

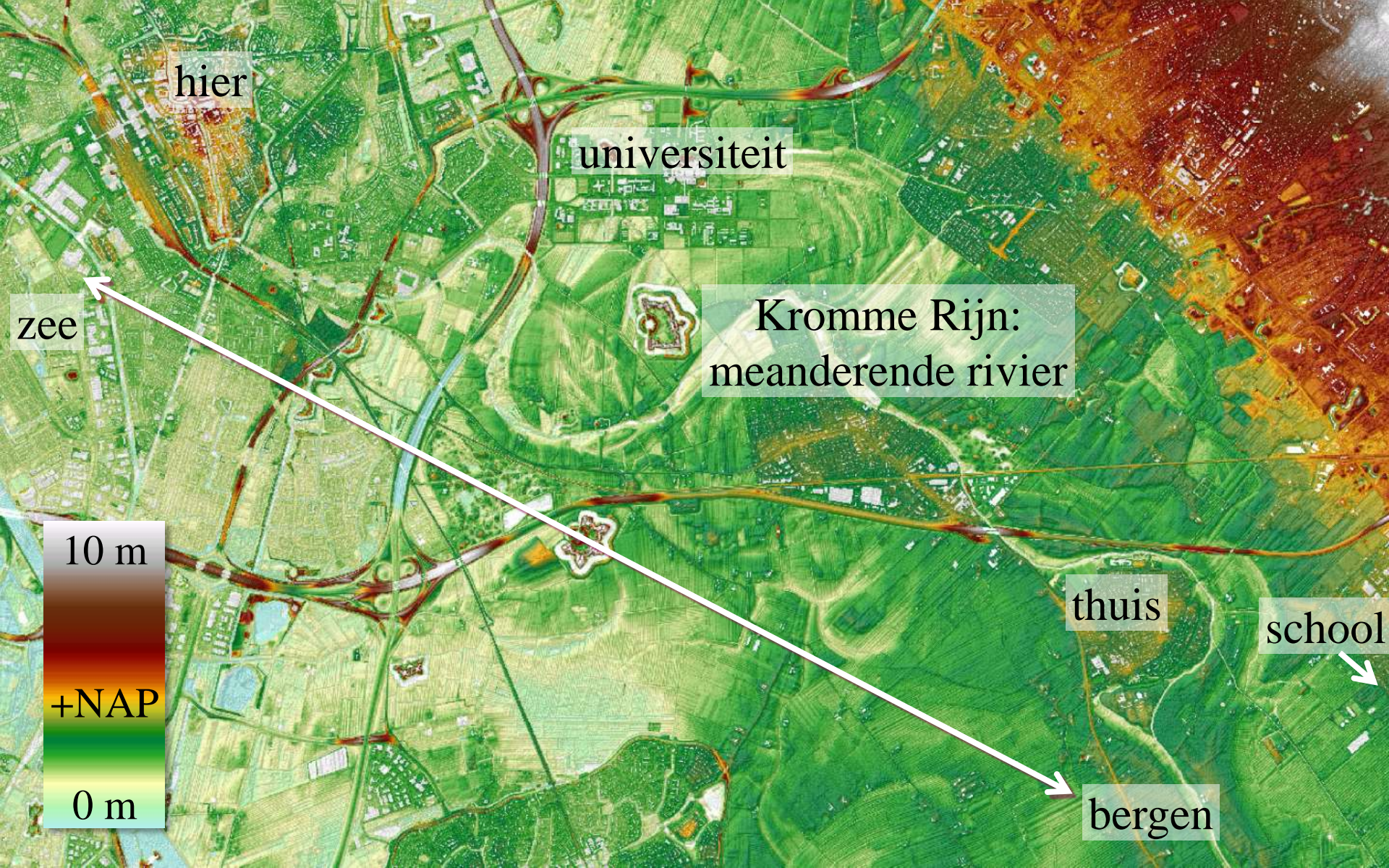


# Per kerend tij: het spel van water en zand in rivieren en delta's

Maarten G. Kleinhans

tekst en filmpjes komen online





hier

universiteit

Kromme Rijn:  
meanderende rivier

zee

10 m

+NAP

0 m

thuis

school

bergen



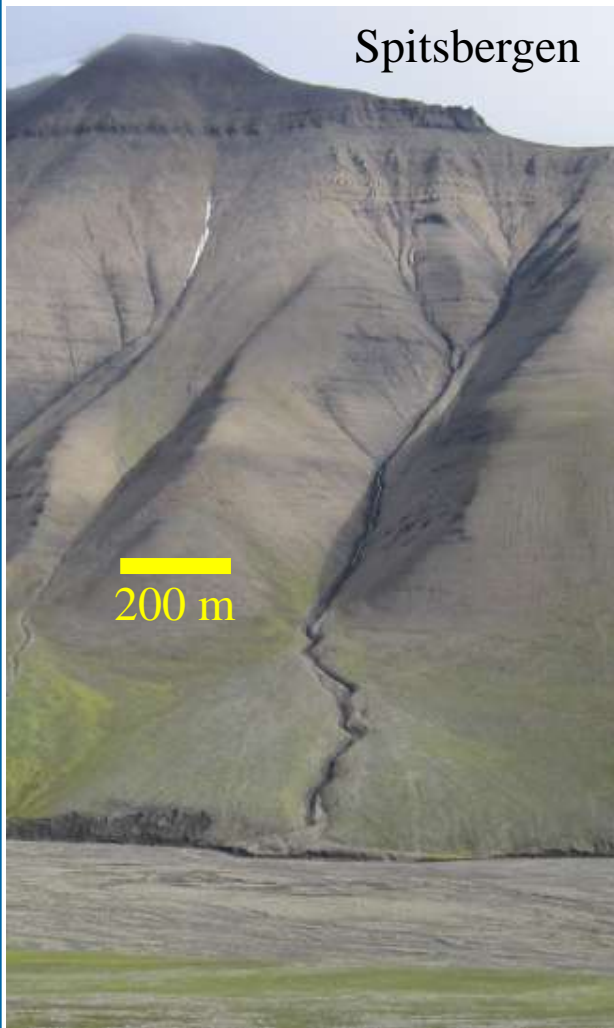
**Andre Ermolaev**  
**(IJsland)**







Spitsbergen



Mars



Lab

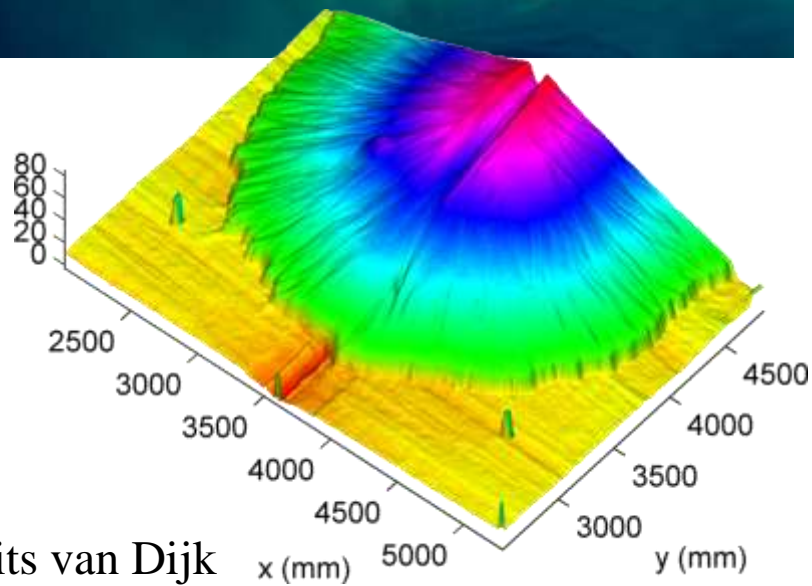
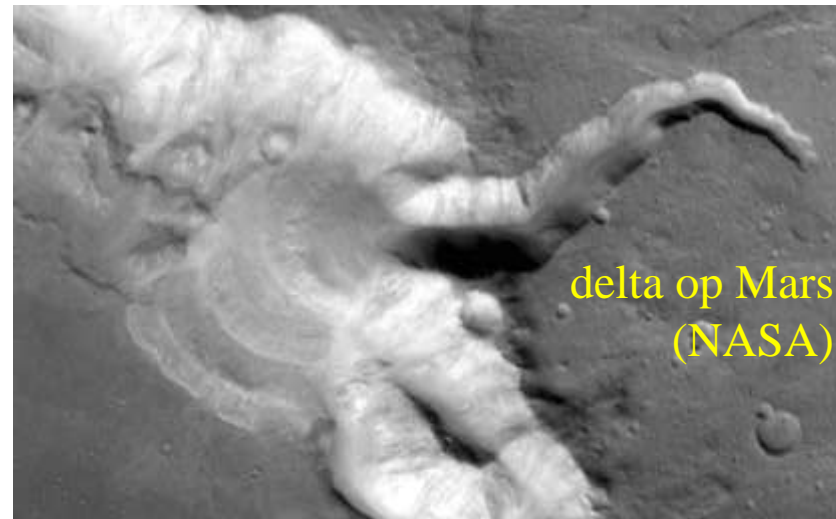


Spitsbergen

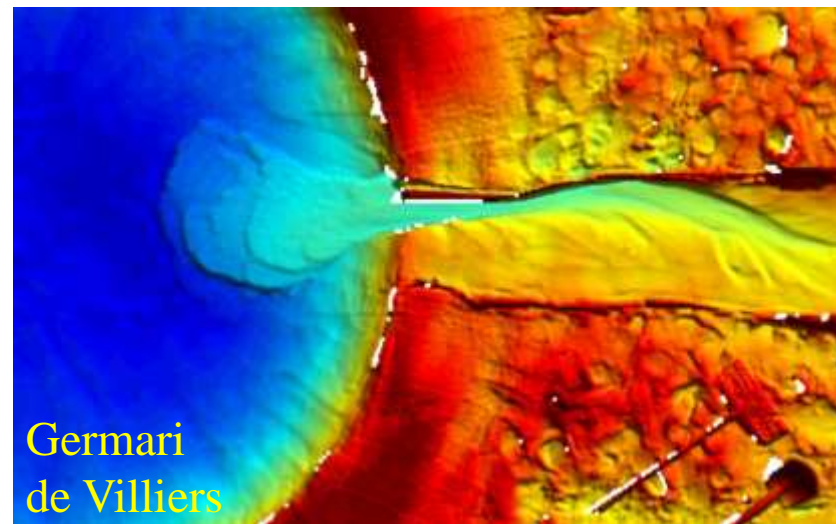




Horton delta  
(NASA)



Maurits van Dijk









# Patronen in het zand





**Andre Ermolaev**





Run 1: Constant discharge



Run 2: Discharge of Brahmaputra



10

20

30

40

50

60

70

80

Distance (km)





# Zandbanken en zingende snaren









vluchtend



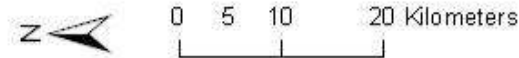
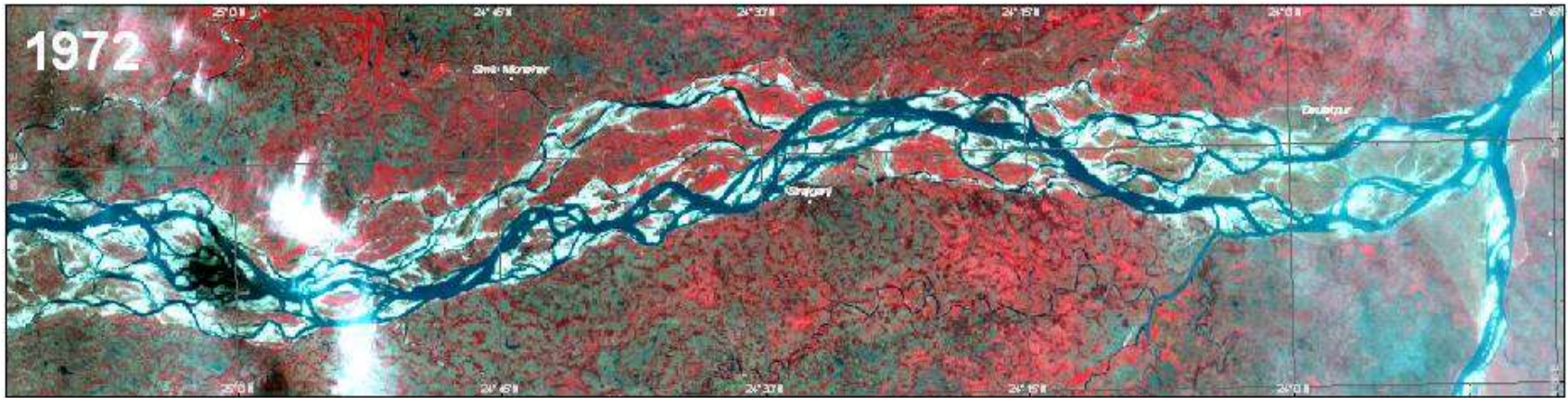
overgang



meanderend



# Jamuna rivier (Bangladesh) (Landsat)





# Zelfbouwend rivierenland





afkalvende oever  
nevengeul, Vecht (Junne, Ommen)



