EGU2020

האוניברסיטה העברית בירושלים
THE HEBREW UNIVERSITY OF JERUSALEM
الجامعة العبرية في اورشليم القدس

GEOLOGICAL SURVEY OF ISRAEL

מכון שמיר למחקר
מחקר נוטע עתיד
SHAMIR RESEARCH INSTITUTE

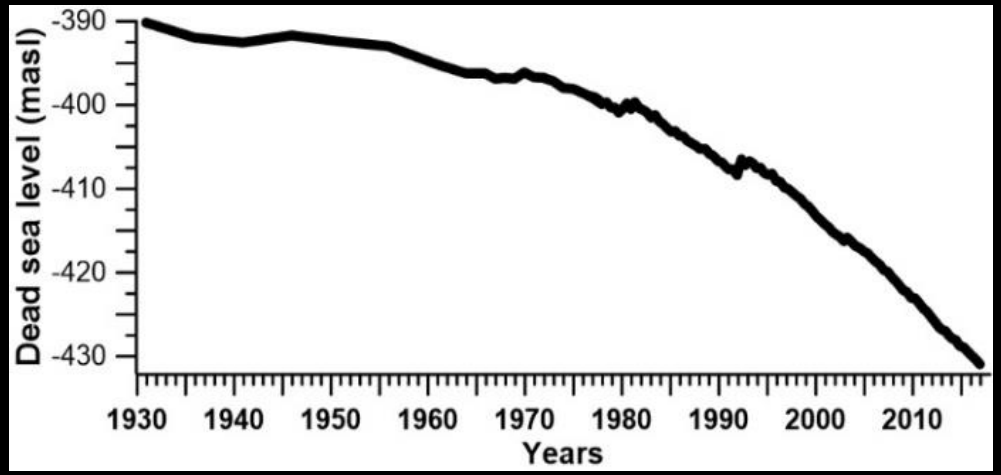
Photo: Peleg Michaeli(2005)

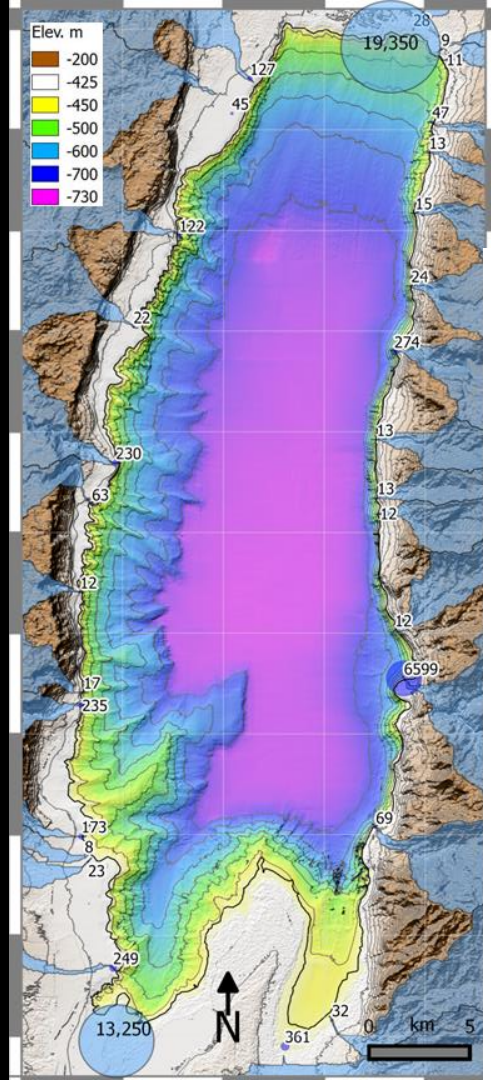
Out of equilibrium sinuosity: The development of incised meandering channels in response to base-level fall

