MEANDER CUTOFFS IN TIDAL COASTAL LANDSCAPES: RARE OR EVERYWHERE?

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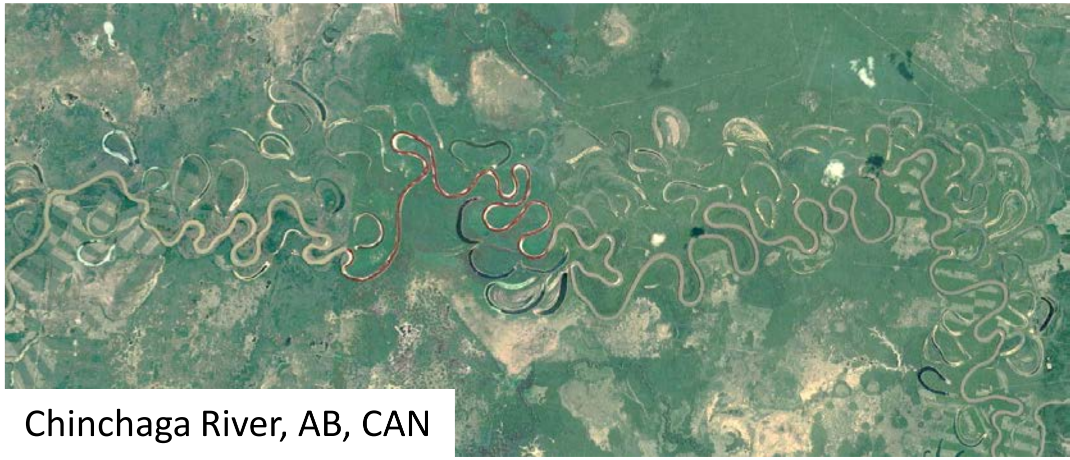
In spite of similar meander-planform dynamics and width-adjusted migration rates, tidal meanders have long been thought to be less cutoff-prone than their fluvial counterparts.

We hypothesize that the observed paucity of cutoff scars in tidal settings is only partly real, and depends on three concurrent factors:

1. Reduced size of most tidal channels

2. Higher rates of channel infill in tidal settings

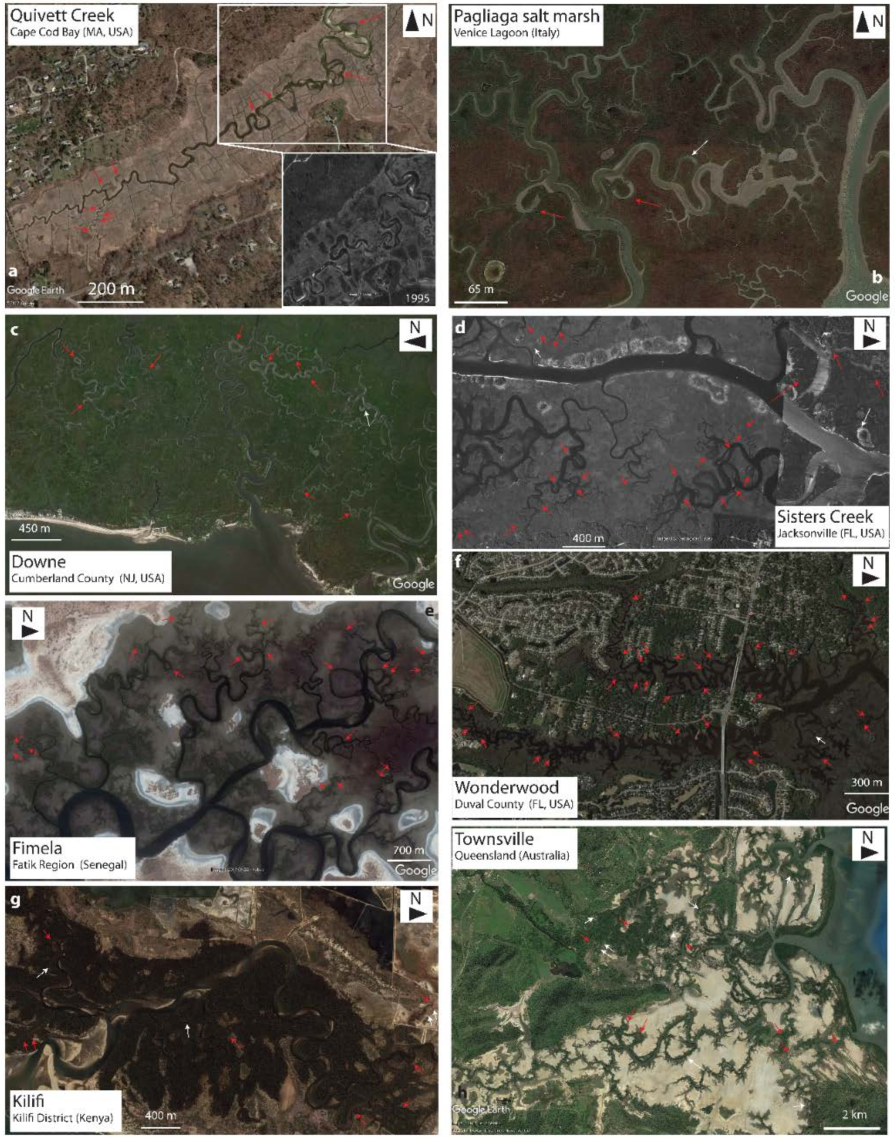
3. Higher channel density of intertidal plains