1992



2002



1 km

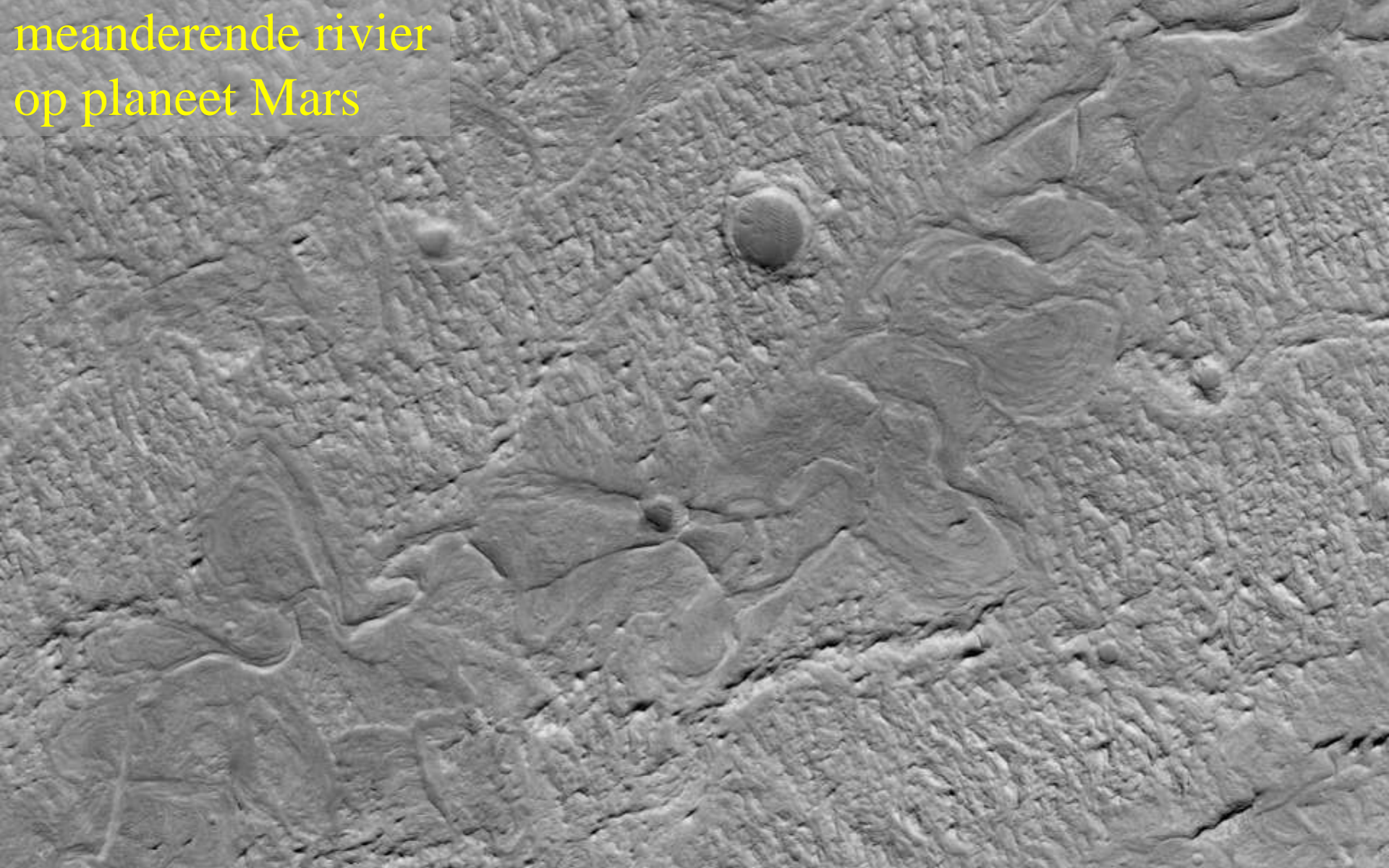


2008



1 km

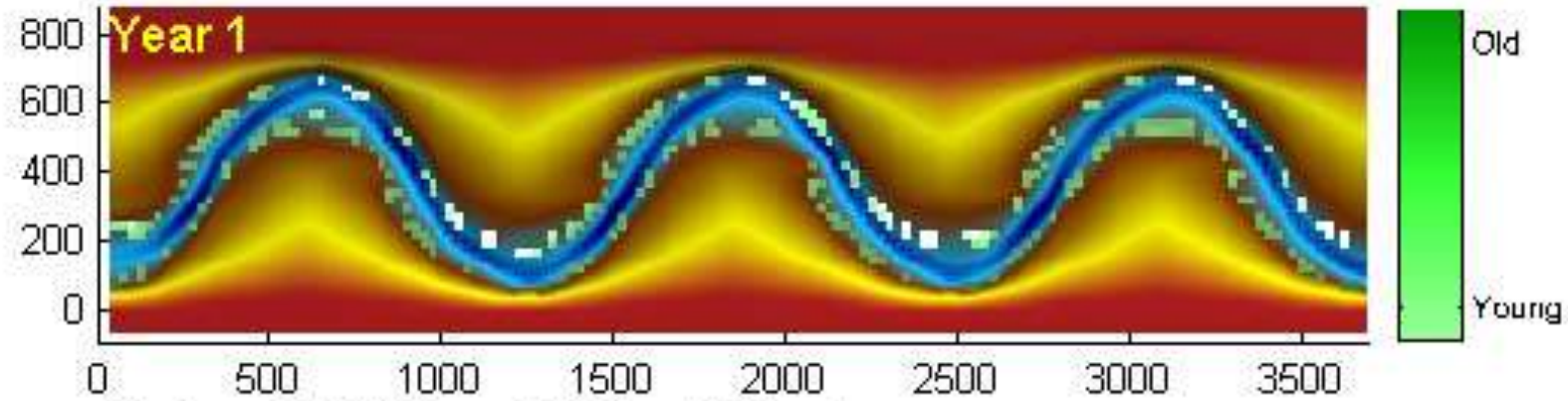
meanderende rivier  
op planeet Mars







### Bed level with vegetation (m)



Van Oorschot & Kleinhans, 2014. Utrecht University

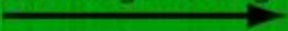




Wout van Dijk  
& Wietse van de Lageweg



stromingsrichting

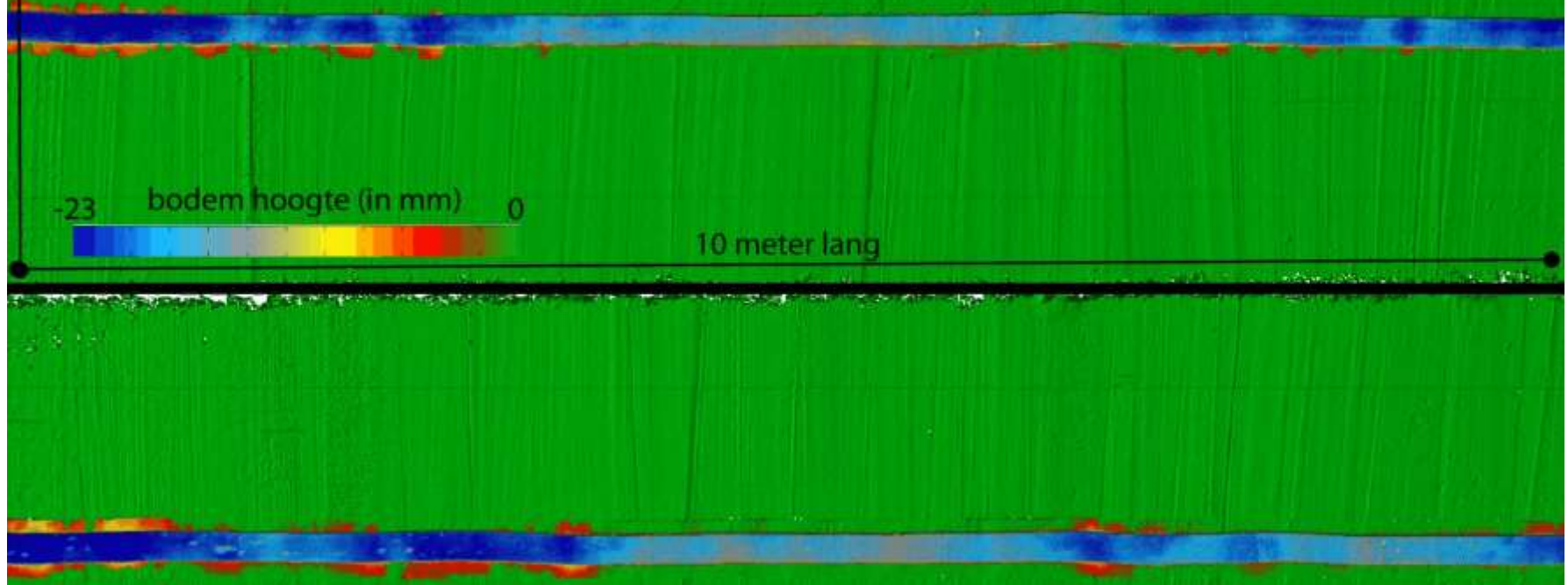


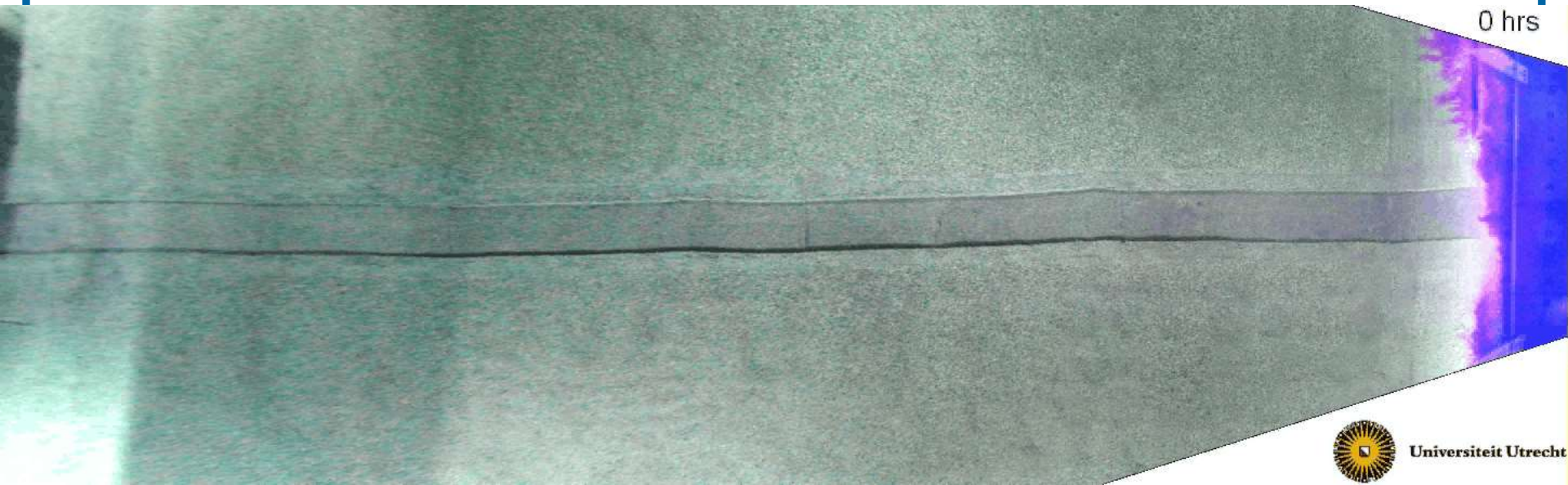
3 meter breed

-23 bodem hoogte (in mm) 0



10 meter lang



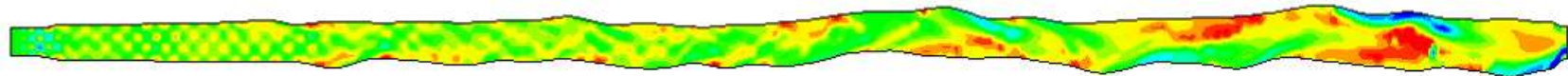
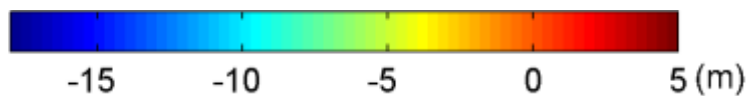
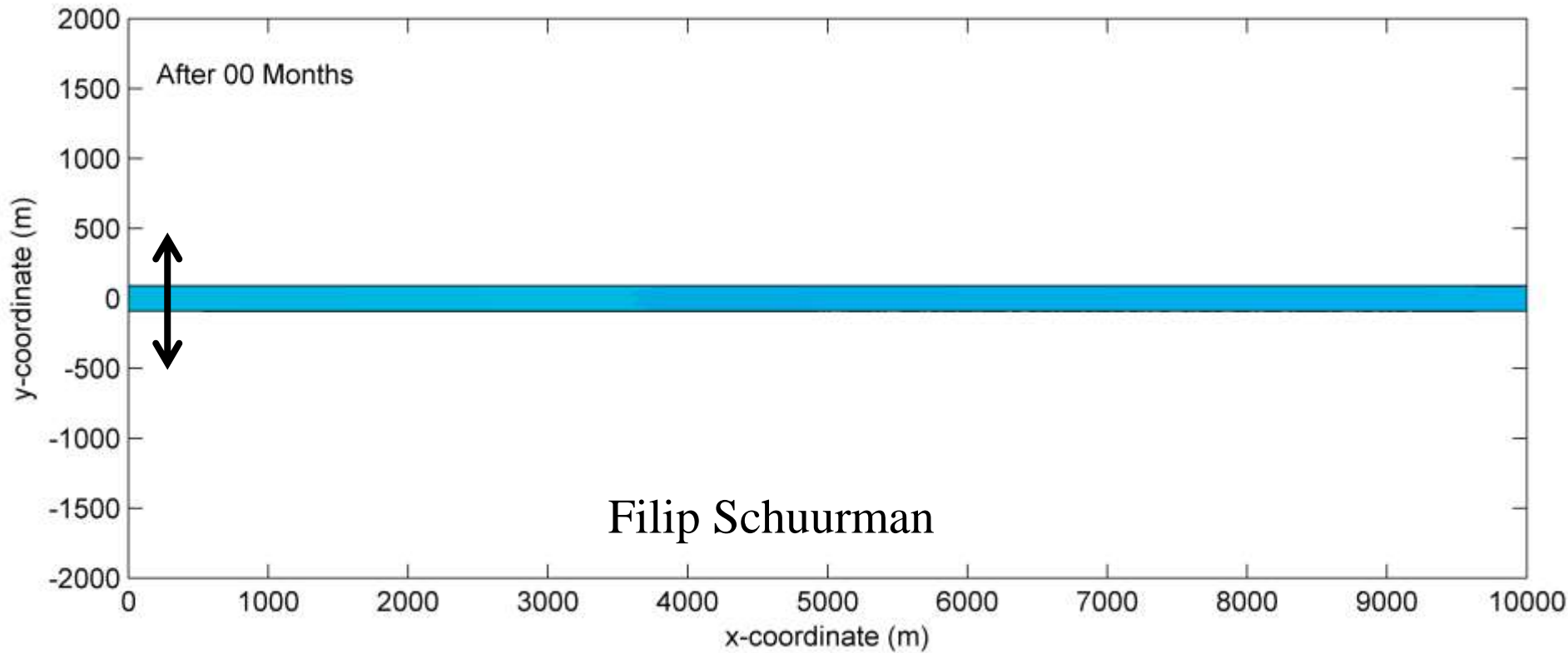


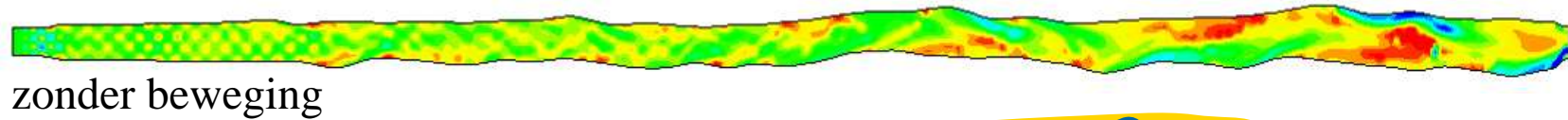
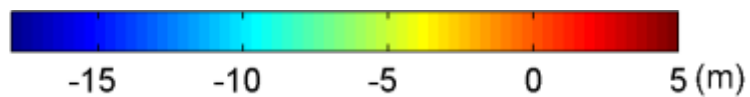
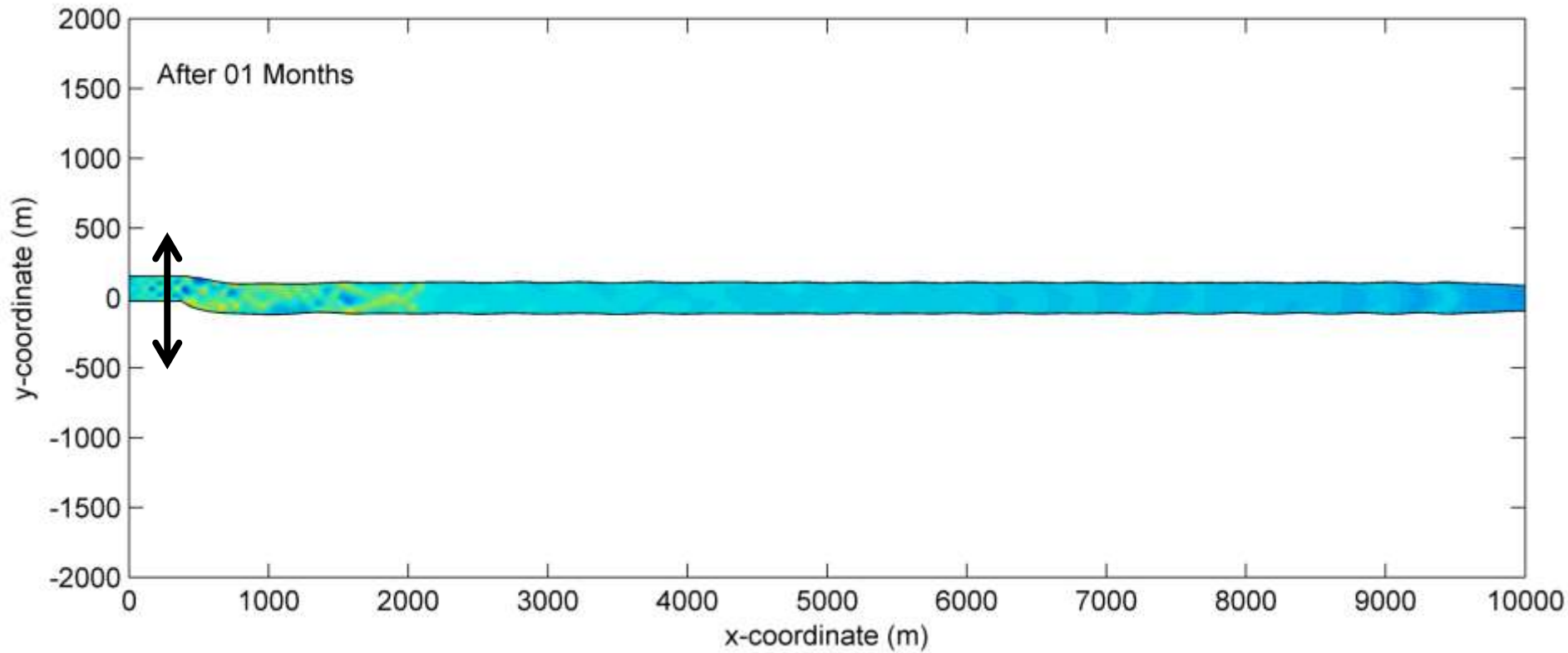
Universiteit Utrecht

