EGU General Assembly

Modeling the planform evolution of confined meandering rivers

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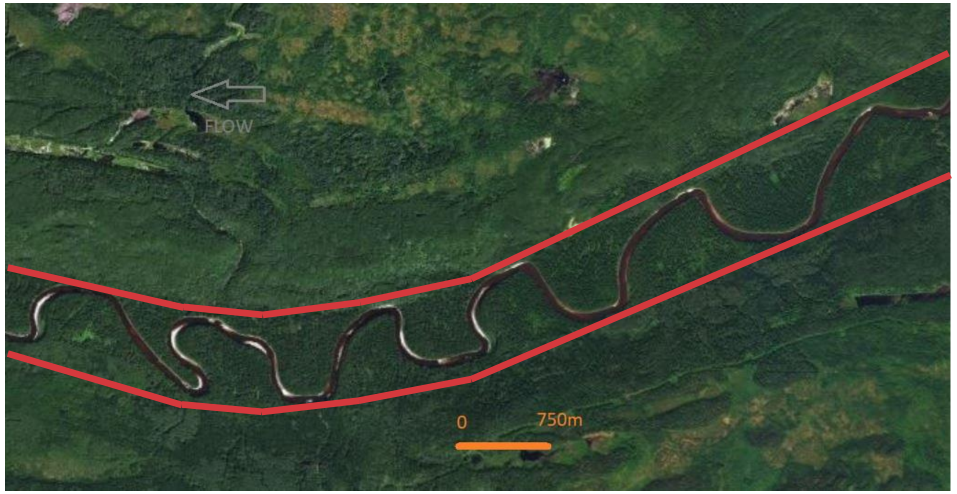
Introduction

What is the confined meandering river?

Confined Meandering VS Free Meandering



Fort Nelson river
Canadian prairies, CA

YATA river
Amazon river basin, Bolivia

Images from Bing.com

Overview of the study

- **Goals**
  - What is the effect of valley confinement on meandering rivers planform and dynamics?
  - Which are the main effective controller parameters for these river types?
  - Are there any relevant value for those parameters?
- **Method**
  - ✓ Meander morphodynamic model-based investigation space measuring (Bogoni et al 2017) is used.

State of ART

- Few systematic field investigations on the form and dynamics of confined meandering rivers(e.g. Nicoll, T. J., & Hickin, E. J. (2009))
- Also very few modelling studies using meander planform models(e.g. Howard 1992)
- Laterally unconfined meandering shows different behavior under sub-and super-resonant regimes (Zolezzi, G., & Seminara, G. (2001)).
- Meander planform models can account for floodplain heterogeneity (Bogoni, M, & Lanzoni, S. (2017))

J. Fluid Mech. (1985), *vol.* 157, *pp.* 449–470 449
Printed in Great Britain

A unified bar–bend theory of river meanders

By P. BLONDEAUX AND G. SEMINARA
Istituto di Idraulica, Facoltà di Ingegneria, Università di Genova, Genoa, Italy

1 Modeling Channel Migration and Floodplain Sedimentation in Meandering Streams

ALAN D. HOWARD
University of Virginia

J. Fluid Mech. (2001), *vol.* 438, *pp.* 183–211. Printed in the United Kingdom 183
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Downstream and upstream influence in river meandering. Part 1. General theory and application to overdeepening