Elad Dente, Nadav Lensky, Efrat Morin, and Yehouda Enzel

THE DEAD SEA GEOMORPHOLOGICAL WONDERLAND

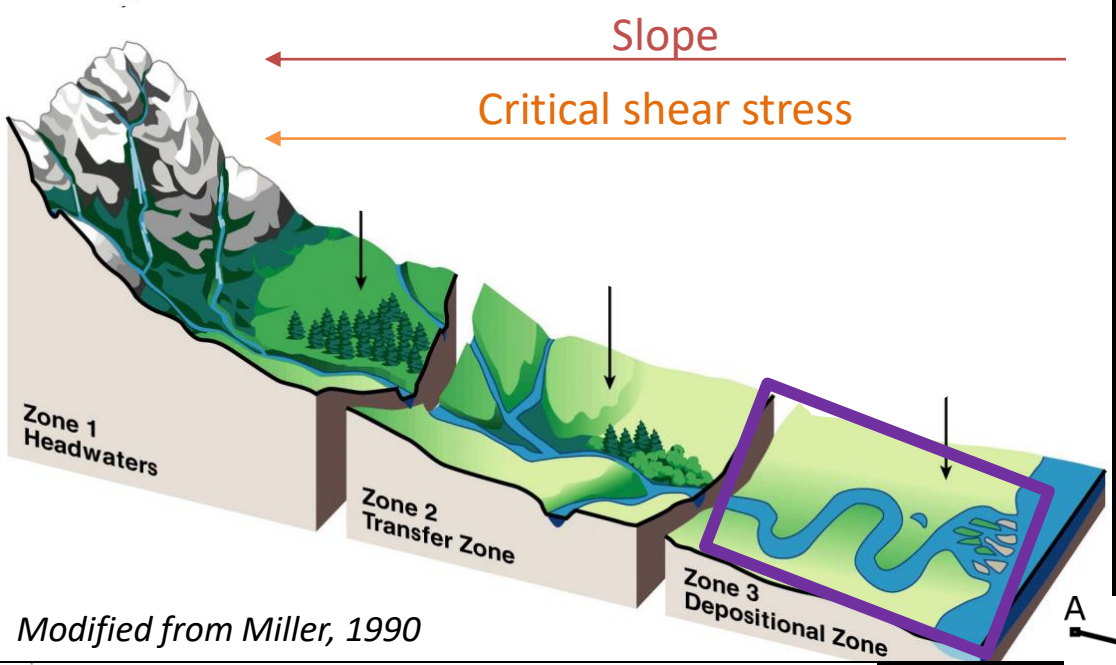
- Deep lake experiencing 40 m level drop at 1 m per year !
- > 40 channels evolving in response
- Various slopes, substrates and hydrologic regimes
- High resolution data (time and space)





Lensky and Dente, 2015; Bathymetry: John Hall


Ein Feshkha study area
provides a field-scale laboratory for observing the impact of steepening regional slope on the channel pattern
- Homogeneous substrate
- Relatively stable discharge
- 12 channels
- Different slope settings
Photo: Iyad M. Swaed