Wout van Dijk & Wietse van de Lageweg

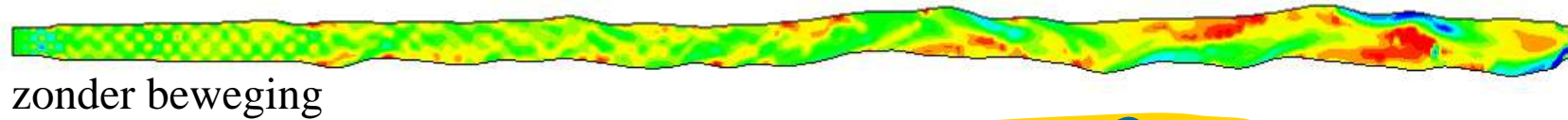
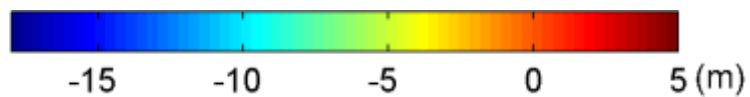
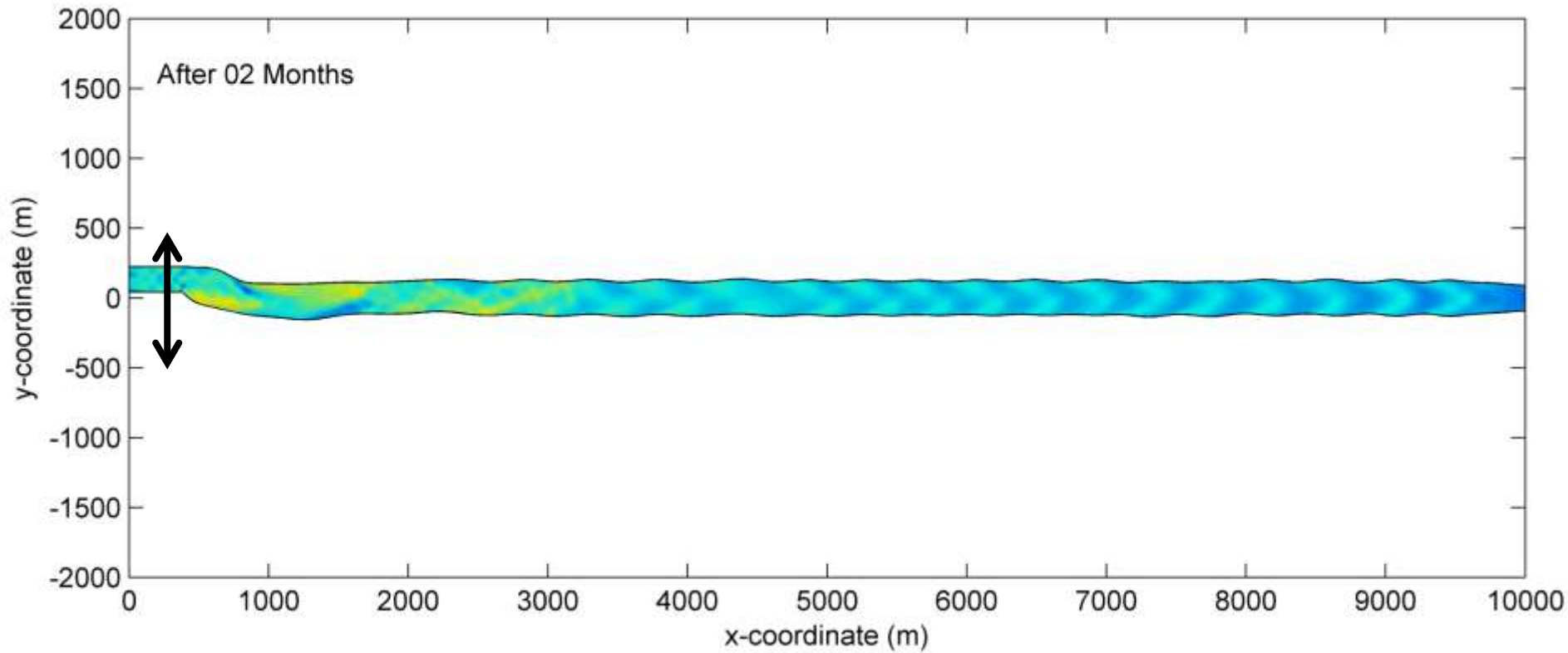


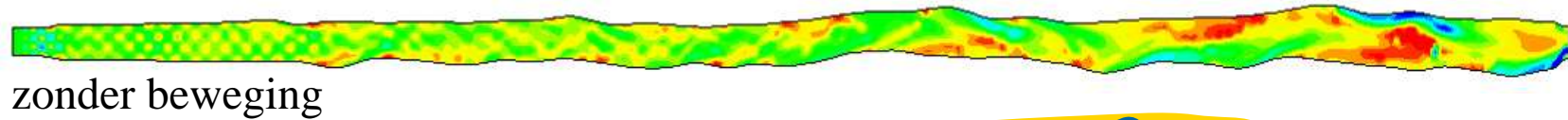
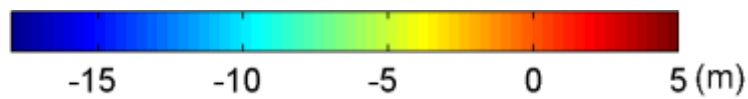
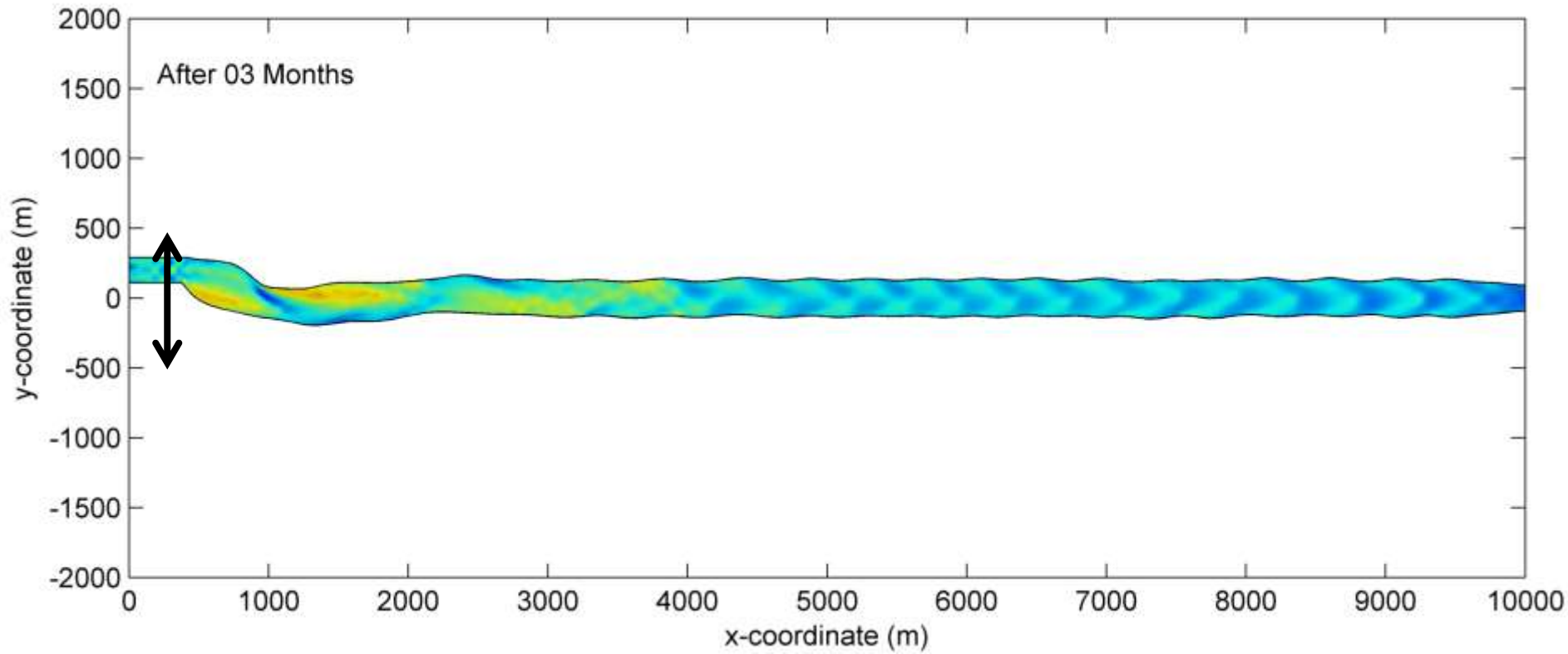




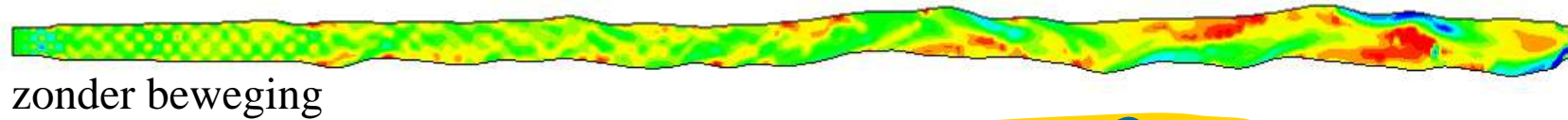
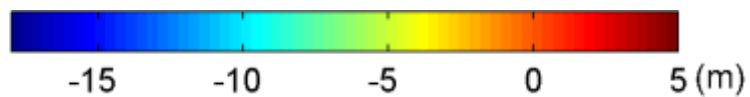
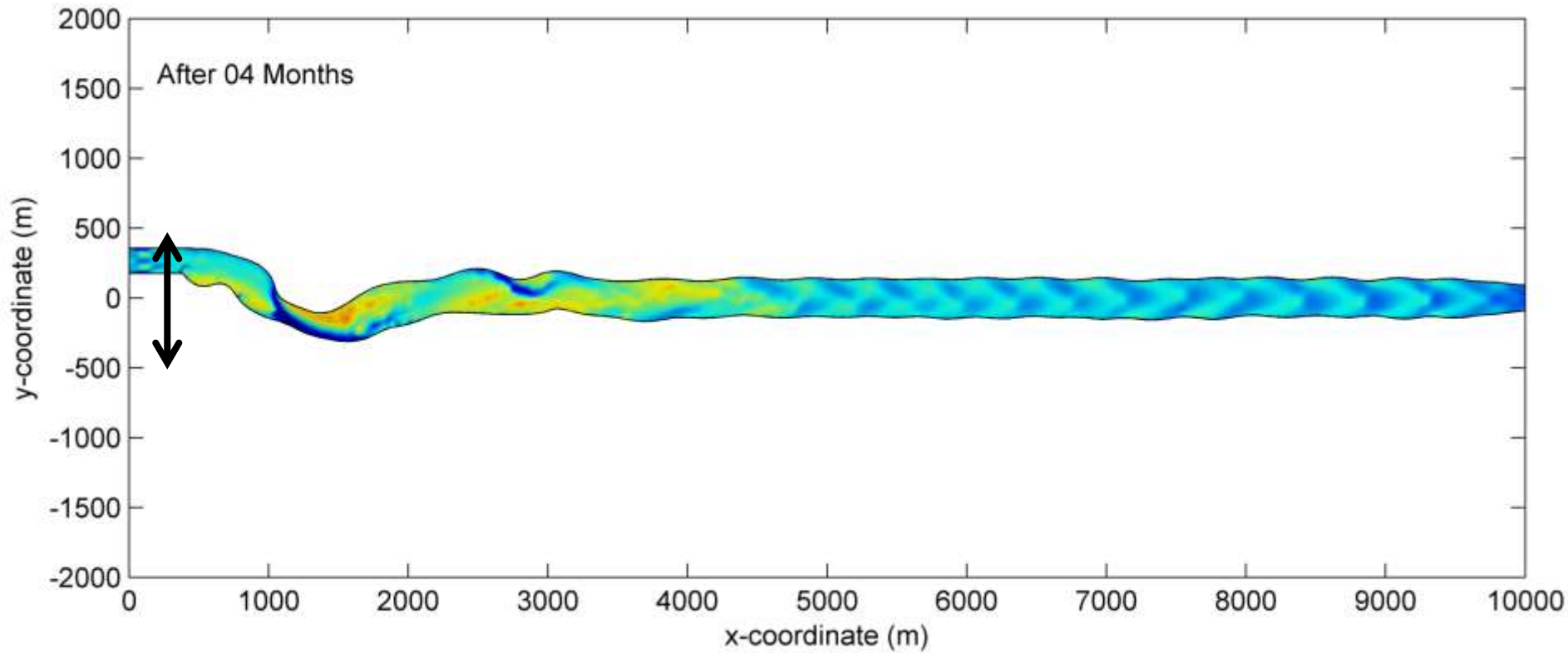


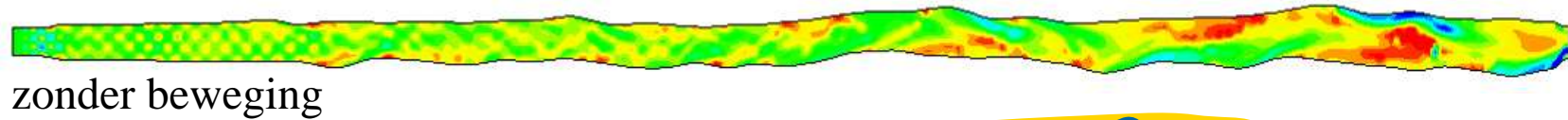
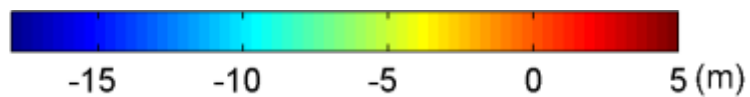
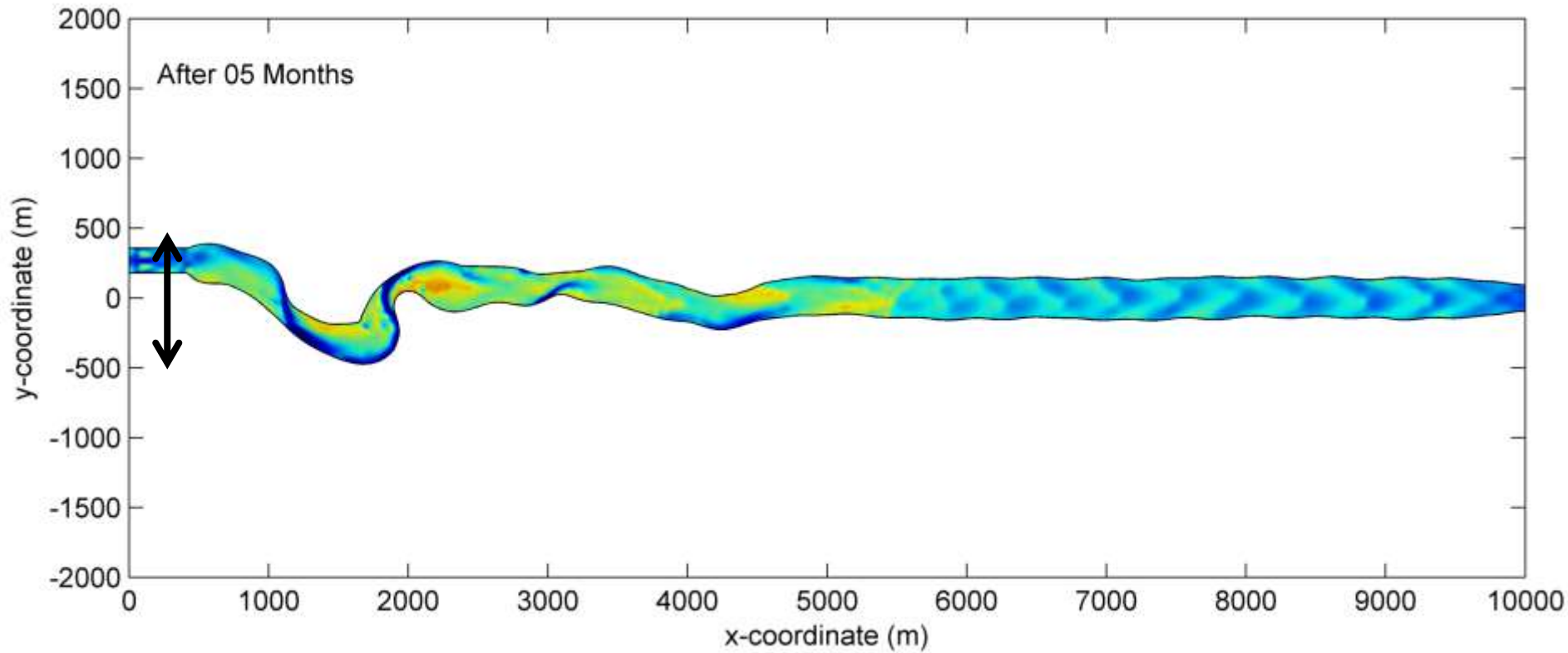