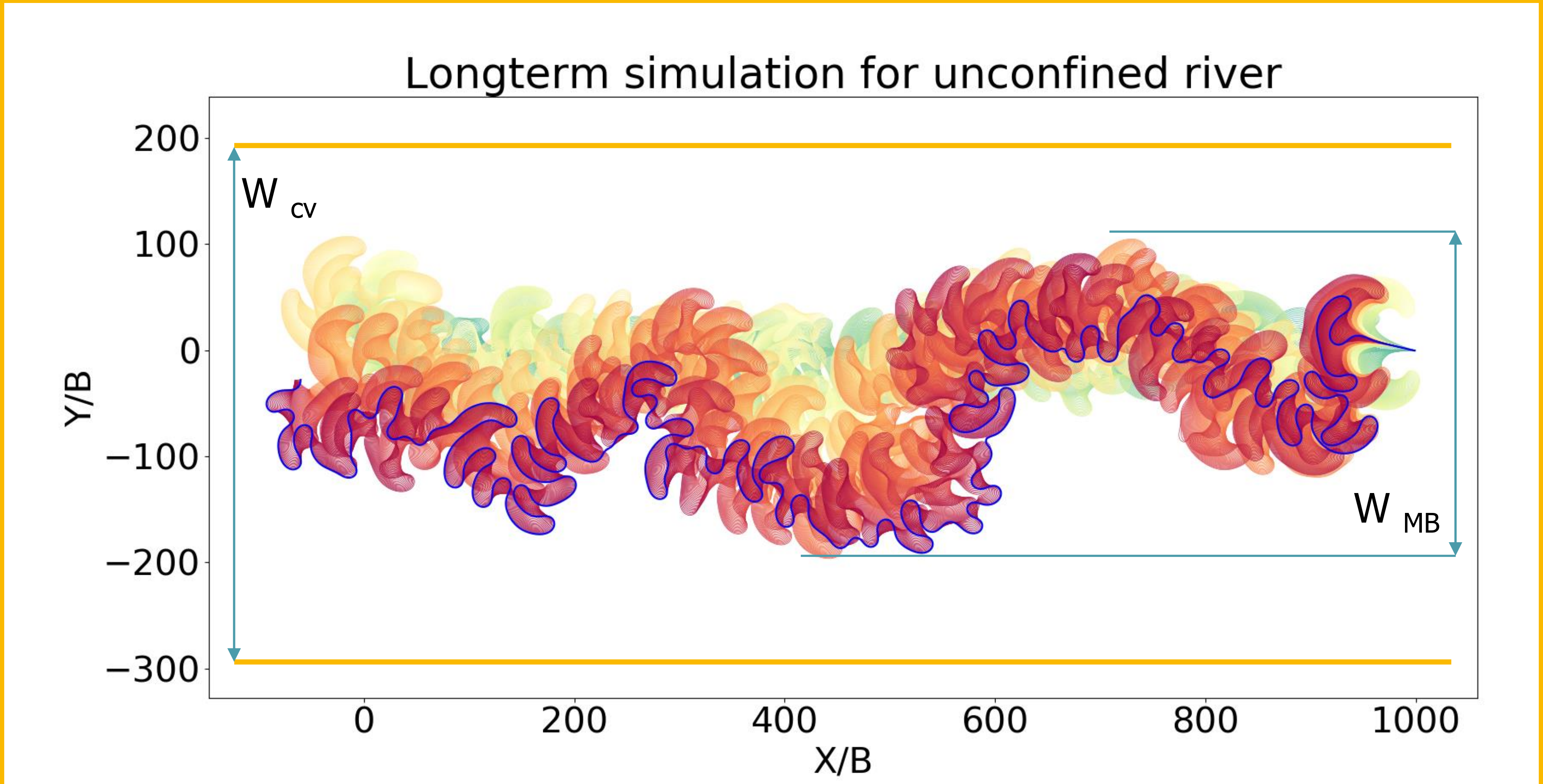
Contents lists available at ScienceDirect
Geomorphology
journal homepage: www.elsevier.com/locate/geomorph
ELSEVIER
GEOMORPHOLOGY

Planform geometry and channel migration of confined meandering rivers on the Canadian prairies

Tami J. Nicoll *, Edward J. Hickin
Department of Geography, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada V5A 1S6

Controller parameter:

Definition of confinement ratio “C_r”



$$C_r = W_{CV}/W_{MB}$$

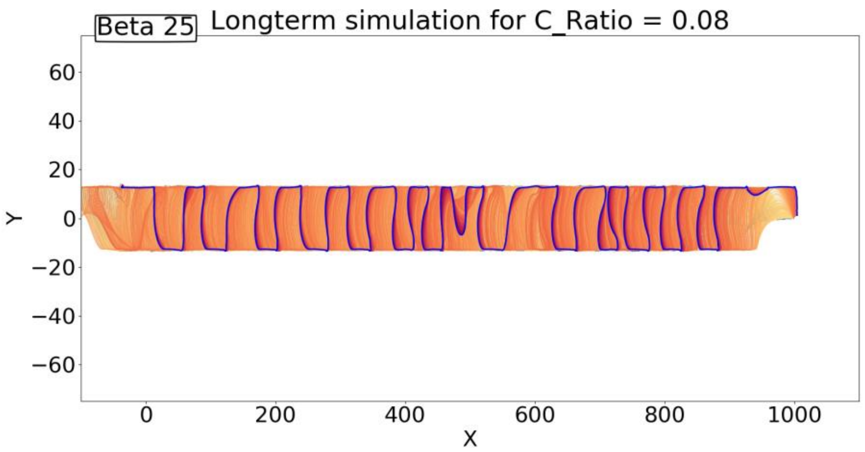
- C_r : Confinement Ratio
- W_{cv} :Width of confinement valley
- W_{MB} : Free Meander belt width, obtained through unconfined long-term simulations

Results

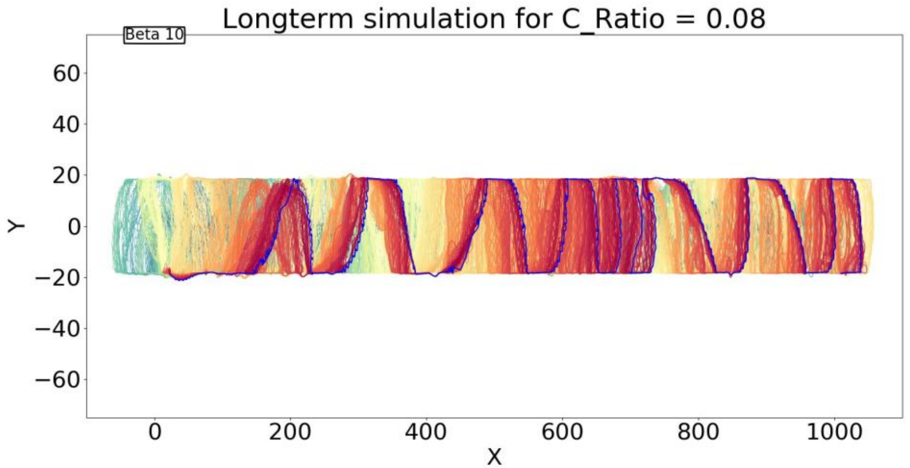
C_r = 0.08 (Strongly confined)

Channel aspect Ratio 10 & 25(Sub- and Super-resonant cases

Super-Resonant



Sub-Resonant



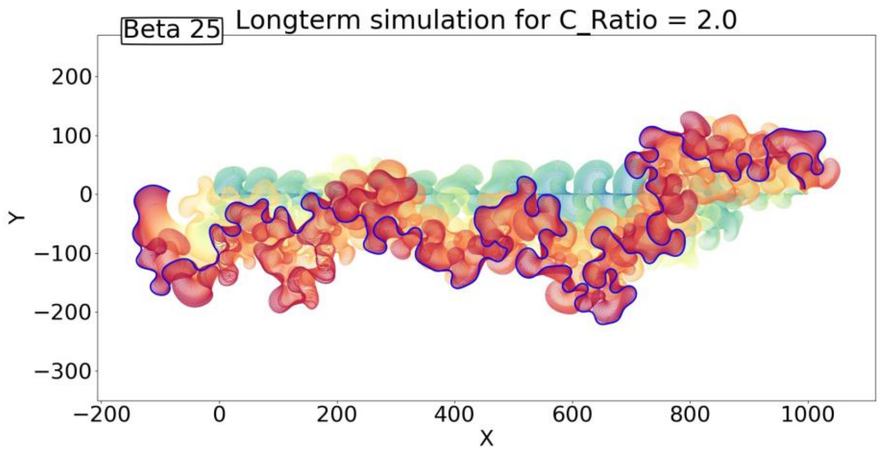
Tip: The solid blue line is the last planform evolution