Chinchaga River, AB, CAN

Quivett Creek, MA, USA

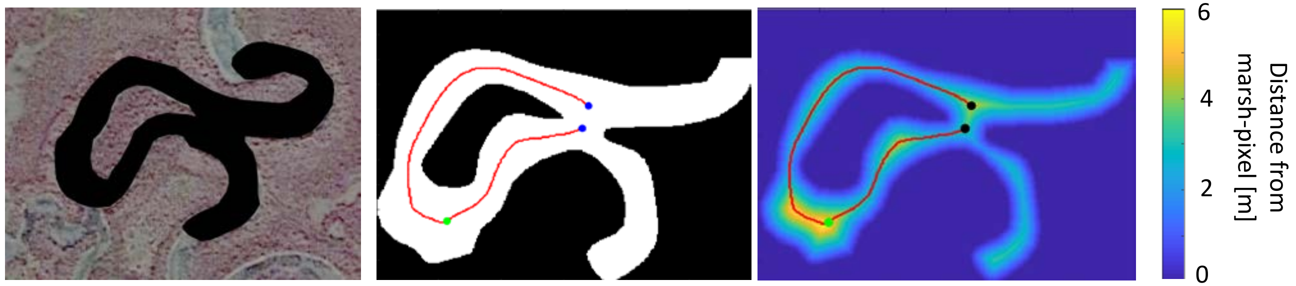
TIDAL MEANDER CUTOFFS



(Red arrows denote individual cutoff)

We have (so far) analyzed more than 120 tidal meander cutoffs found along the World's coasts by:

- measuring the average width of the cutoff meander;

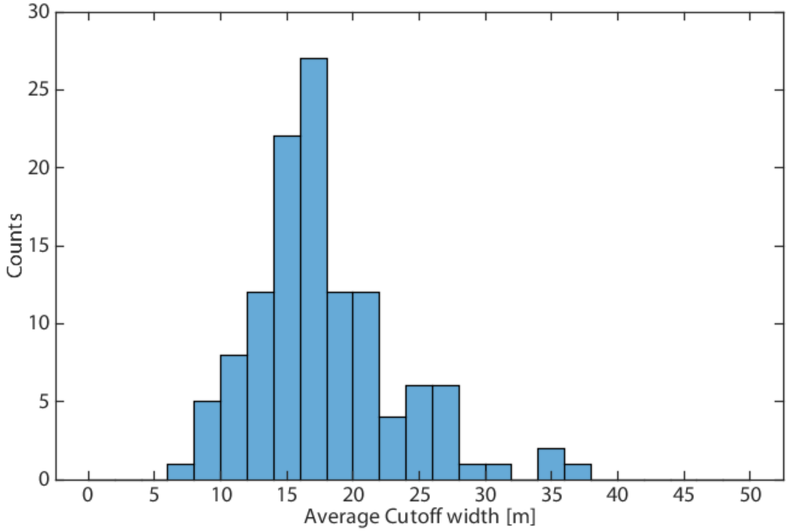


- monitoring the connection of the cutoff meander

Upstream+Downstream connected | Upstream connected | Downstream connected | Disconnected

- quantifying the changes in water surface area through time (when possible)

Reduced size of most tidal channels (+ vegetation cover)



