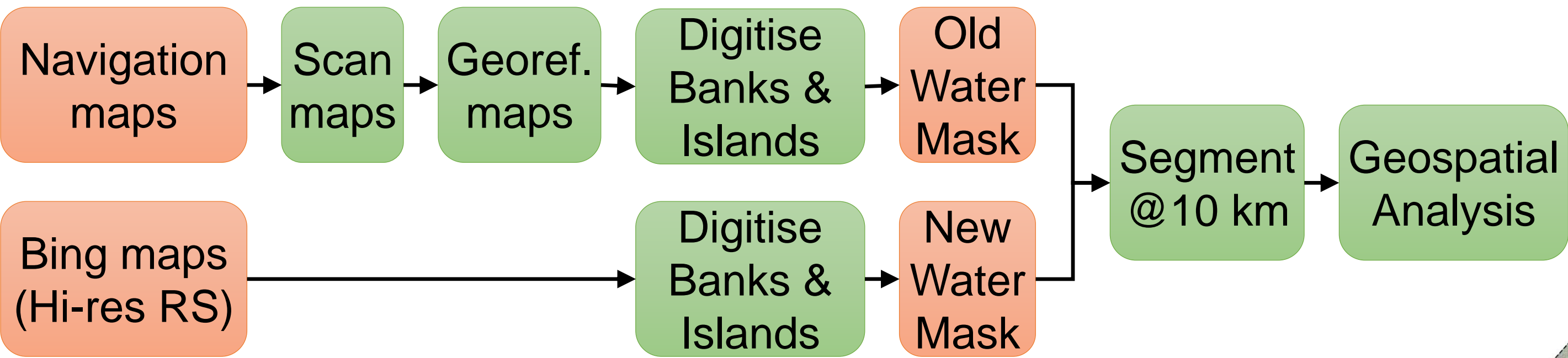


Figure 3: Schematic of methodology

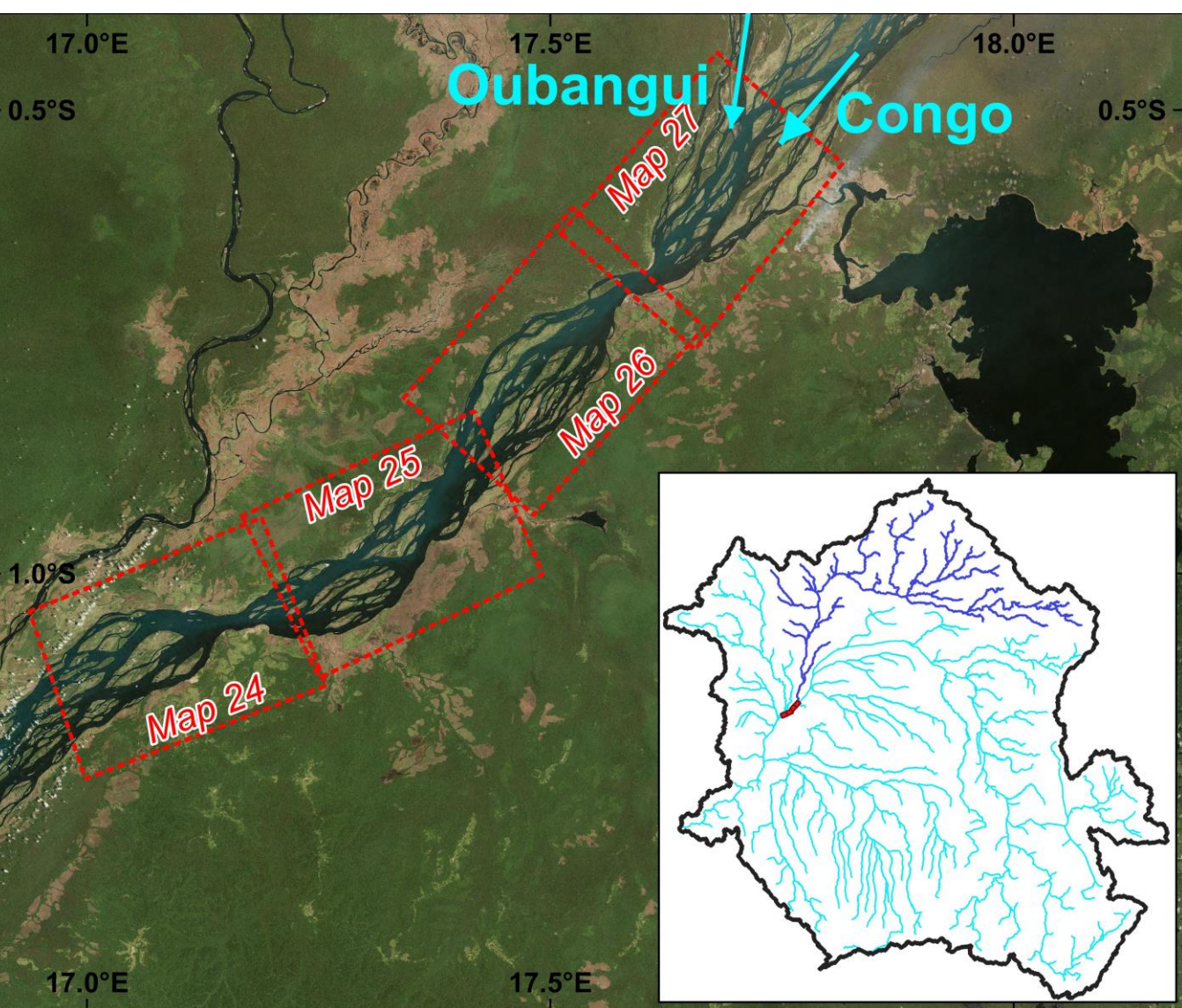
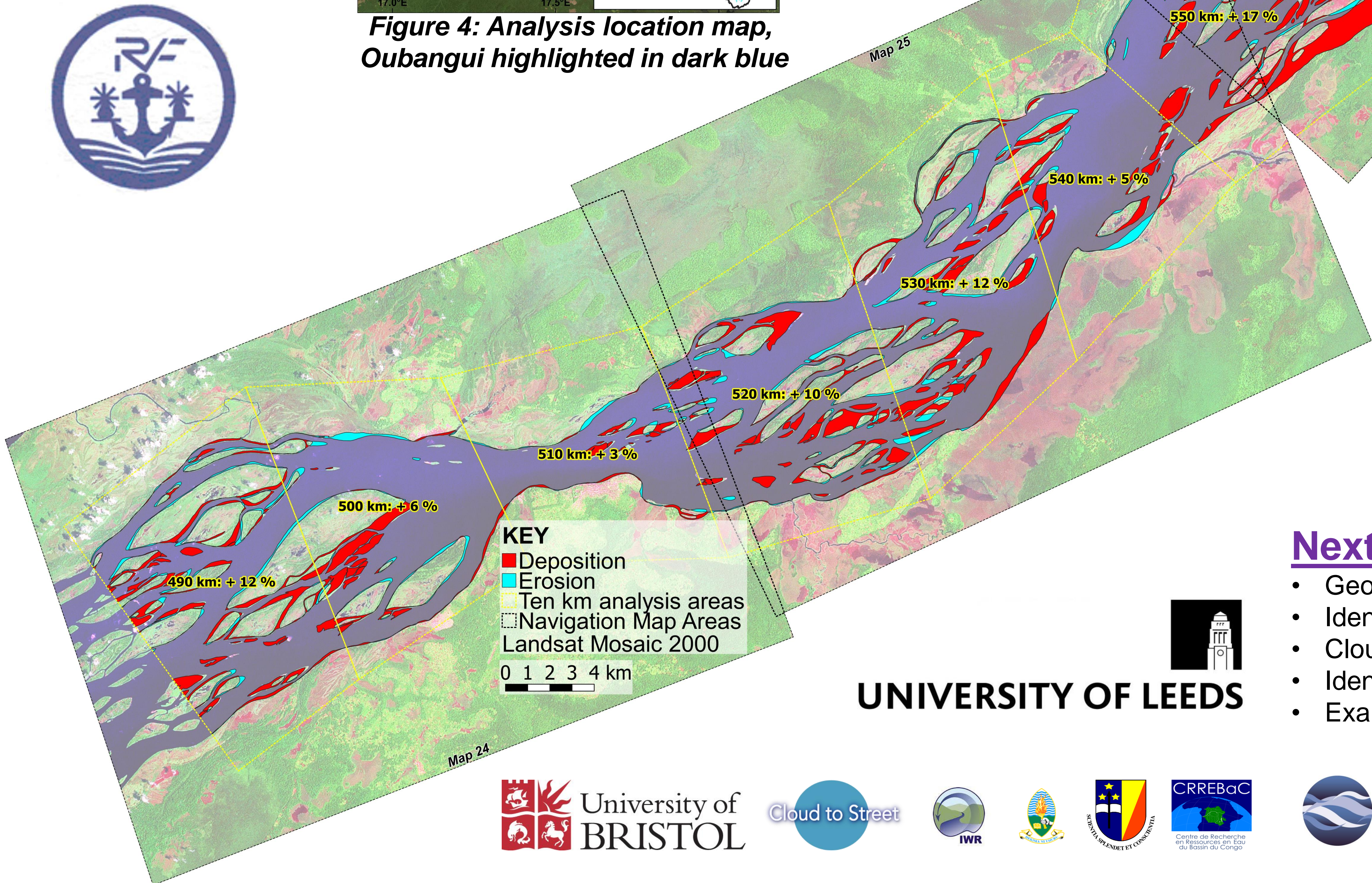


Figure 4: Analysis location map, Oubangui highlighted in dark blue



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Figure 1: Example of Transport on the Congo River