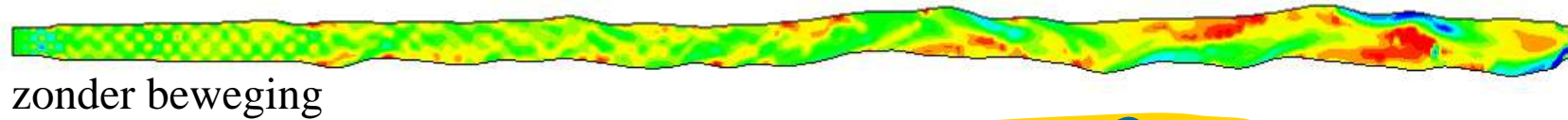
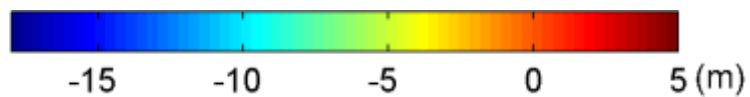
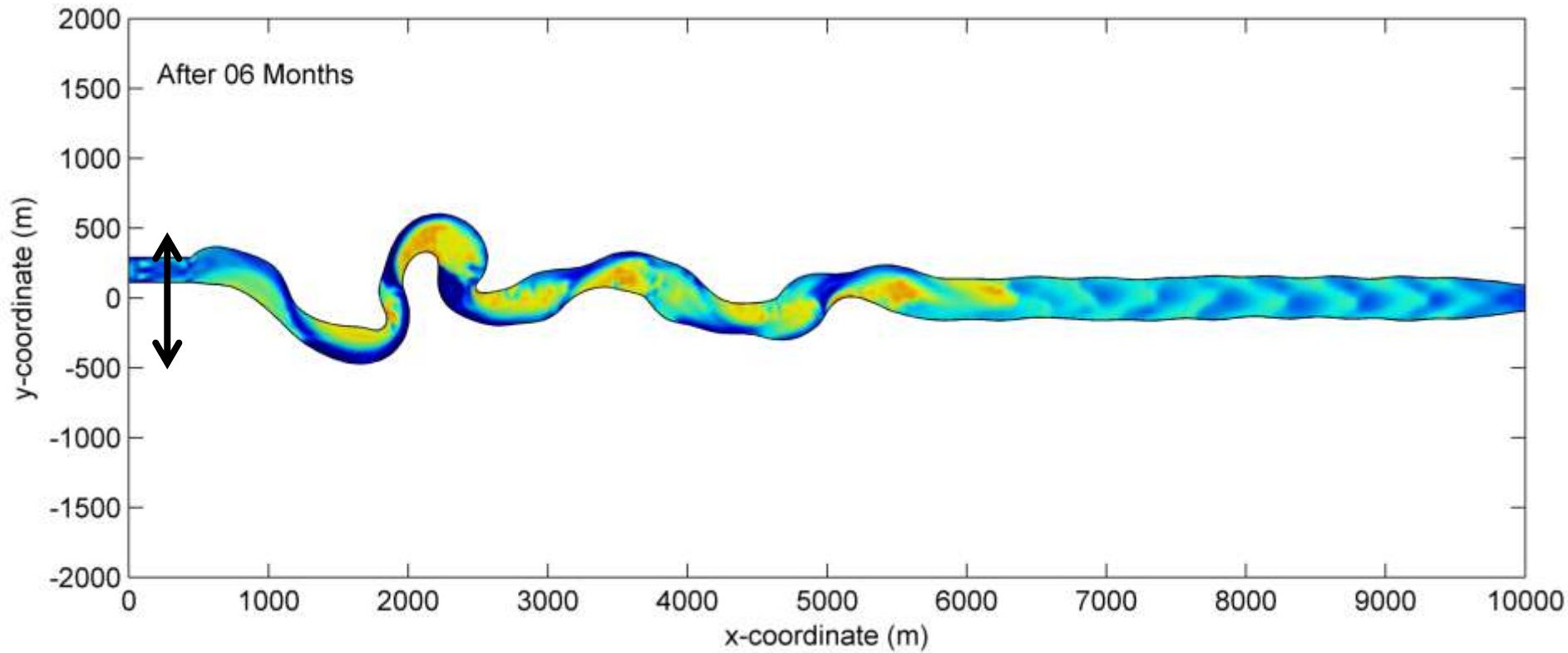


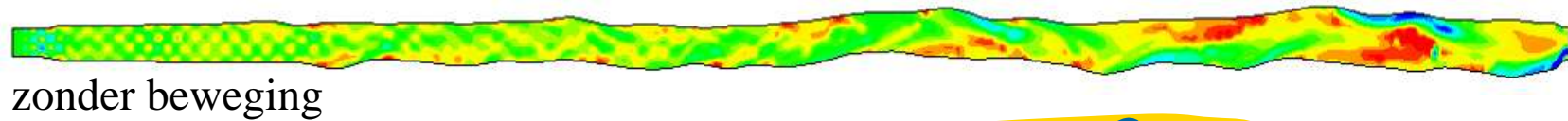
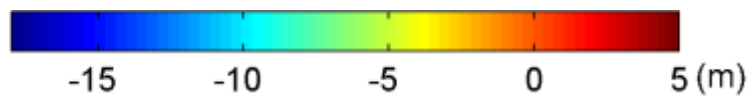
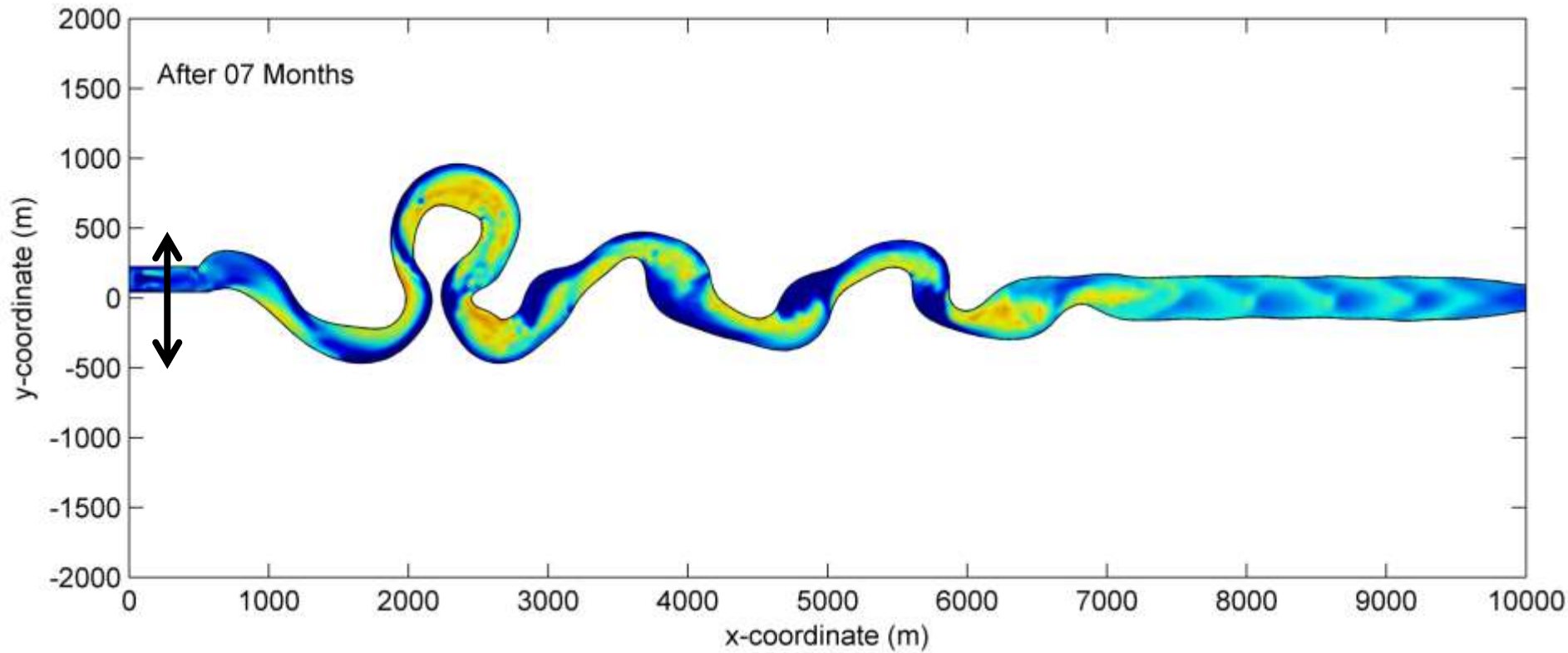




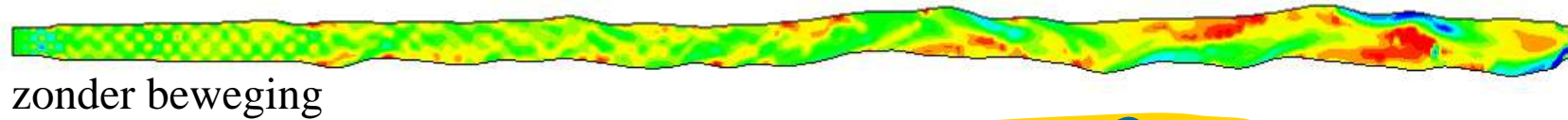
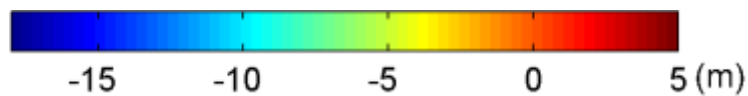
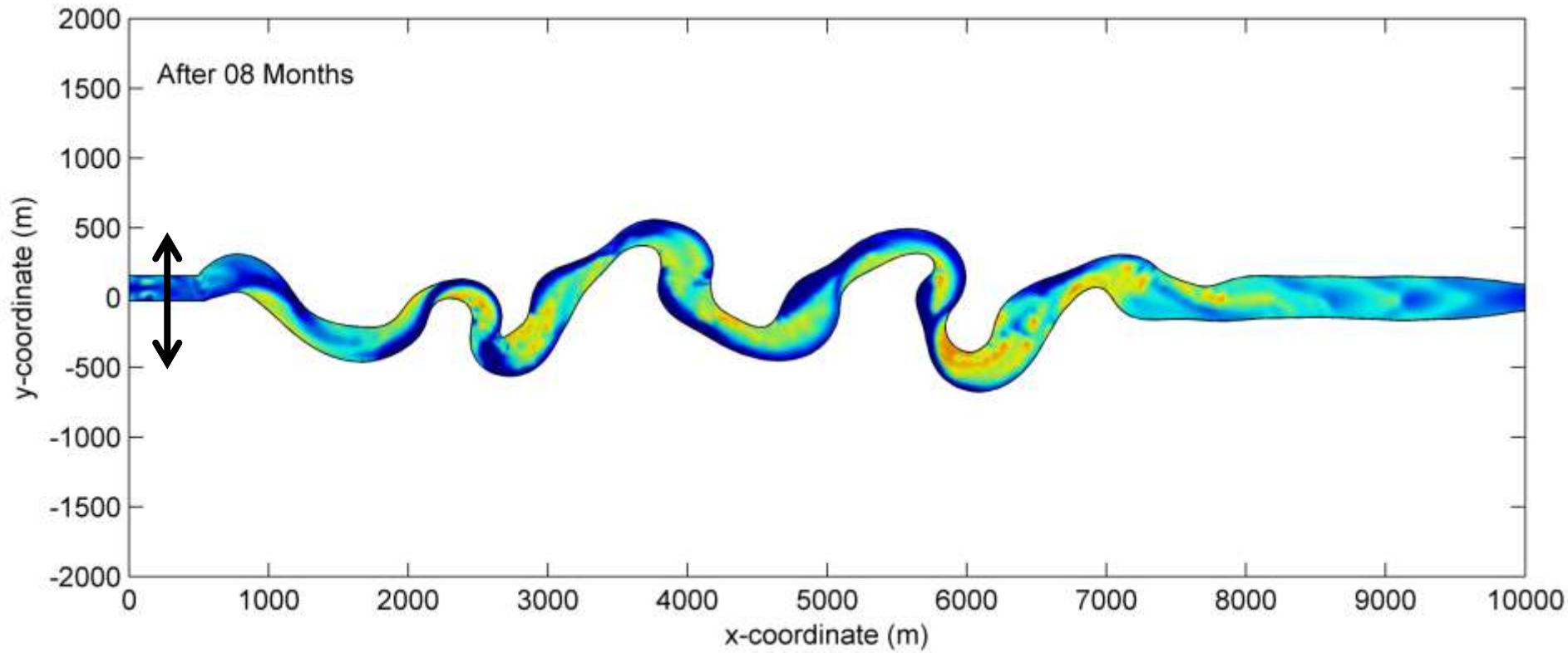


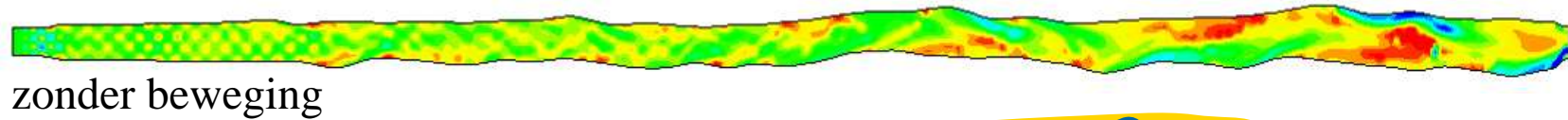
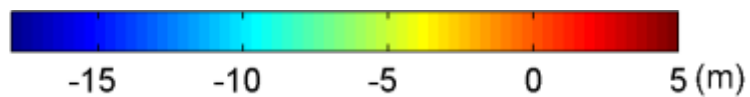
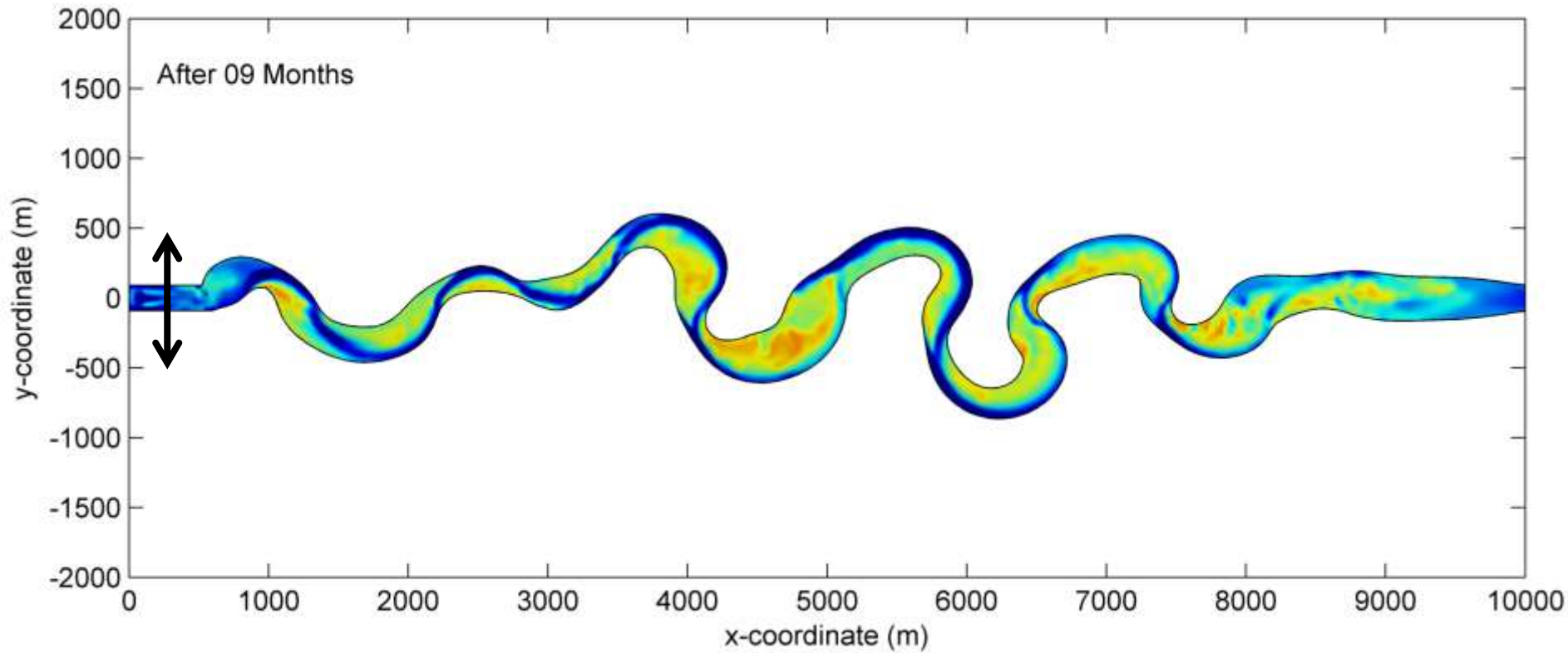