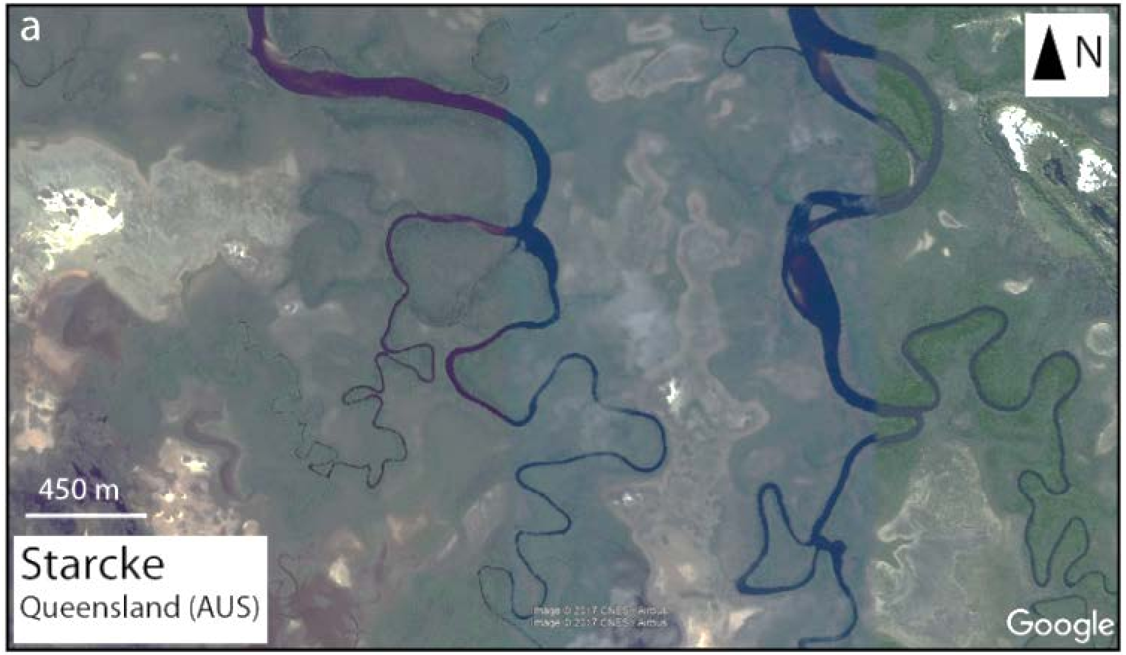
The mode of the cutoff-width distirbution is 15 m (mean value 17 m) which is well below the resolution of the majority of historical satellite images, thus likely making tidal cutoff hard to be identified.

This is especially critical in tidal environments characterized by dense vegetation canopy such as that typically observed in magrove forests.

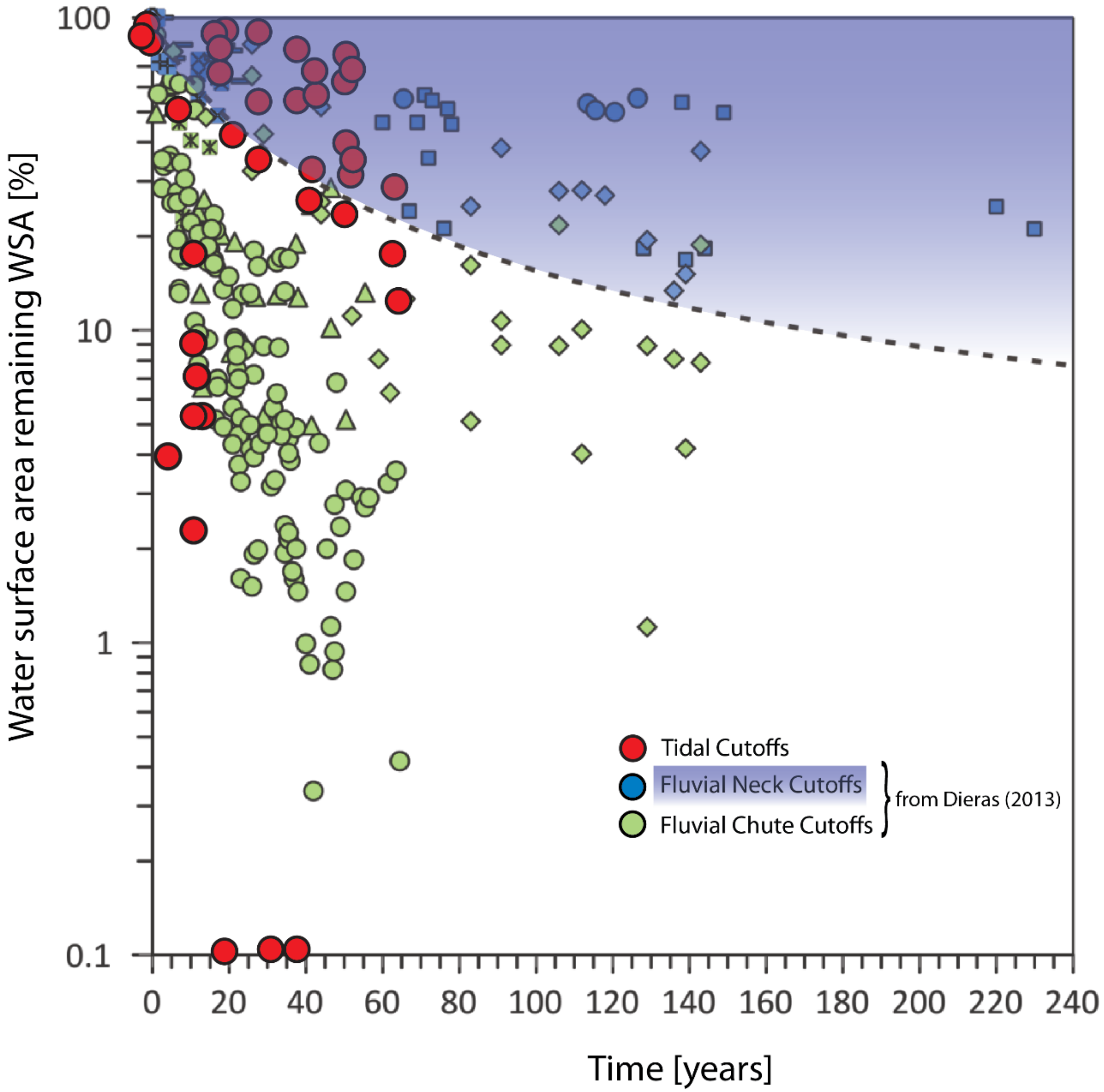
Pagliaga salt-marsh (Venice lagoon)