Results

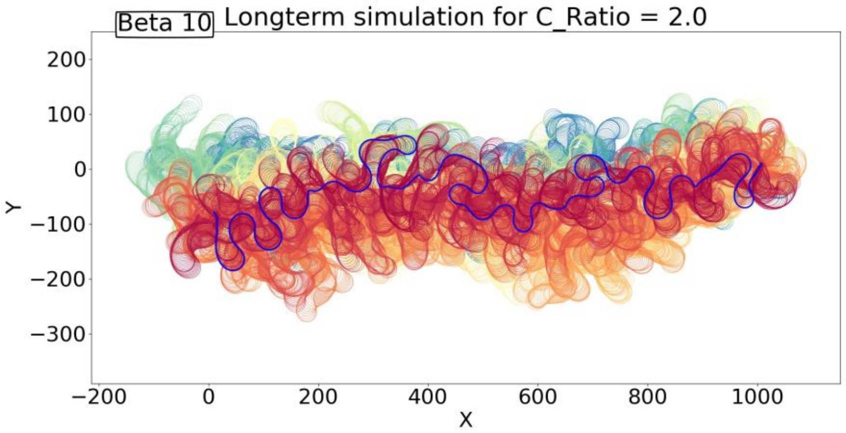
$C_r = 2$ (Almost unconfined)

Channel aspect Ratio 10 & 25

Super-Resonant



Sub-Resonant



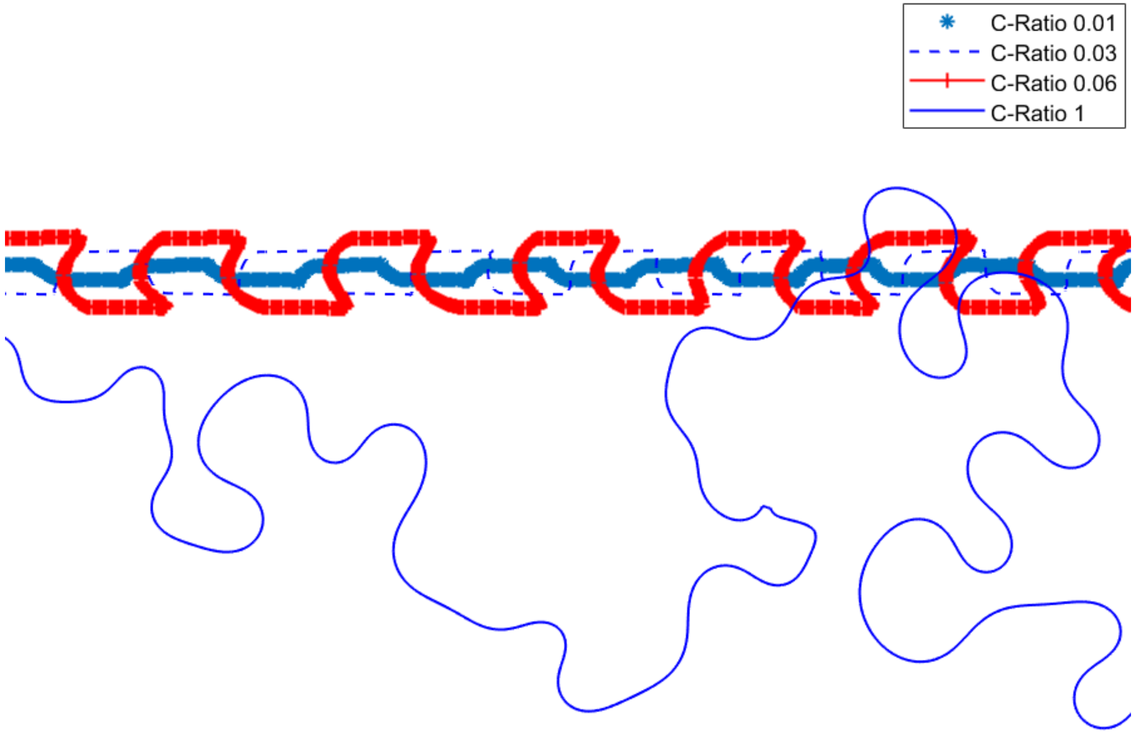
Tip: The solid blue line is the last planform evolution