Figure 5: Deposition & Erosion with net deposition as % of water area per 10 km navigation reach

Results

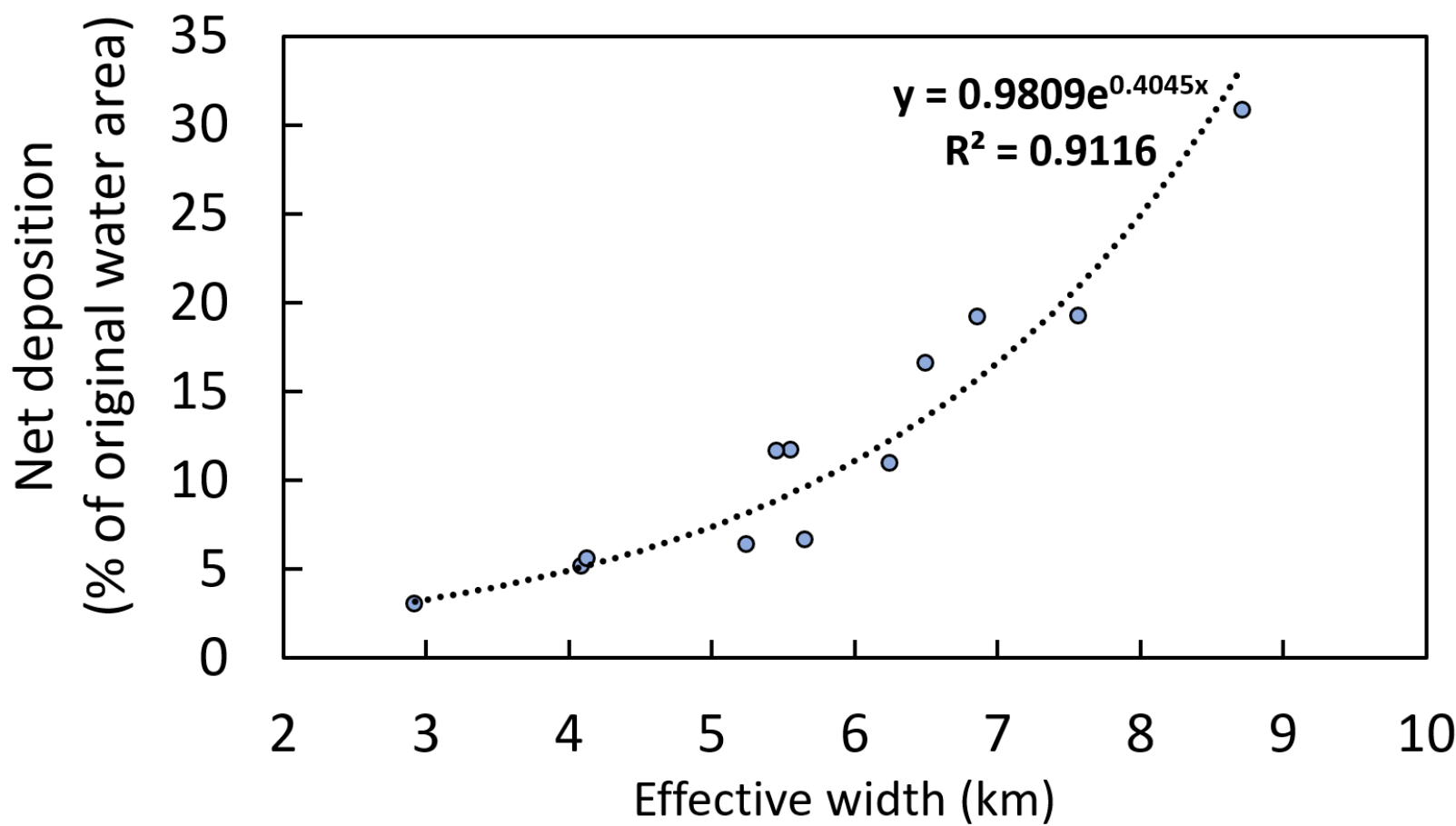


Figure 6: Net deposition is a function of effective width

Conclusions

- Old maps are impressively accurate given tools available
- Net deposition in all reaches since the original maps made
- More deposition in wider-shallower reaches (exponentially related) – velocity lower.
- Indicates a reduction in the flow or an increase in sediment
- Wide reaches most difficult to navigate - many sand bars
- **Future changes in upstream inputs of flow or sediment from the Oubangui will likely cause further changes – possibly exacerbating navigation problems here**
- This work is a useful baseline to monitor future change

Next Steps

- Georeference & digitise all maps with CRREBaC support
- Identify other geomorphological change indices to analyse
- Cloud-to-Street, GEE support for seasonality and vegetation types
- Identify other historical navigation maps for other reaches and repeat
- Examine RVF outputs from PANAV project including bathymetry