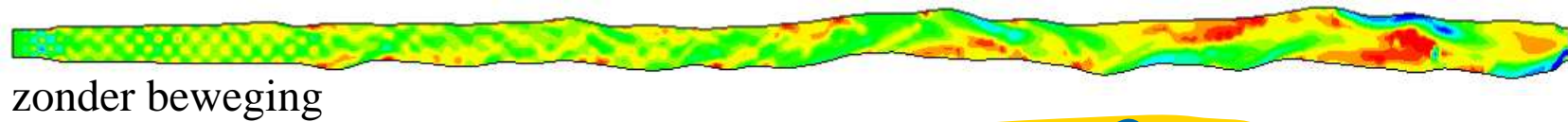
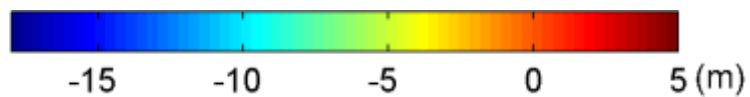
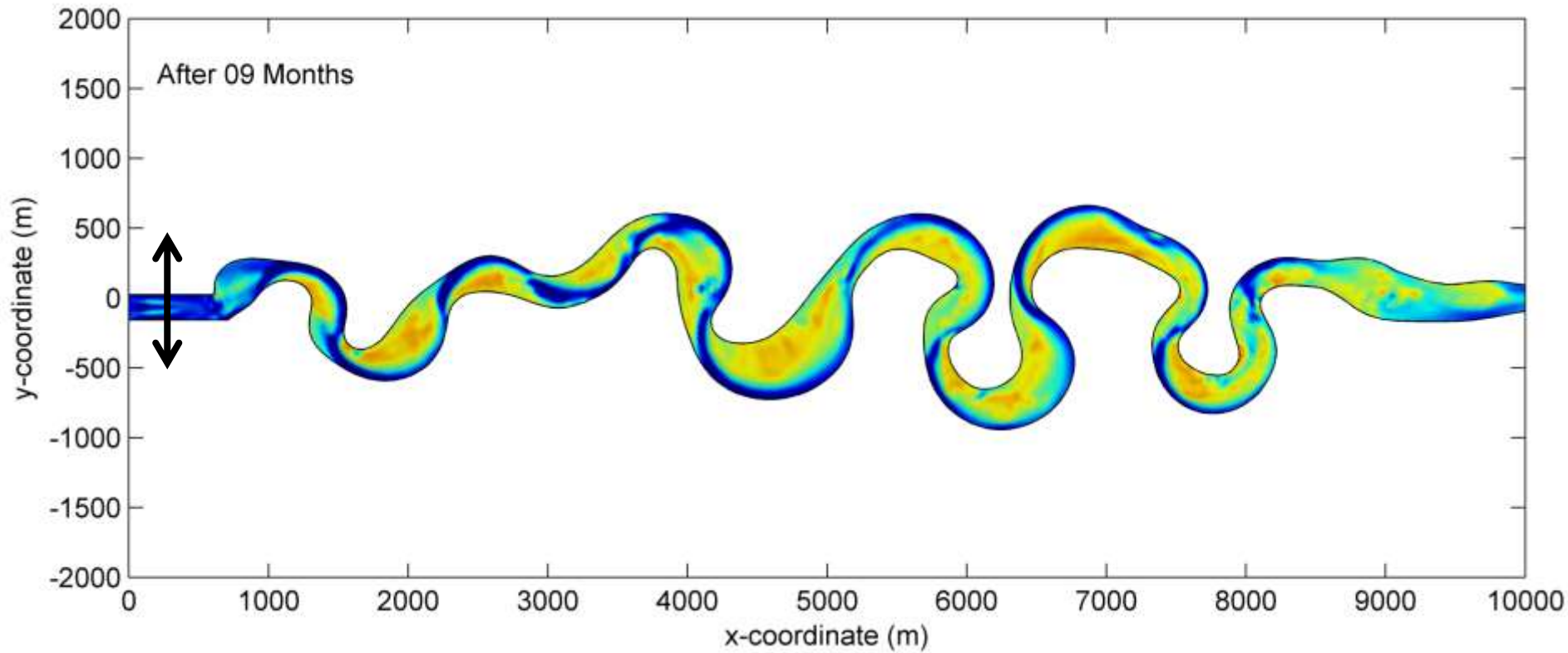


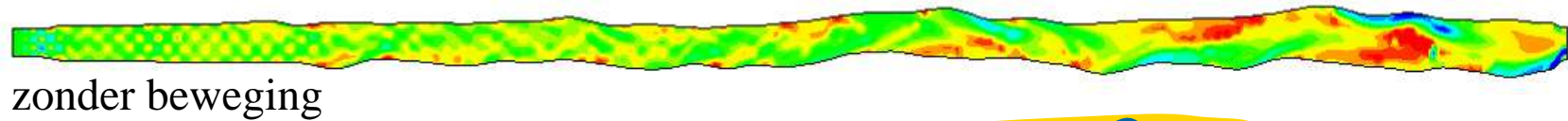
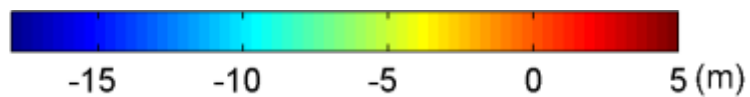
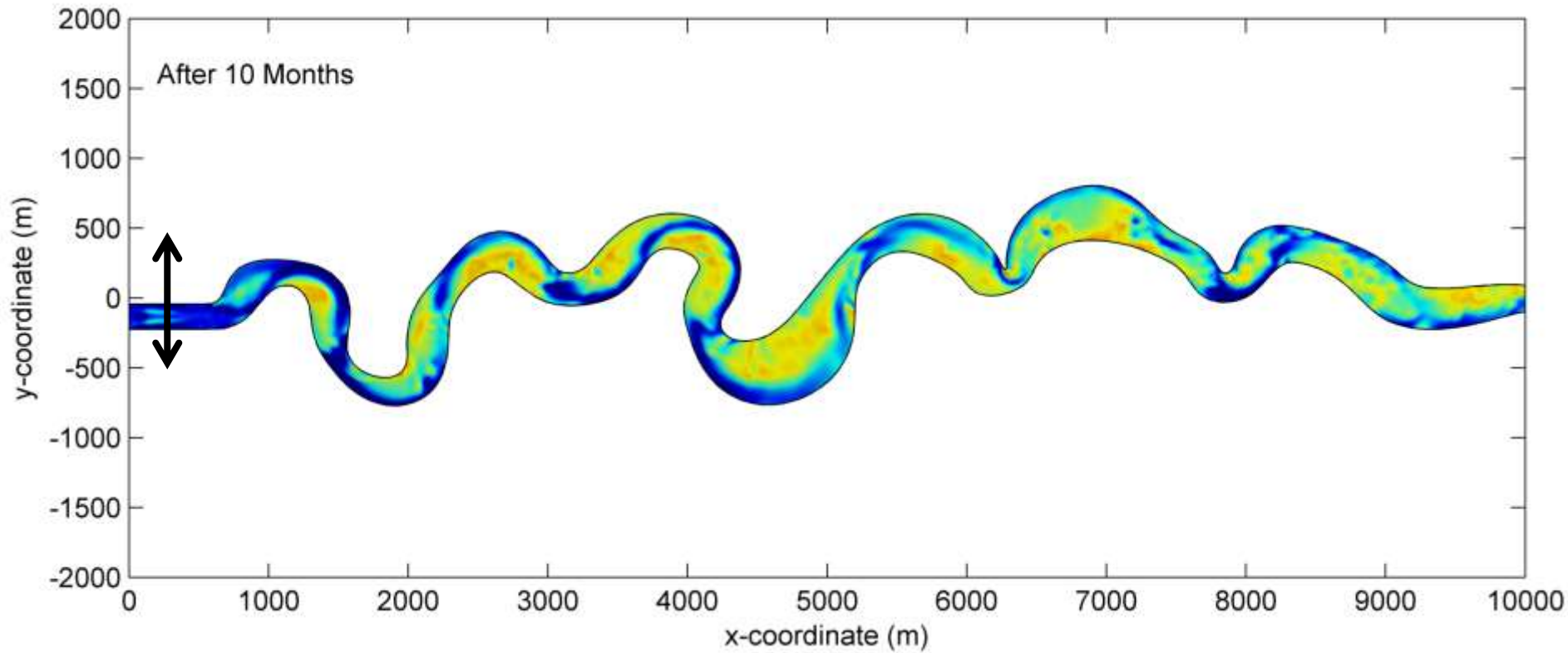




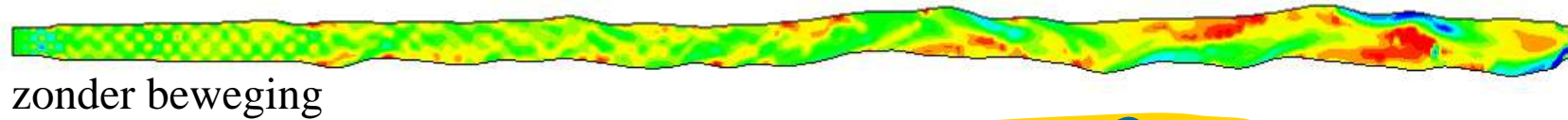
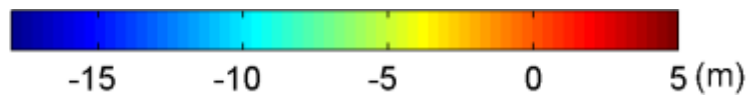
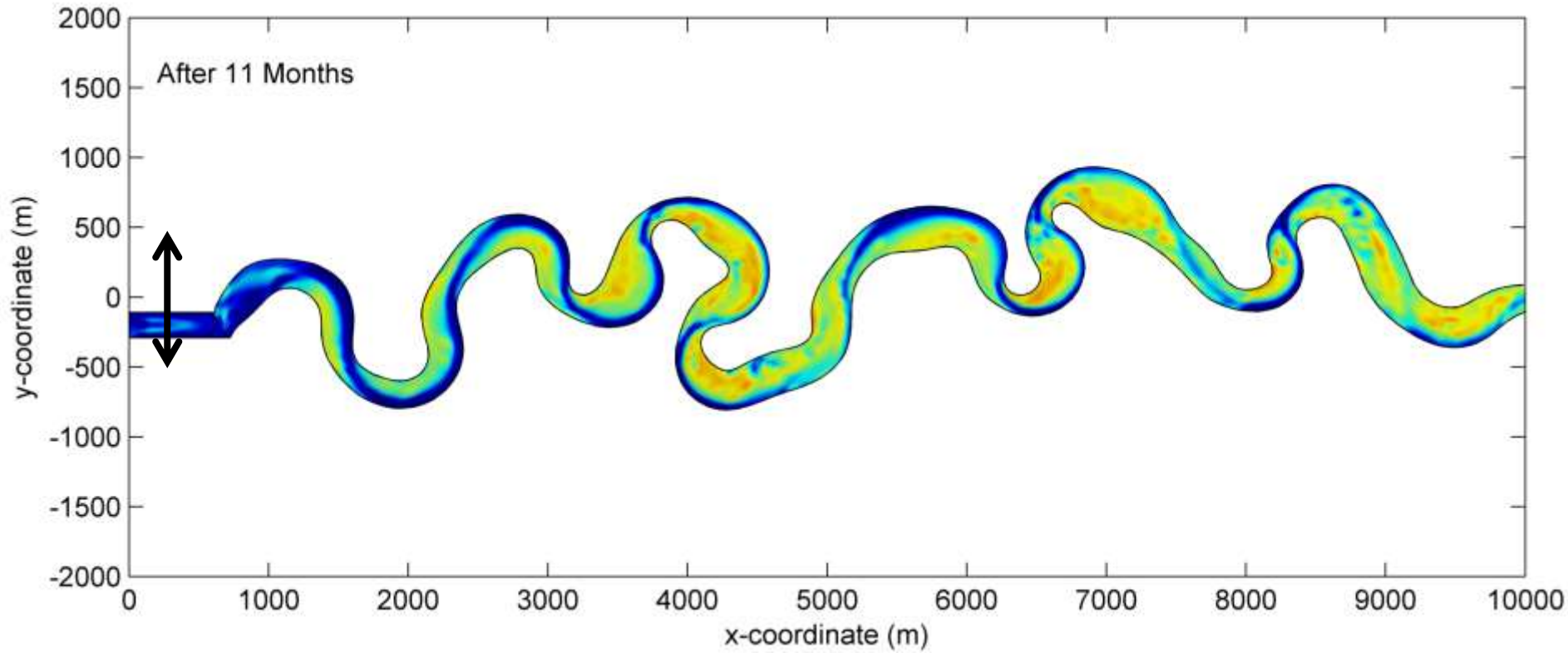


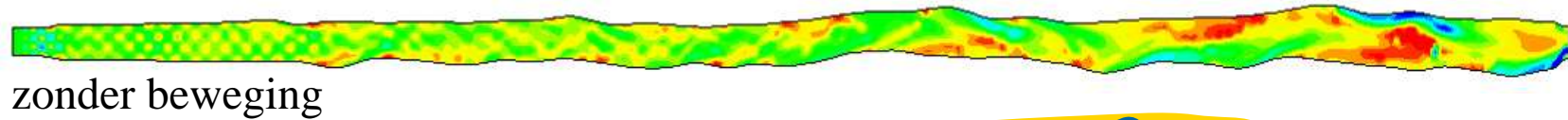
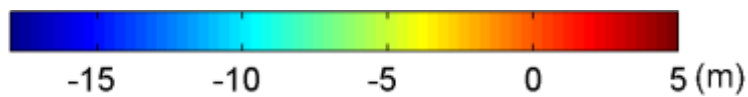
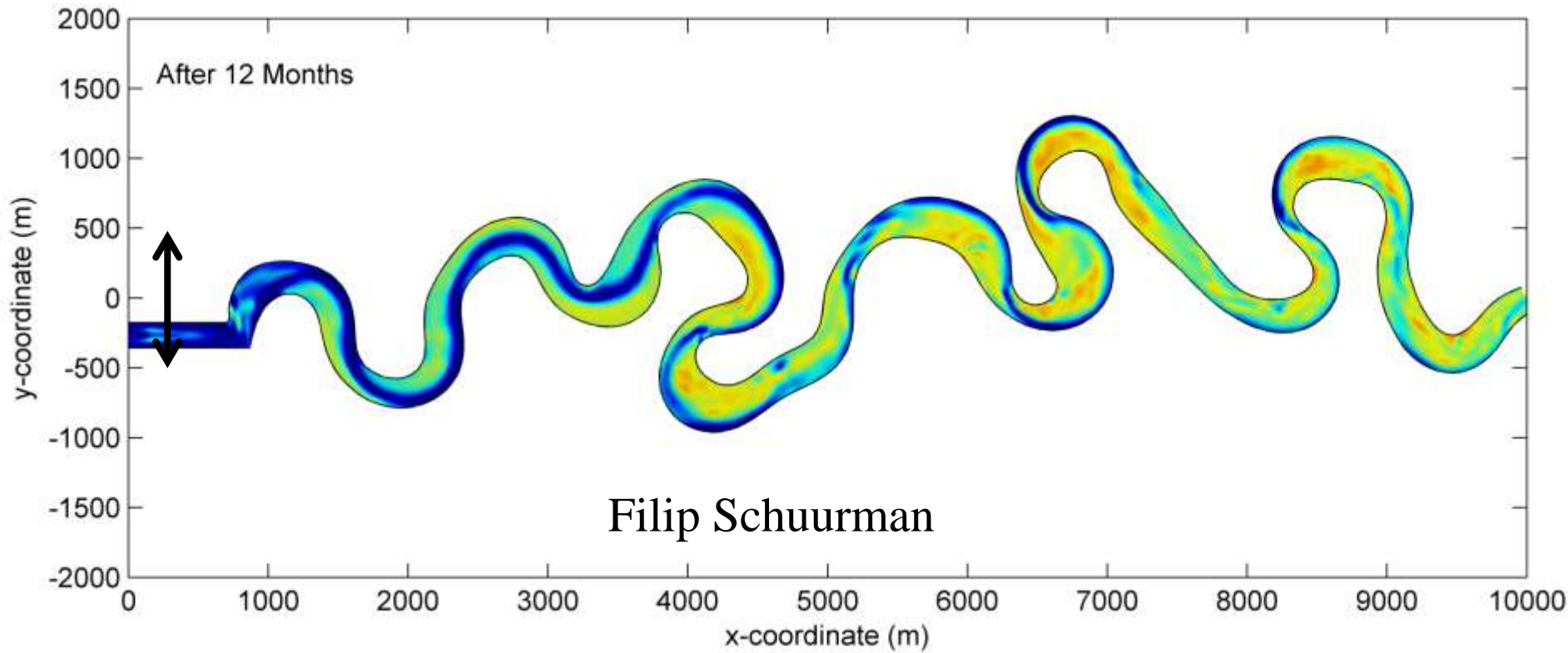












# Riviersplitsingen en -verleggingen





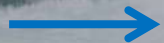


Cumberland Marshes, Canada



An aerial photograph showing a meandering river channel, the Steamboat Channel, winding through a vast, green, marshy landscape. The channel is characterized by sharp, frequent turns, creating a zig-zag pattern. The surrounding terrain is a mix of dense green vegetation and open marshland. A blue arrow in the lower-left quadrant points towards the channel's junction with a larger, straighter river. The overall scene is a natural, undisturbed wetland environment.