Results

C_r variation

Channel aspect Ratio β 25

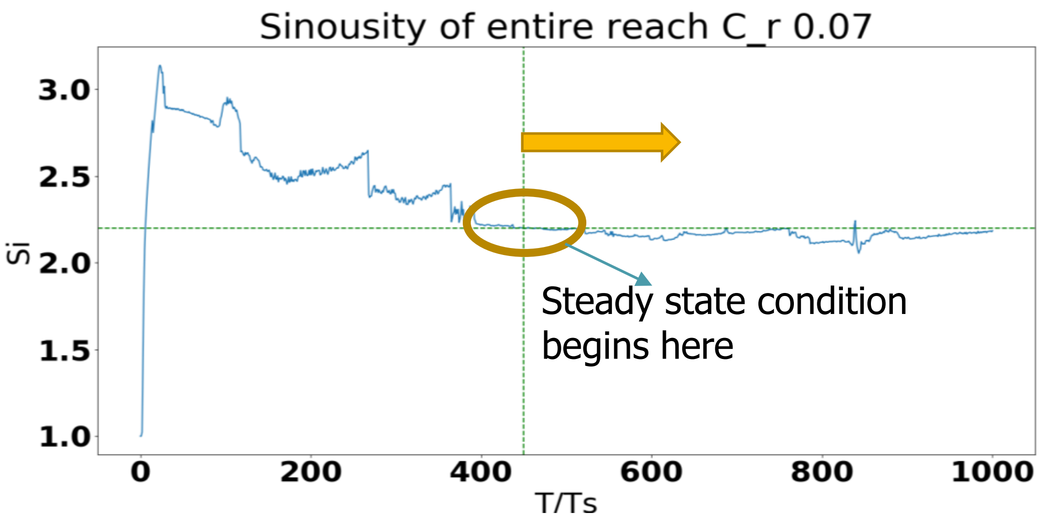
- Downstream Skewing (Super-resonant regime) in this case channel aspect ratio β 25
- Increase in meander wavelength with increase in C_r
- Oscillatory movement between constraints
- “Attachment” of centerline to side-valley walls