Landsat 1995

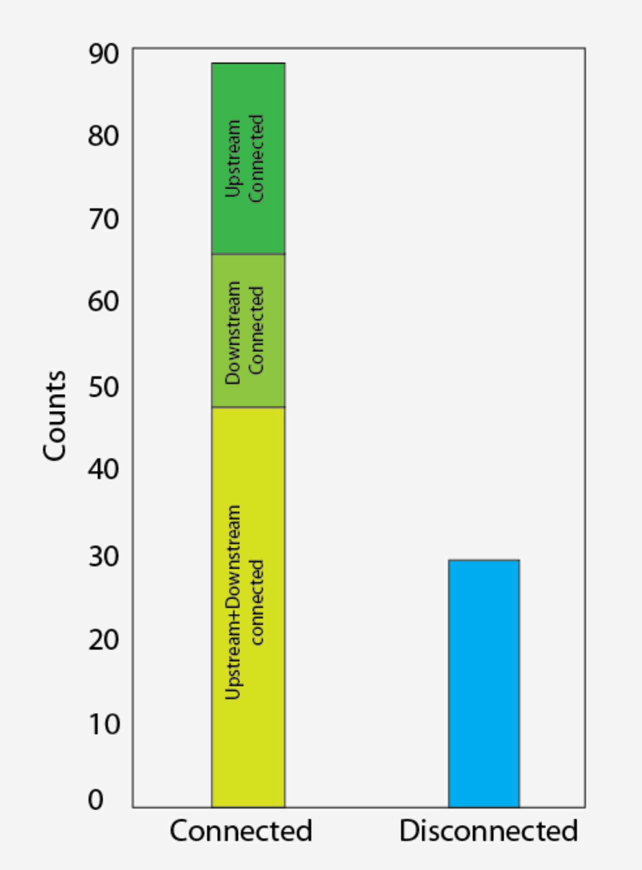
Maxar 2018



Higher rates of channel infill in tidal settings



Tidal meander cutoffs can potentially be infilled much more rapidly than their fluvial counterparts. This is likely due to the periodic tidal flooding of cutoff meanders, coupled with high concentration of suspended sediments that charcaterizes the tidal environment.



We also show that tidal meander cutoffs remain often connected to the channel they originated from, thus favouring flooding and subsequent infilling of the meander oxbow.

Additionally, high rate of organic deposition characterizing tidal landscapes, coupled with the fast-growing halophytes that usually colonizes salt marshes, might contribute to rapidly reduce the water surface area remaining within the cutoff.

Higher channel density of intertidal plains

Finally, we observe that in salt-marshes characterized by spatially dense tidal channels, meanders might have not enough space to fully develop before connecting to another adjoining active channel (i.e., channel piracy).

Therefore, we argue that the high channel density that typically characterizes intertidal plains militates against the development of meander cutoffs, and justifies the apparent scarcity of cut-off scars in tidal environments compared to their fluvial counterparts.

We are currently testing this hypothesis by analyzing different tidal channel networks worldwide.