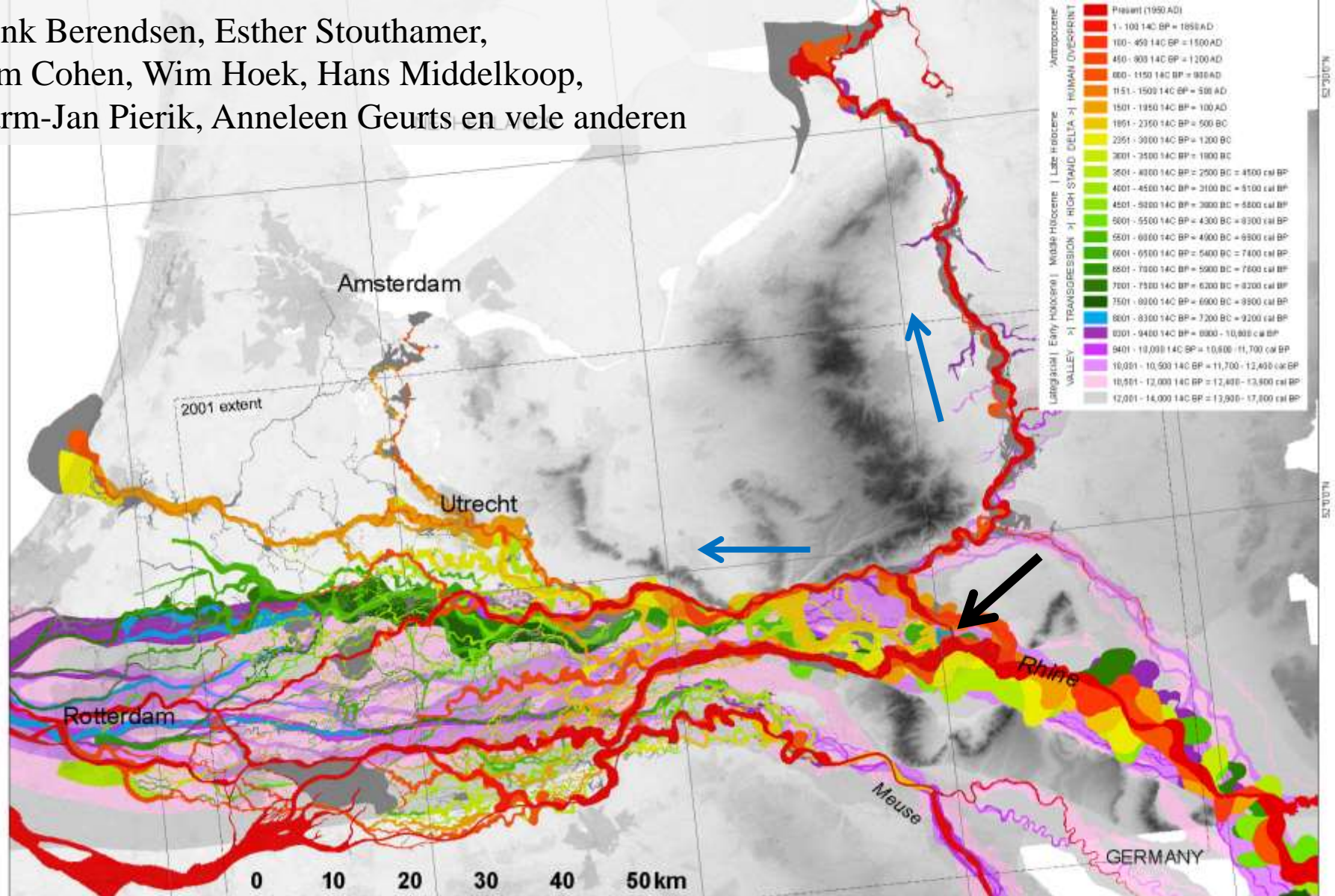
Steamboat Channel  
(nu knie-diep)



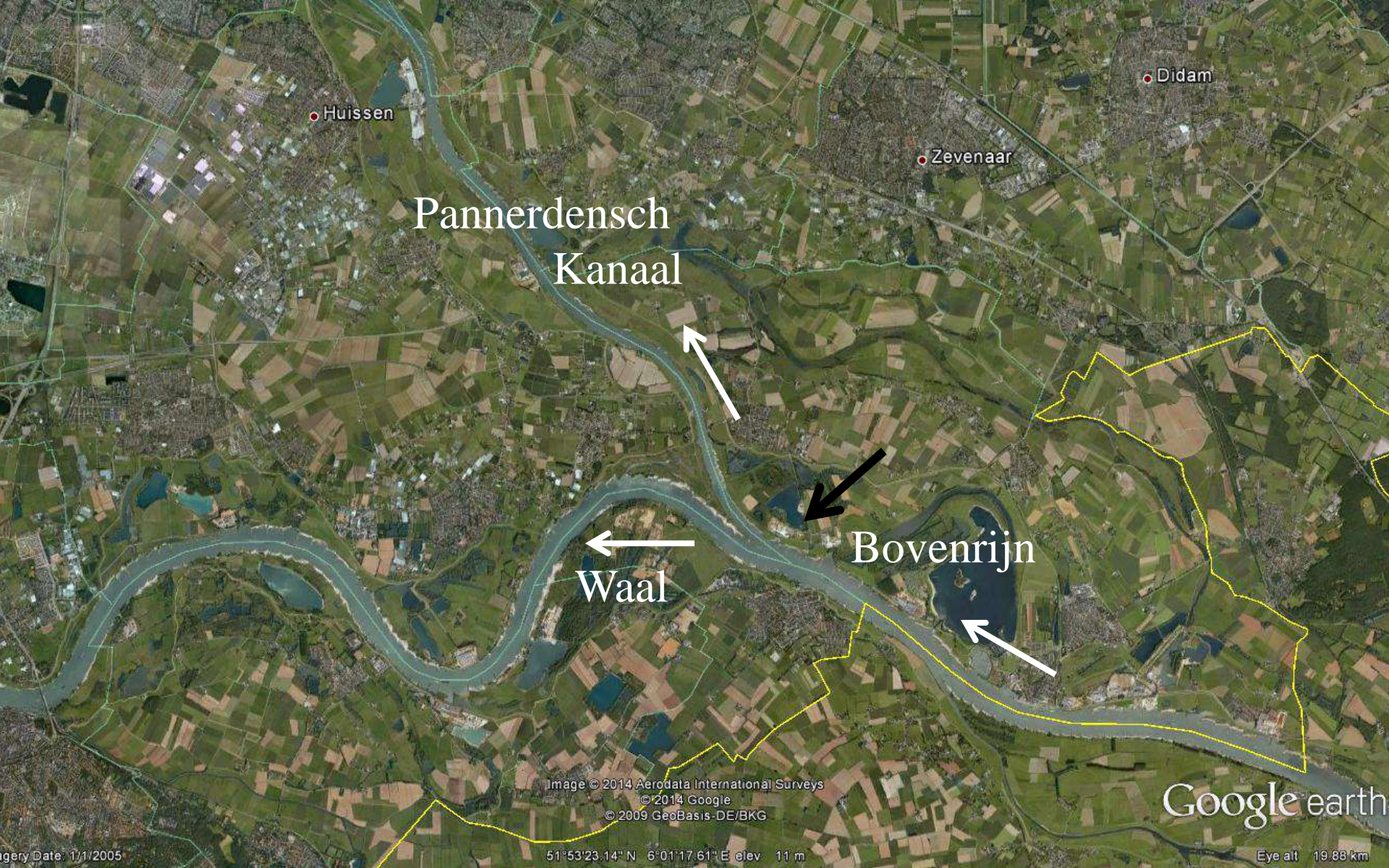
Cumberland Marshes, Canada



Henk Berendsen, Esther Stouthamer,  
Kim Cohen, Wim Hoek, Hans Middelkoop,  
Harm-Jan Pierik, Anneleen Geurts en vele anderen







Huissen

Didam

Zevenaar

Pannerdensch  
Kanaal



Bovenrijn

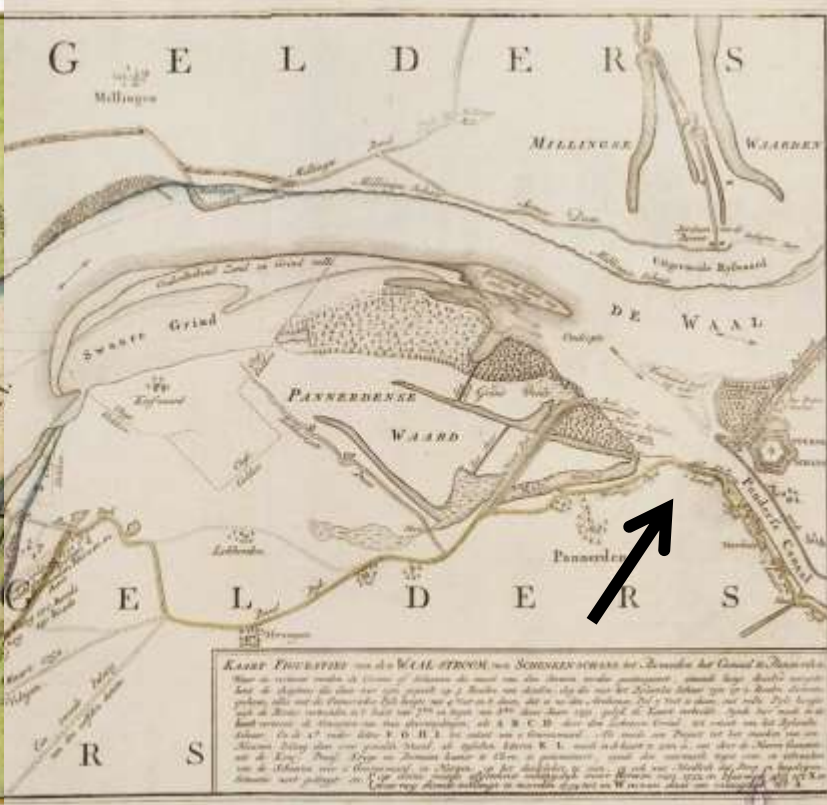
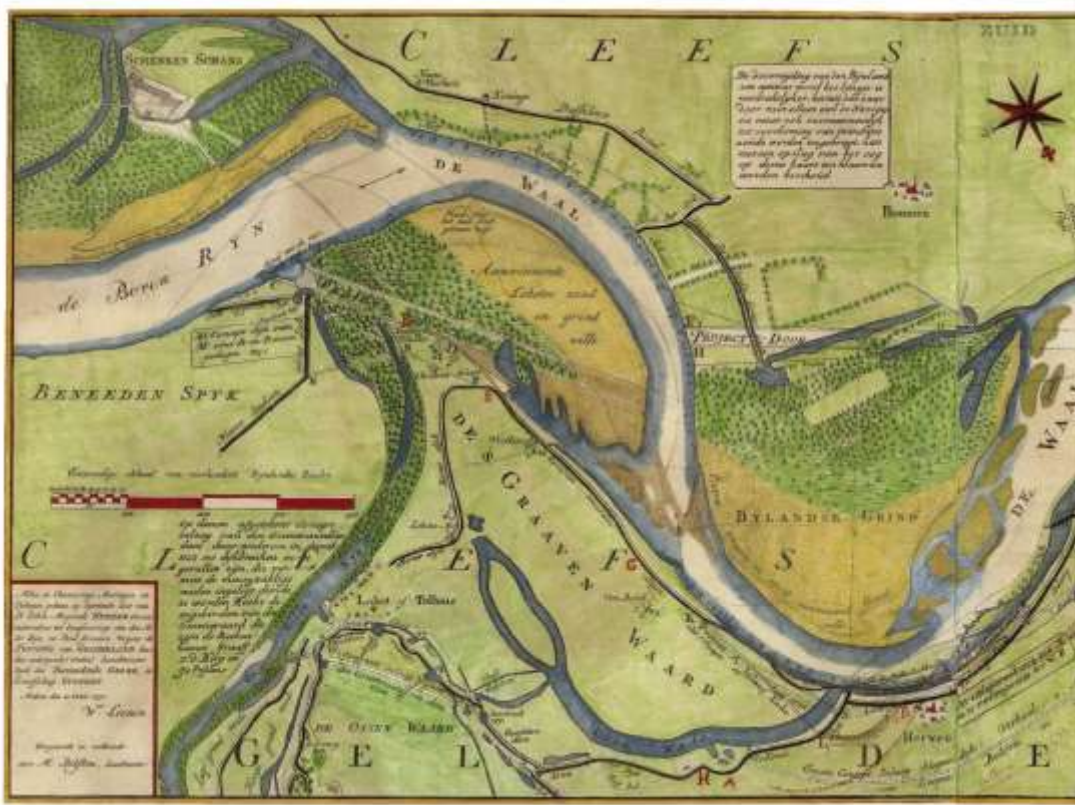
Waal



Image © 2014 Aerodata International Surveys  
© 2014 Google  
© 2009 GeoBasis-DE/BKG