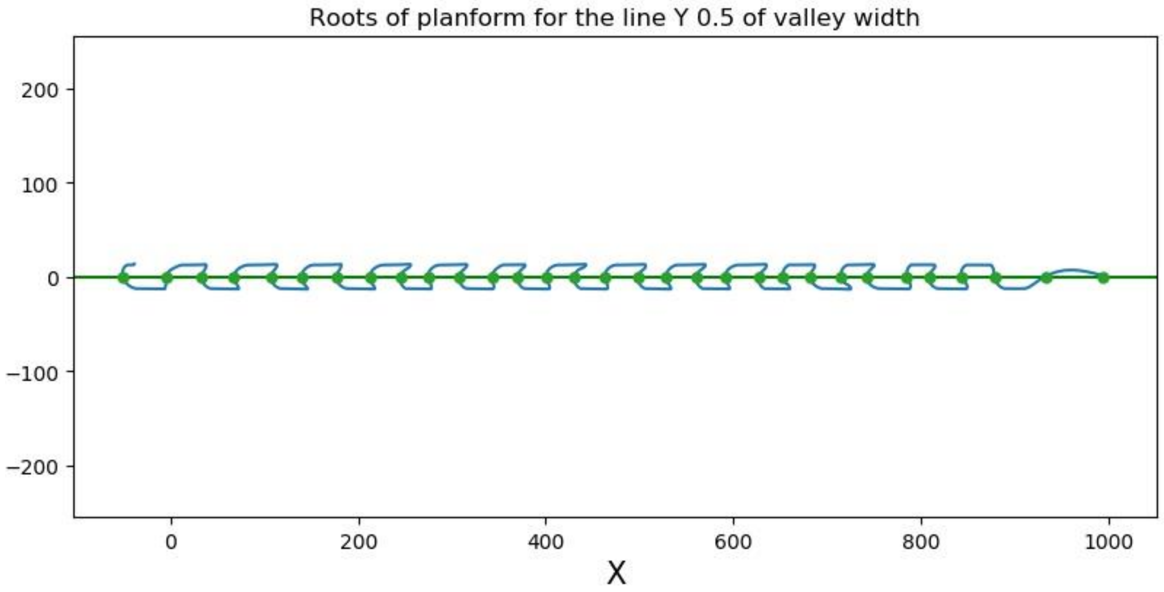


Results

River-valley line intersection

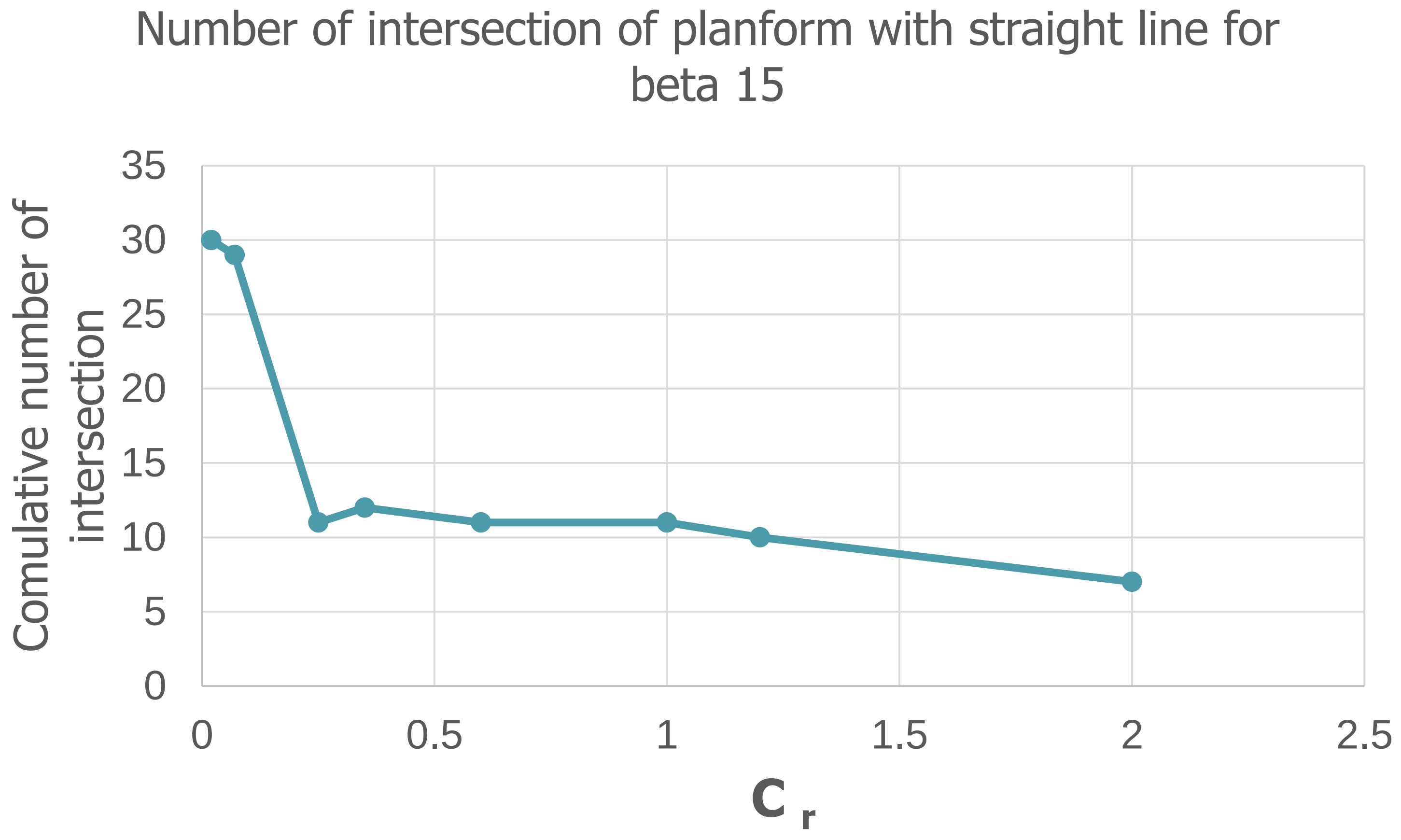
- Roots of planform means the number of time that latest planform evolution has intersection with straight line acroases from mid of the valley





