



# **Controls on the Morphology of Fluvial and Tidal Influenced Channels in the Gulf of Carpentaria, Australia.**

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## ABSTRACT

The influence of wave, tide and fluvial processes interact to control sediment erosion, transport and deposition in clastic coastal environments. This results in mixed-process coastal systems, which can form good quality, yet geometrically complex reservoir deposits. Channels in modern analogue mixed process environments provide useful insights into how wave, tide and fluvial processes affect paleochannels and can aid subsurface stratigraphic correlation and palaeoenvironmental reconstruction.

The Gulf of Carpentaria is an epicontinental sea which formed as a result of sea level rise during the last marine transgression. Holocene deposits have prograded over low gradient bathymetry and display a range of channel forms. The channels that traverse these coastal plains cannot be satisfactorily characterised by simple morphological classification. They have morphologically complex patterns which have developed in response to the seasonal variations in fluvial, tide and wave energy.

A numerical examination of the effects of fluvial, tidal and wave energy on the geometry and morphology of 70 single and distributary channels in the Gulf Carpentaria was undertaken using desktop based statistical analyses. Catchment area was used as a proxy for fluvial discharge in these largely ungagged catchments while wave height and tidal range was applied directly from available gauged data. These channels were divided into two subsets based on whether their channel mouths were best described by linear or exponential trends and by the channels being either distributary or single channels. These four groups were then tested separately to assess their geometrical characteristics, including the rate of decrease in channel width downstream of equi-width (fluvial) reaches, and the wave, tide and fluvial ratios.

Of the analysed channels 65% were found to have a linear width profile, and their parallel banked profile was further enhanced by a strong positive correlation with catchment which exhibited very low slope of distance to equi-width. These parallel banked (linear) channels were found to be fluvial dominated while the other 35% had an exponential width profile with their entrance width visually exhibiting a strong funnelling characteristic, and the channels having a wider entrance width and a longer distance to equi-width. These exponential channels are more tidally dominated. There was a general decrease in tidal energy and wave influence with increase in distance to equivalent width in the channels, this relationship implies that a channel's distance to equivalent width can be used to identify where the fluvial energy is least effective moving downstream indicating that another process is dominant which is usually tidal or in some cases wave energy.

It is also shown that there are characteristic relationships between geometric variables like entrance width at the channel mouth and the rate of decrease in channel width downstream of equivalent - width (slope) with proxies of fluvial influences and tidal range. These relationships may overlap as a result of the complex morphodynamic feedbacks between fluvial discharge, tidal propagation and wave height in this tropical monsoonal environment.

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