Modified from Miller, 1990

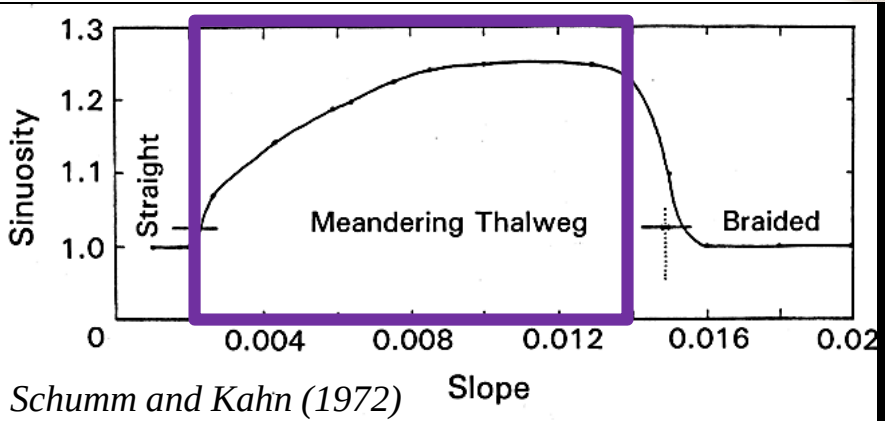
Slope and Sinuosity

↑ Slope

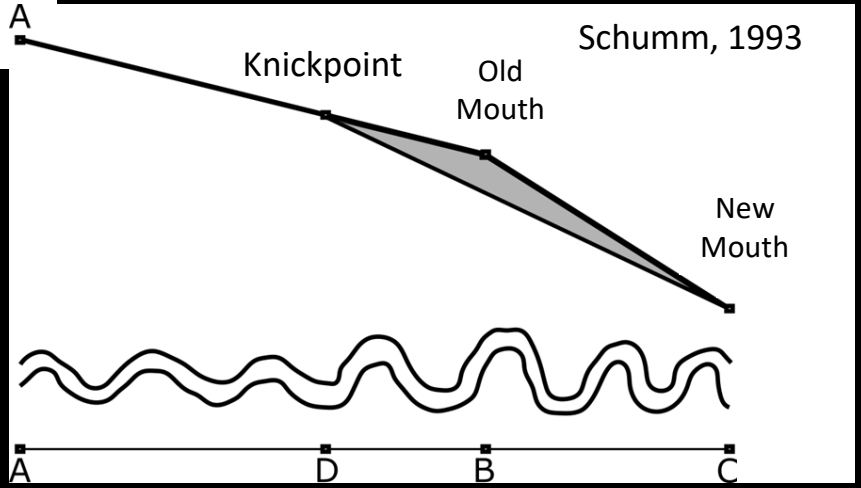
↑ Velocity ($=R^{2/3}\mathbf{S}^{1/2}/n$)

↑ Stream power ($=\rho g\mathbf{QS}$)