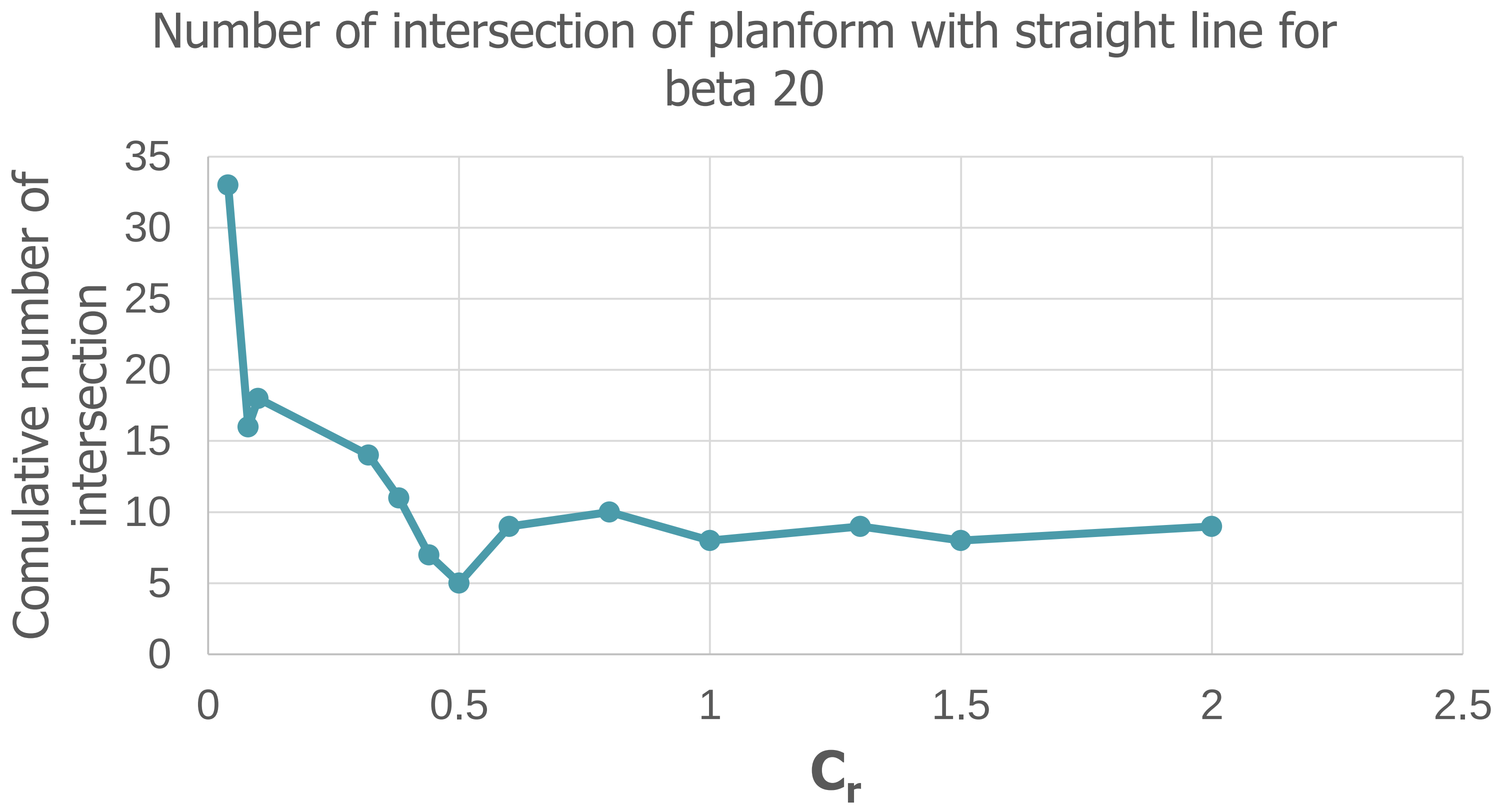
Results

River-valley line intersection



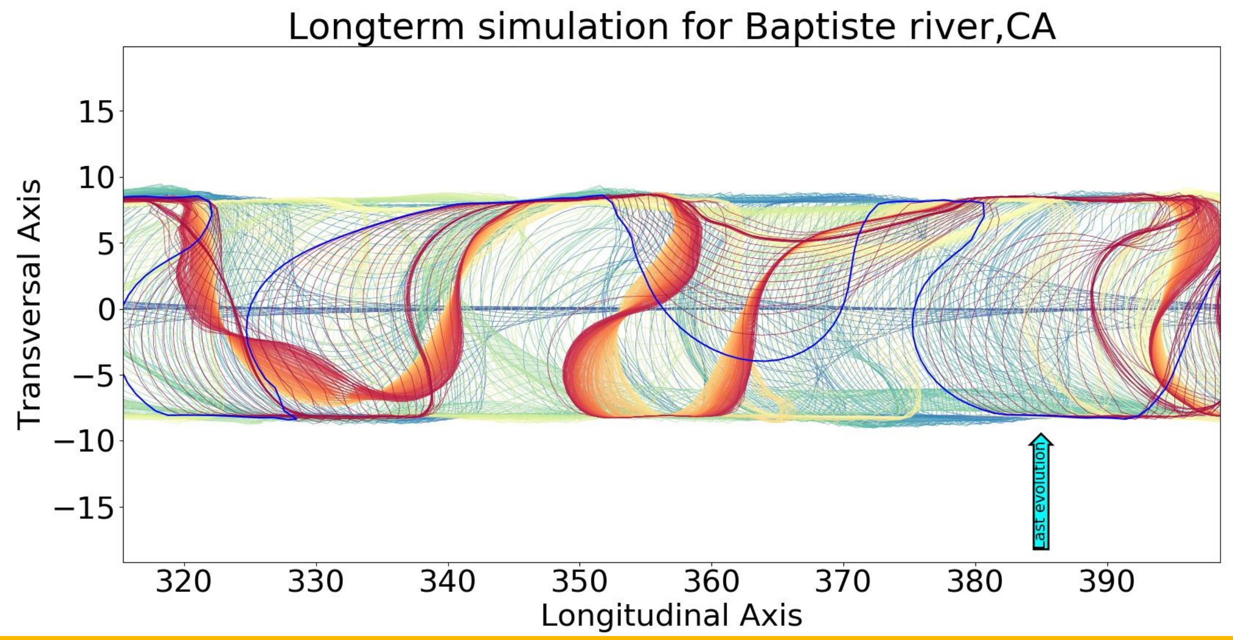
Results

River-valley line intersection



Future developments

- Figuring out the effects of the existence of Constraints on the migration of river
- Finding out the mechanism of the migration in confined meandering river
- Defining a ratio to generalize the definition of confinement to understand "In which ratio the free meanders becomes confined meanders"
- Correlational analysis and sensitivity analysis over parameters for these types of meanders
- Doing the modelling for real confined meandering river



Question