Google earth







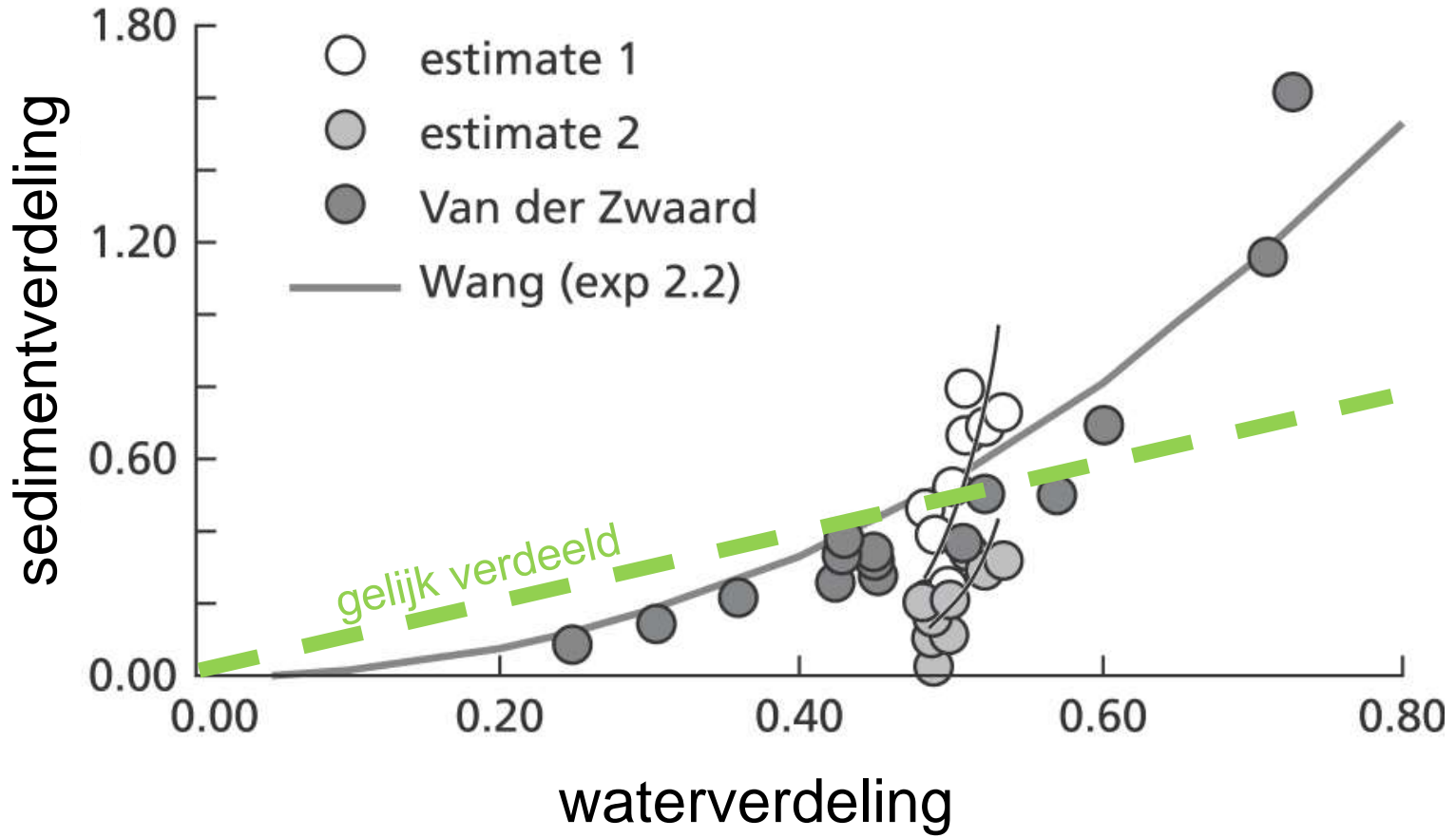
Christiaan Huygens  
1629-1695







# a Pannerdensche Kop





# Riviermondingen



















Westerschelde

Hedwige

Image © 2014 Aerodata International Surveys

Date: 1/1/2005

51°23'29.81" N 4°05'20.86" E elev 0 m





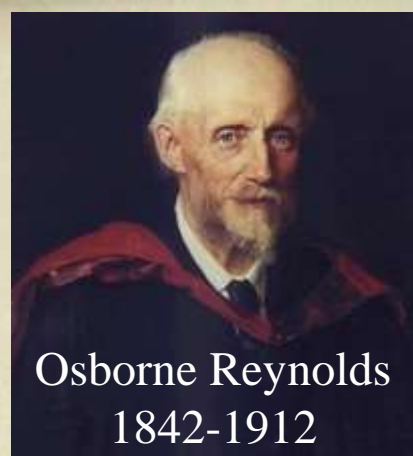
# Trekken aan de staart van een leeuw





# De Metronoom: nieuwe getijmachine



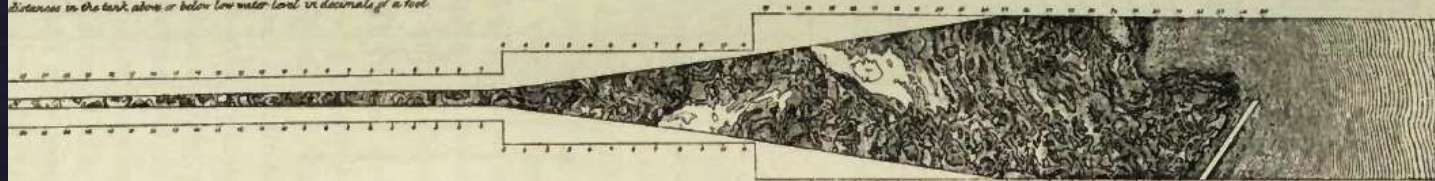


Osborne Reynolds  
1842-1912

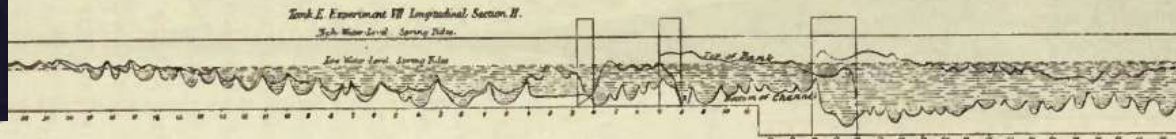
WITH LAND WATER.

Tank E. Experiment VII. Plan II. After 101730 tides at 36.34 Sec?

Distances in the tank above or below low water level in decimals of a foot.

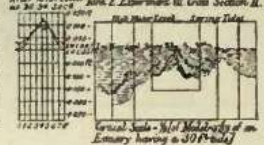


Tank E. Experiment VII Longitudinal Section II.  
High Water Level - Spring Tides.



Horizontal Scale -  $\frac{1}{4}$  of Model -  $\frac{1}{3155}$  of an Estuary having a 30 Feet tide.

Tide Curves after 101730 tides Tank E. Experiment VII Cross Section II.

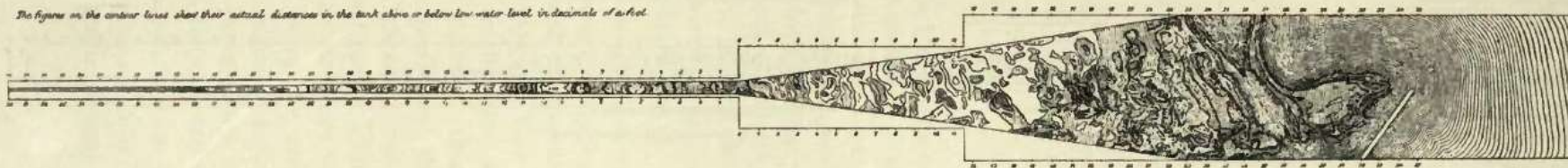


Vertical Scale -  $\frac{1}{64}$  of Model -  $\frac{1}{3155}$  of an Estuary having a 30 Feet tide.

WITH LAND WATER.

Tank F. Experiment VI. Plan I. After 16972 tides at 24.21 Sec?

The figures on the contour lines show their actual distances in the tank above or below low water level in decimals of a foot.

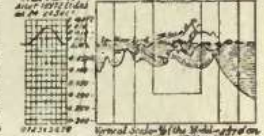


Tank F. Experiment VI Longitudinal Section I.  
High Water Level.



Horizontal Scale -  $\frac{1}{4}$  of Model -  $\frac{1}{3155}$  of an Estuary having a 30 Feet tide.

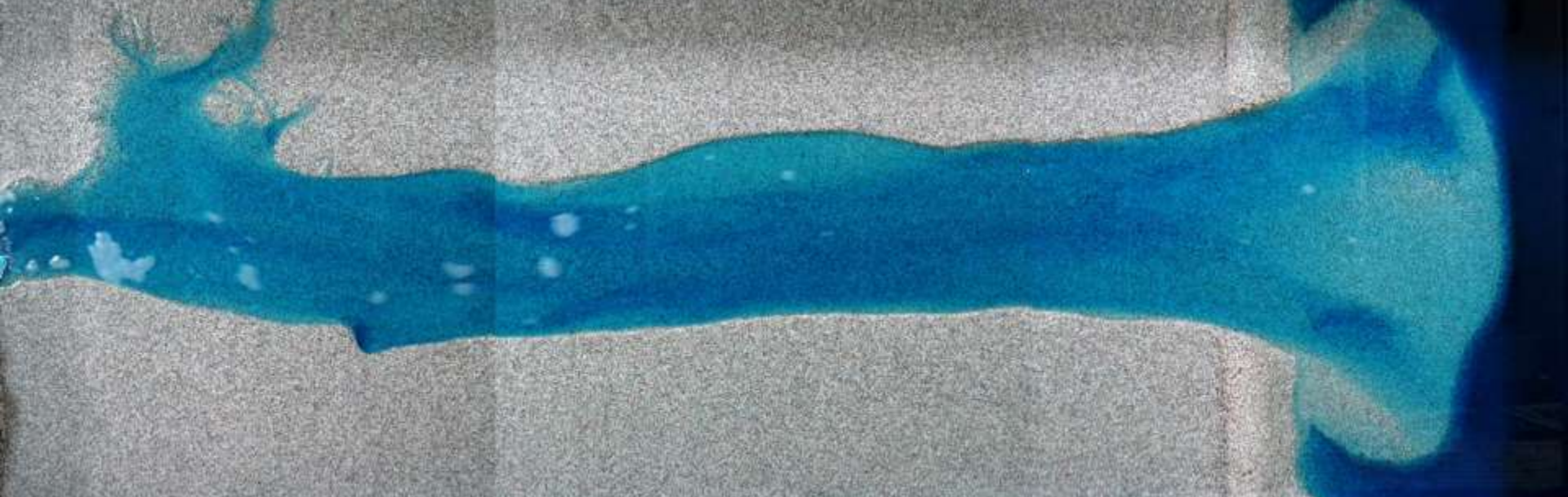
Tide Curves after 16972 tides Tank F. Experiment VI Cross Section I.



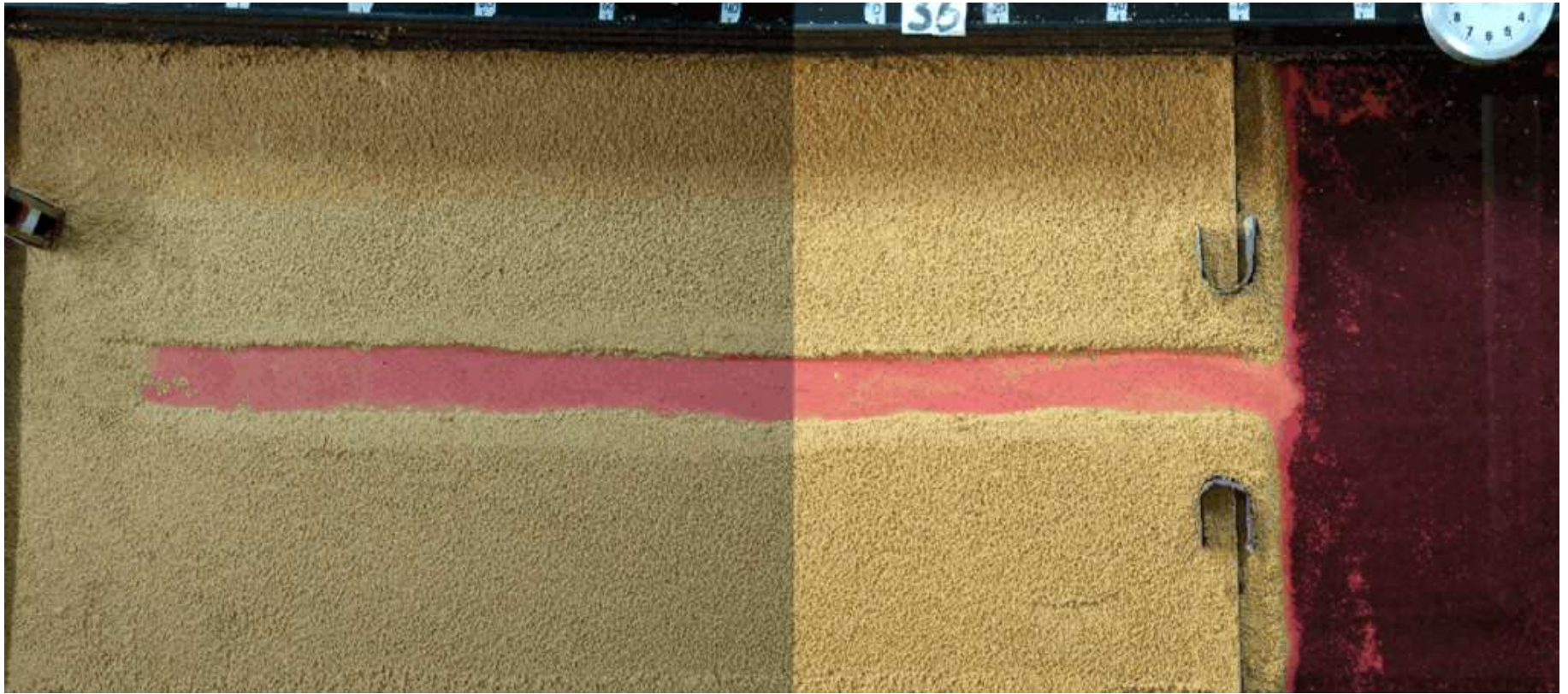
Vertical Scale -  $\frac{1}{64}$  of Model -  $\frac{1}{3155}$  of an Estuary having a 30 Feet tide.

Fig. 14.