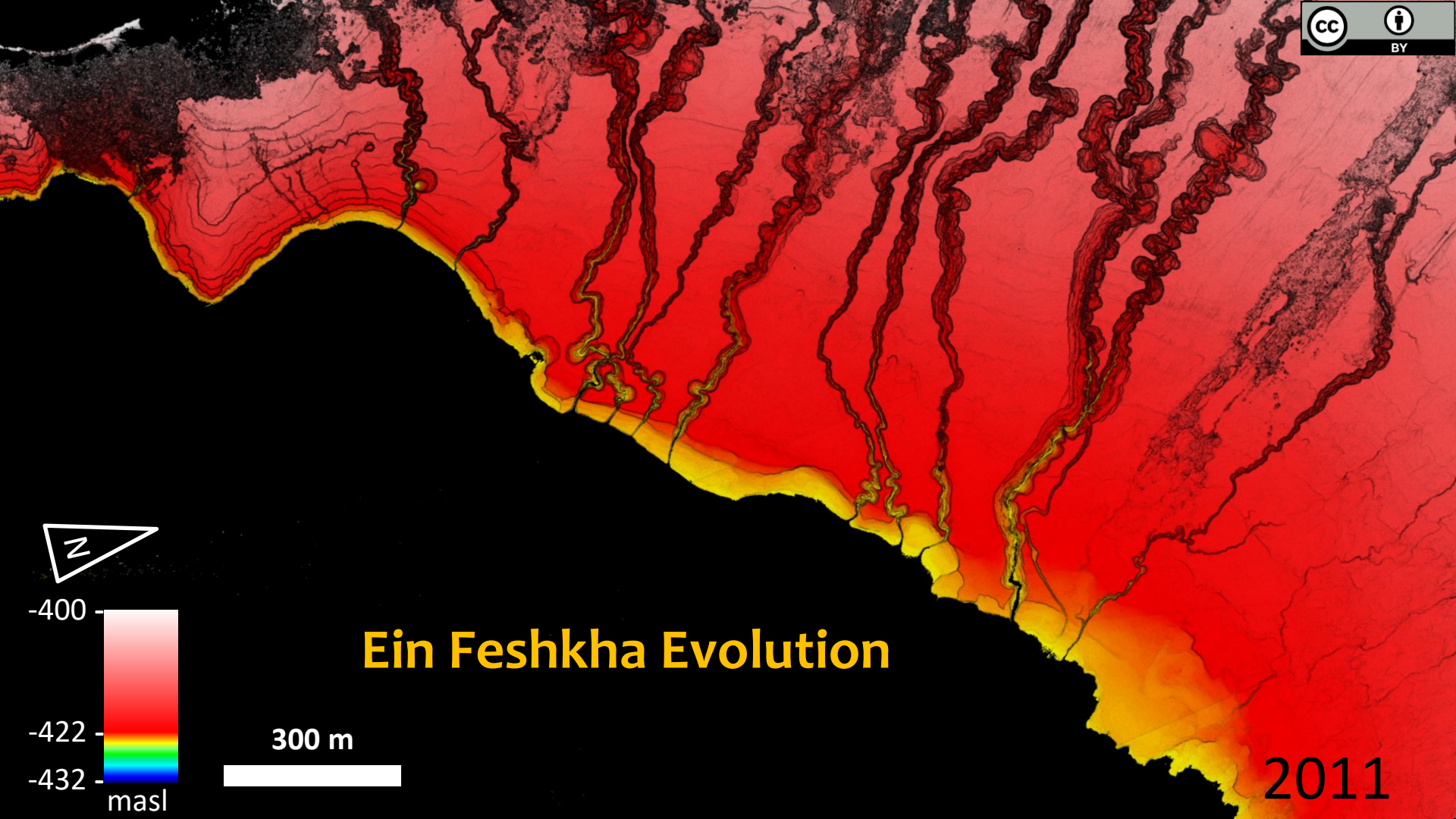
↑ Sinuosity

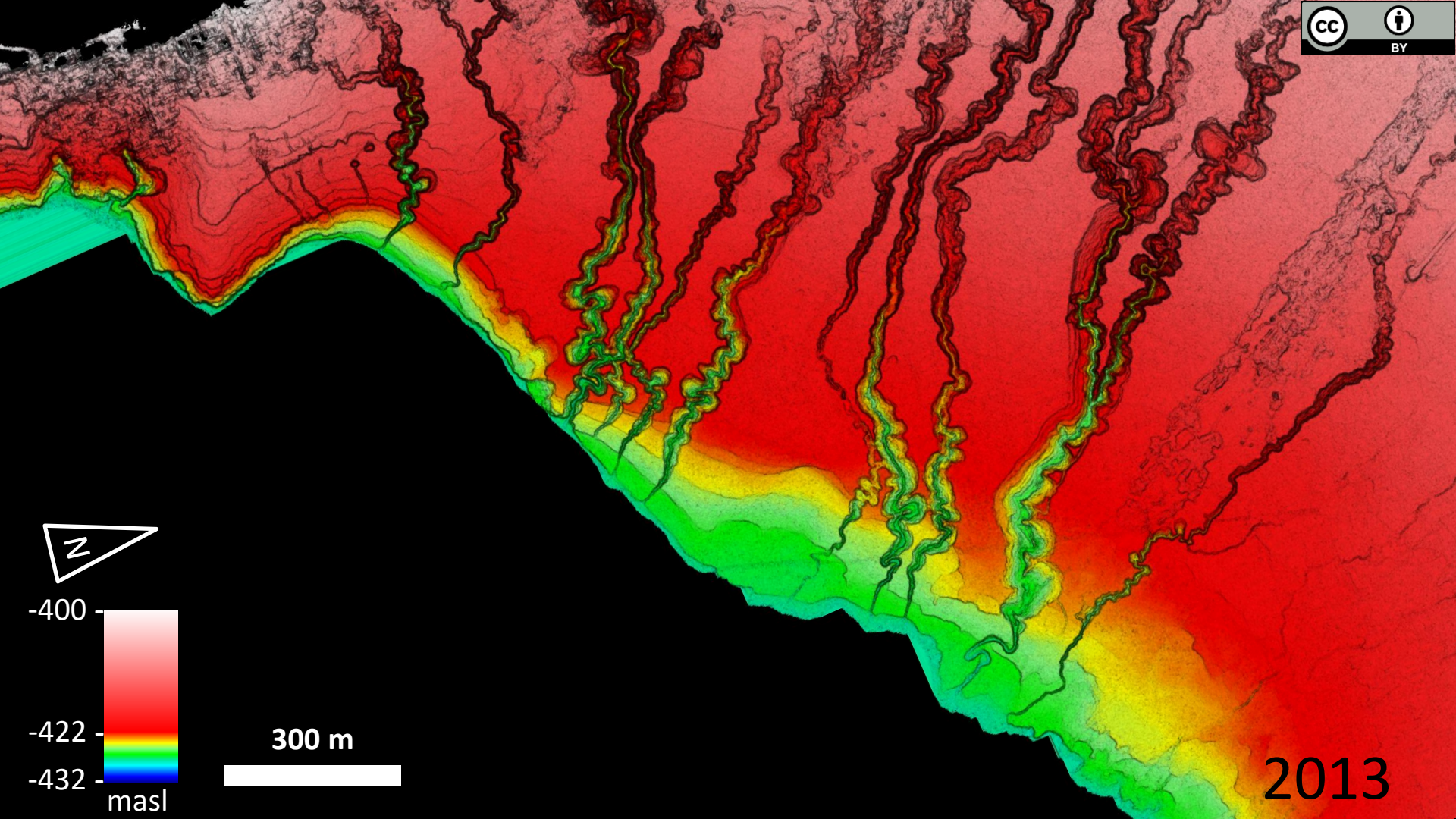