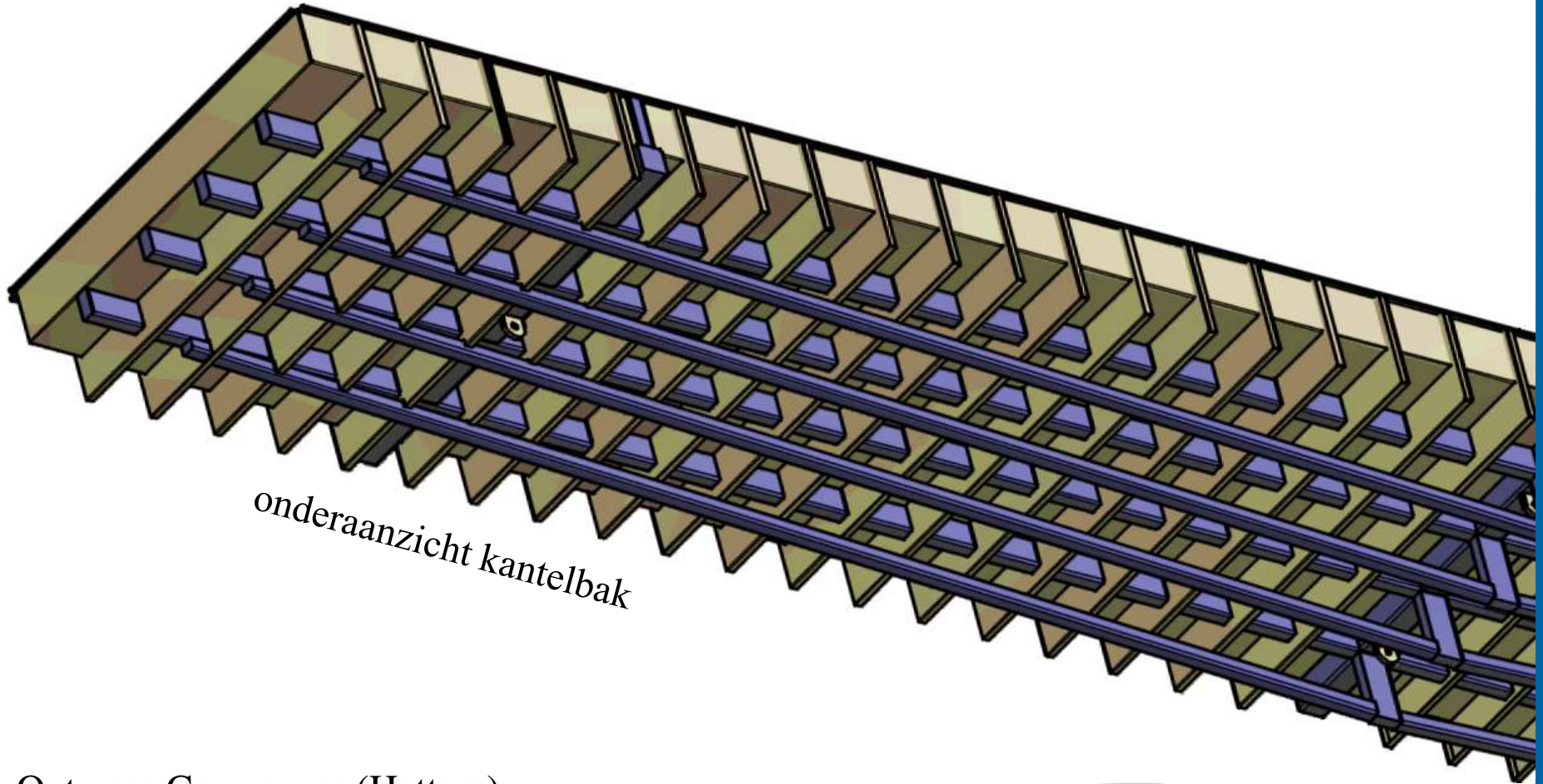
Jasper Leuven



Renske Terwischa van Scheltinga



# Licht en sterk, gesneden met laser



*onderaanzicht kantelbak*



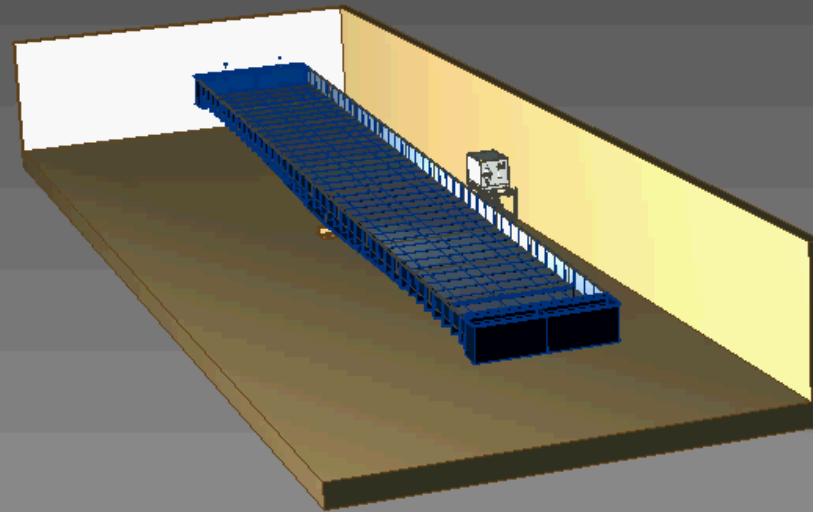




*Victoria amazonica*  
Oude Hortus,  
Universiteitsmuseum  
Utrecht



# Ontwerp Consmema (Hattem)



Enabling new technology

# Aanschouwelijk, inzichtelijk en vormend onderwijs







**MET EI**

**ZONDER EI**

# Opleiding Aardwetenschappen

- didactiek opfrissen
- intervisie
- peer review van onderwijs
- Tijd en causaliteit in de aardwetenschappen





Van peuter tot promovendus (m/v)









Zoek ..

## Breng(t) wetenschap in de klas!

**IK BEN LEERKRACHT**



**IK BEN WETENSCHAPPER**



**WETENSCHAP EN TECHNOLOGIE →**



**ONDERZOEKEND EN  
ONTWERPEND LEREN**









Kapuki maya yanna dok.

Pi! Pi! Pilo steppe gol.

Fofi fofi og deffe.

Pilo pilo.

Ate. Yanna dok.

Pi, Blot tomi tomi.

Yanna bluf...

Deffe!

Apa pilo bozo?

Pluk!

Fofi!

Waan.

Tedepl!

Tedepl! Apa yanna dok?

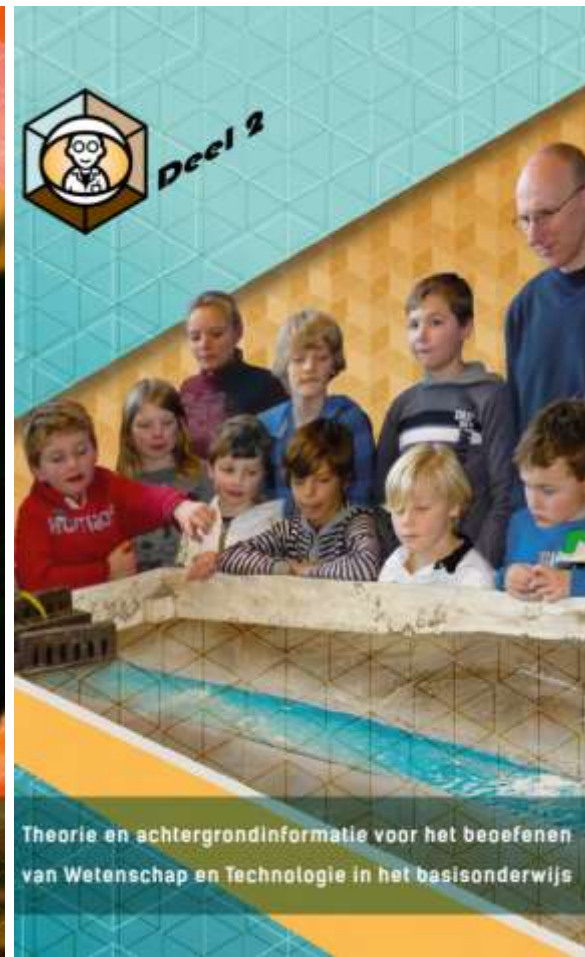
Pi!







# Professionalisering wetenschappers

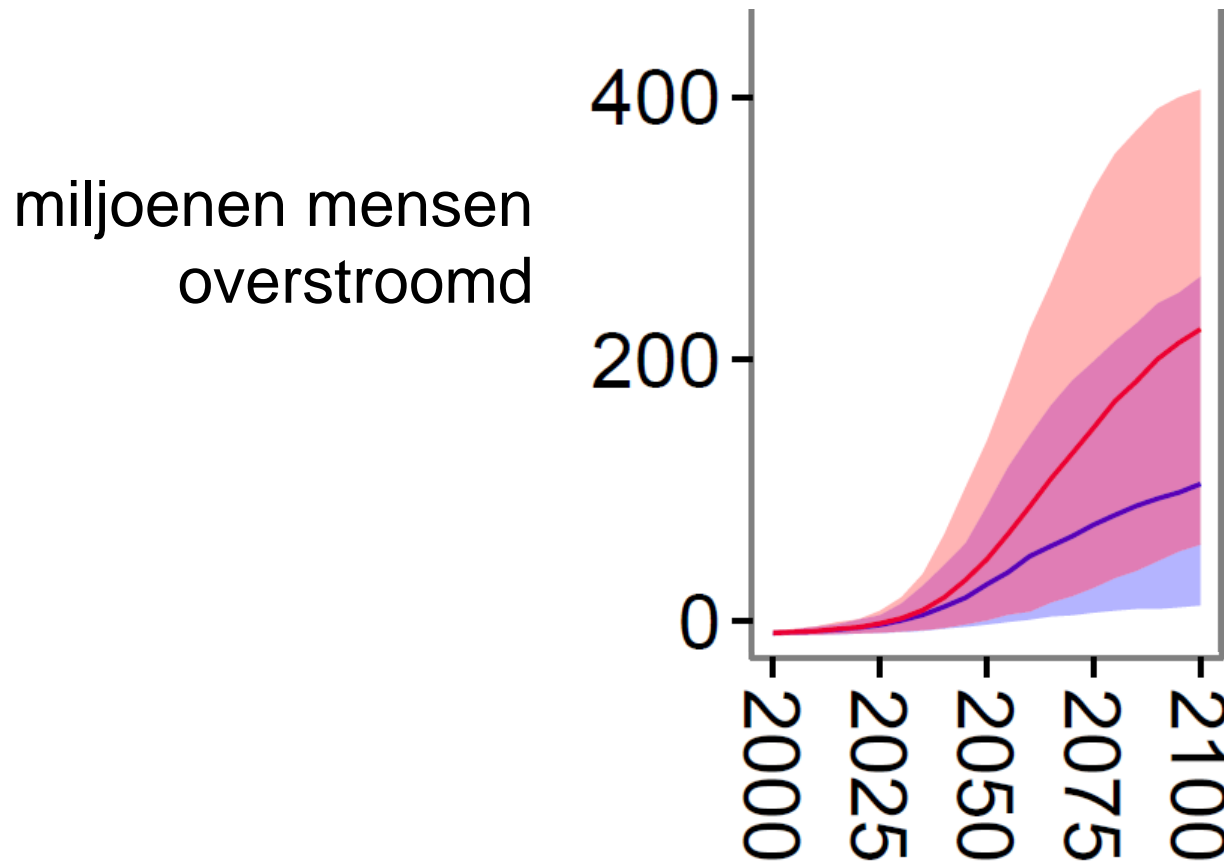


# Toekomst van het Laagland





# Luctor et submergo?



Hinkel et al. 2014

10.1073/pnas.1222469111

• 14 april 2012, 20:19

## Bommetje PVV onder 'definitieve plannen' Bleker met Hedwigepolder



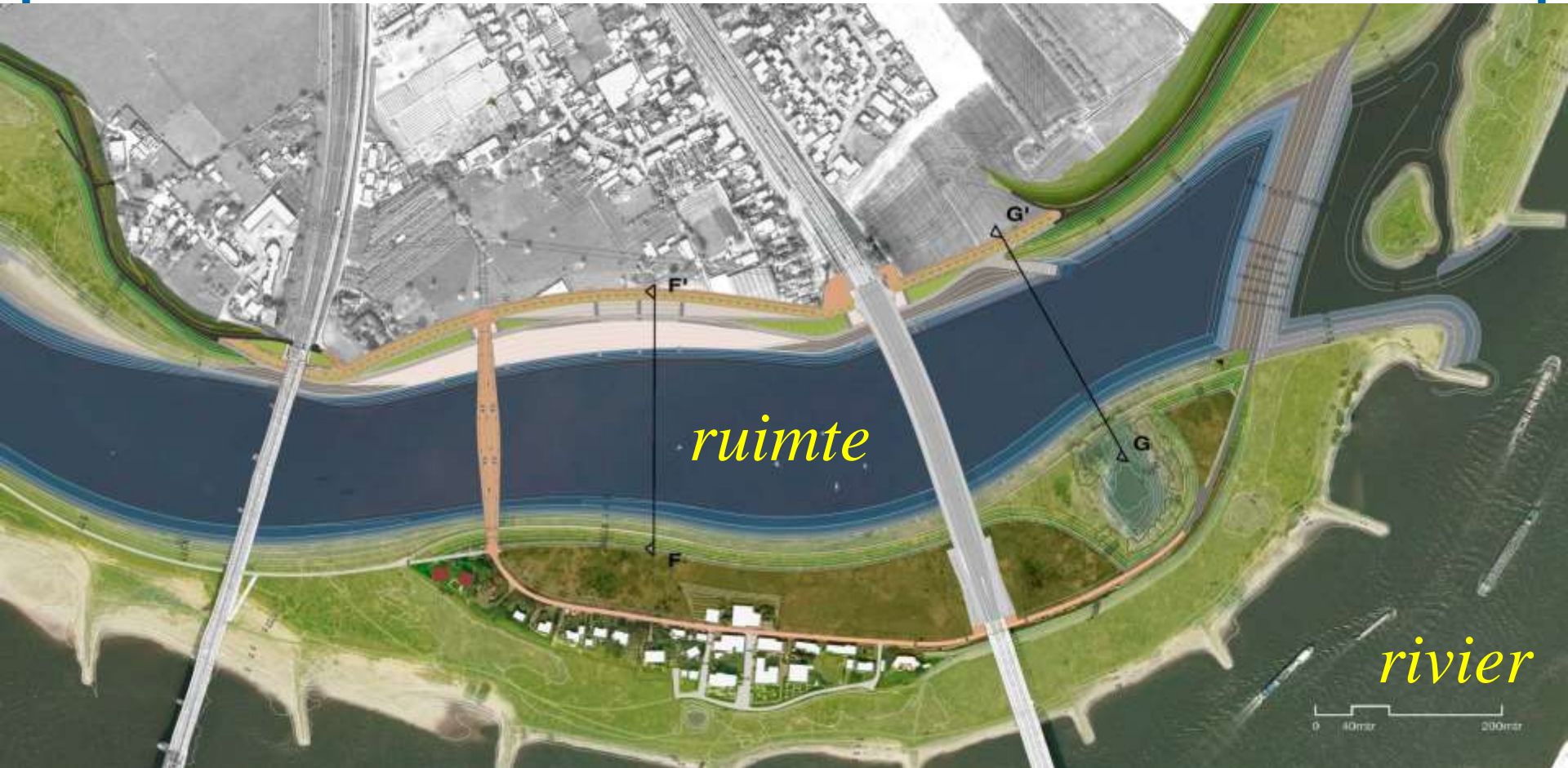


# Groots Plan

- kennis en ideeën
- maatschappelijk begrip
- durf bij politici
- volledige landelijke regie met totaalvisie

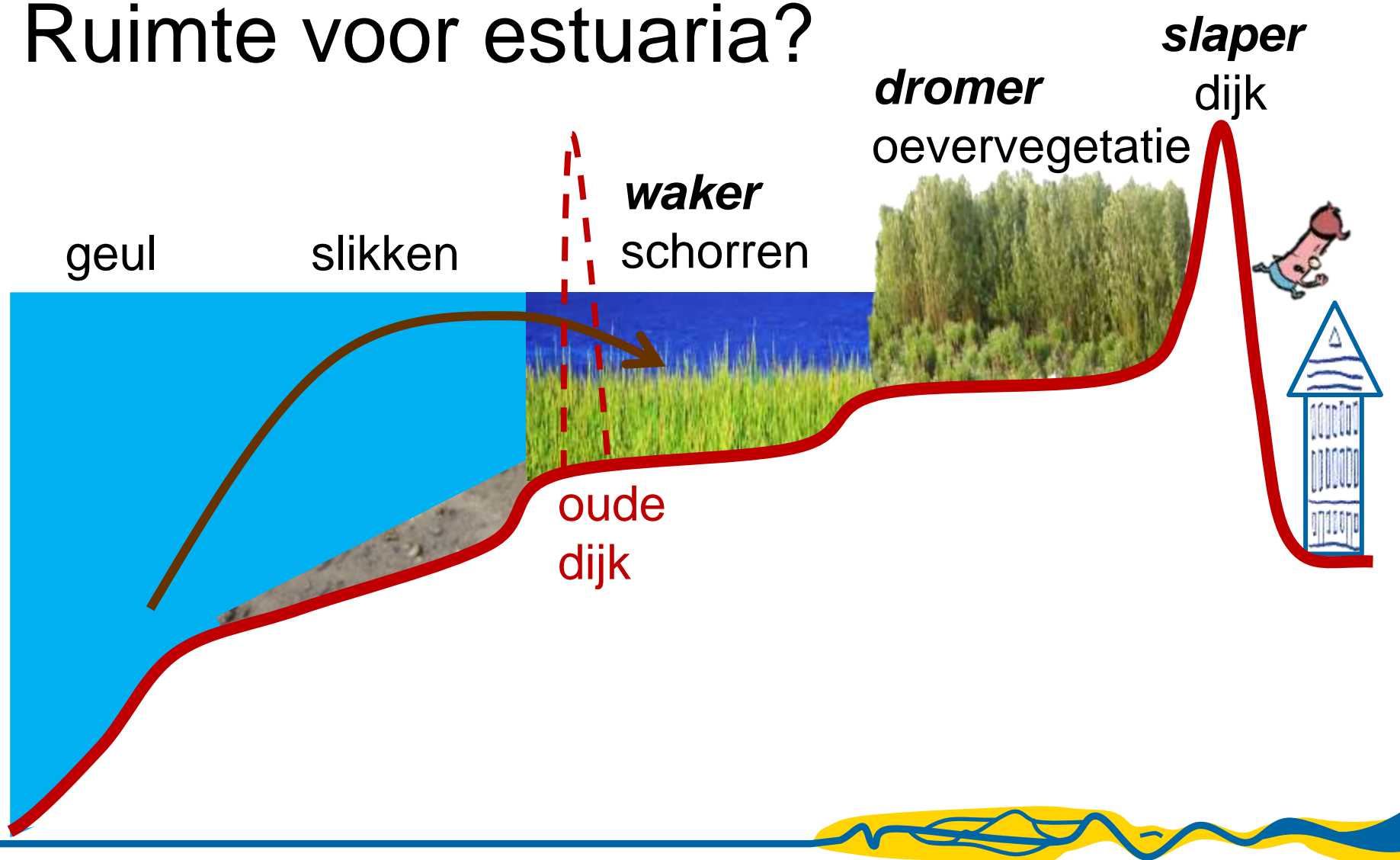


# Ruimte voor de rivier





# Ruimte voor estuaria?



# Werking en waarde van wetenschap





Aan de einder