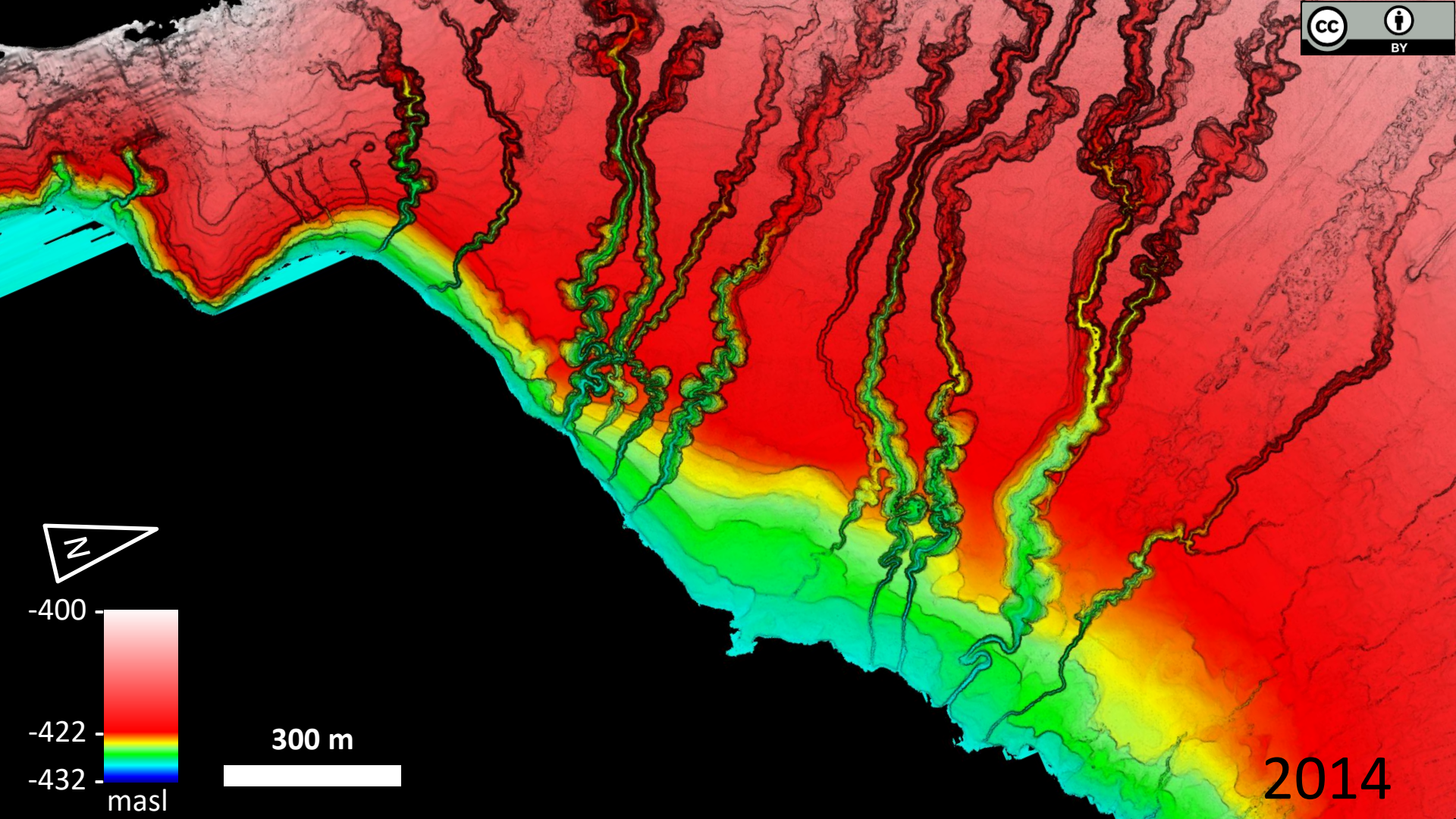
Schumm and Kahn (1972)

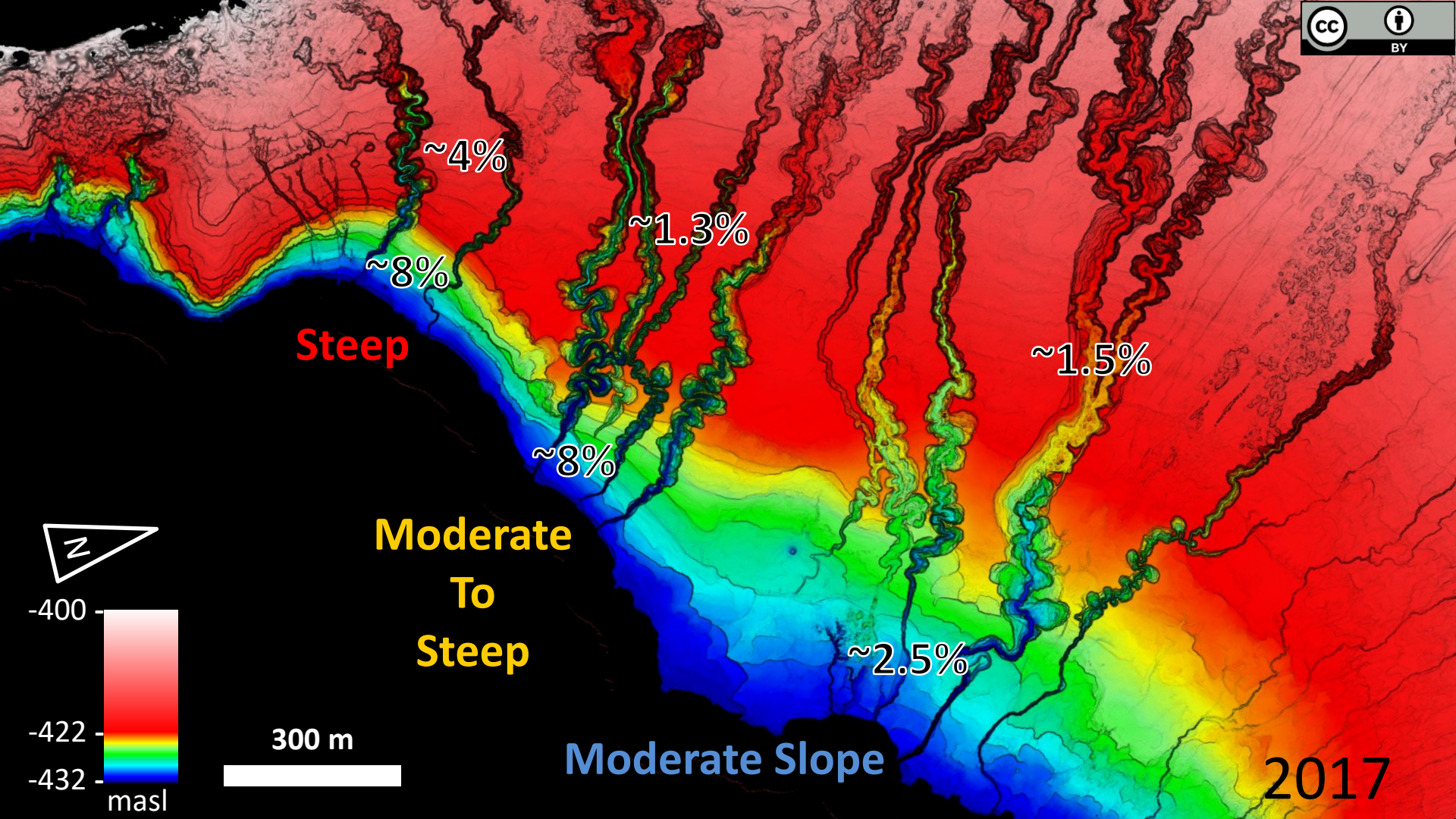


Schumm, 1993


N
-400
-422
-432
masl
300 m
Ein Feshkha Evolution
2011

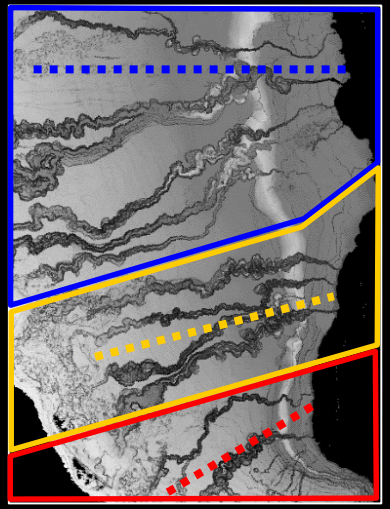

N
-400
-422
-432
masl
300 m
2013

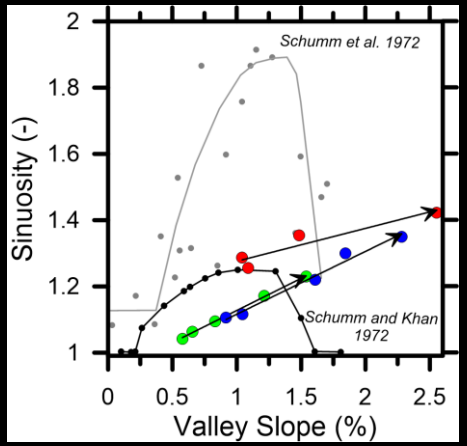

N
-400
-422
-432
masl
300 m
2014

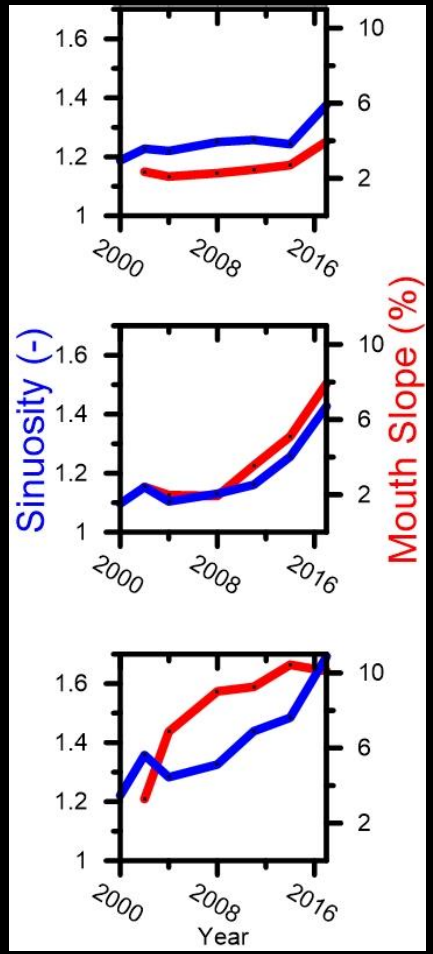

~4%
~1.3%
~8%
Steep
~1.5%
~8%
Moderate
To
Steep
N
-400
-422
-432
masl
300 m
~2.5%
Moderate Slope
2017

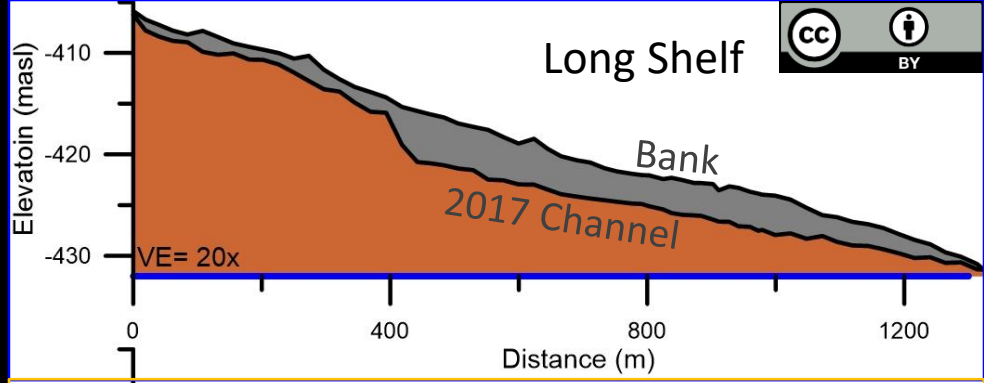

2019

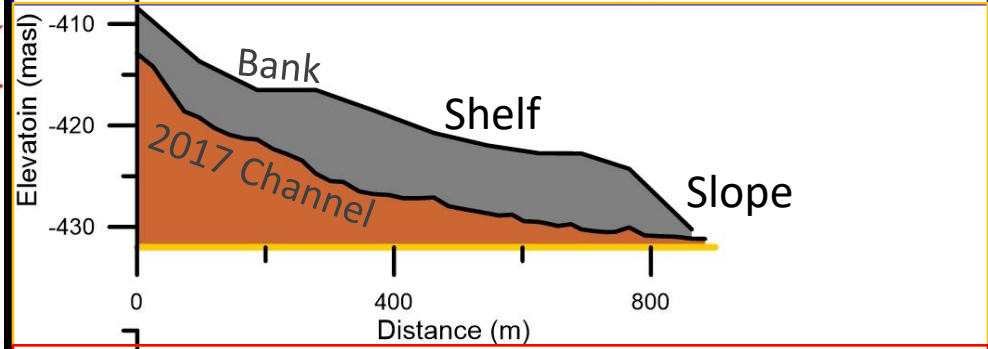
Sinuosity Evolution

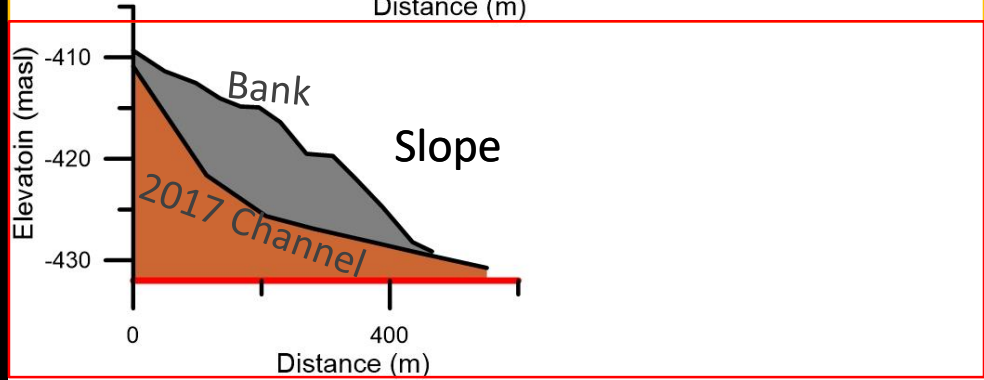












Main Insights

- All the channels exhibit a sinuosity increase with steepening regional slope due to base-level fall.
- Under the effect of steep and constant valley slope, and erodible substrate, the channels first elongate through the formation of new straight reaches, following the receding Dead Sea shoreline.
- Subsequently, under the impact of steepening valley slope, rapid incision confines the flow. In turn, the confined flow exerts lateral erosion on the banks and increases channel sinuosity.

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