Global Climate Forum

Coastal impact modelling with the diva++ library

Session 3 - 31/08/23

Daniel Lincke

Fall/Winter 2023/2024

Recap and remarks

Hypsometric profiles

- A hypsometric profile of a CM is a stylized model of the coastal plain that allows for simple computations of exposure, flood damages and adaptation.
- Basically a mapping from elevation into cumulated data.

Hypsometric profiles

Definition

Given a cm

$$cm : G \to \mathbb{B} \times \mathbb{R}^{\perp} \times (\mathbb{R}^{\perp})^n$$

a (discrete) hypsometric profile (with connectiviy threshold *theta*) of *cm* is a function

$$\begin{aligned} dhsp_{cm,\theta} &: \mathbb{R} \to \mathbb{R}_+^n \\ dhsp_{cm,\theta}(e) &= \sum_{\substack{(x,y) \\ hc_{cm}(x,y) \leq \theta \\ cm(x,y)=(b,z,\vec{d}) \\ z \leq e}} \vec{d} \end{aligned}$$

Hypsometric profiles

Definition, less formal:

- the (discrete) hypsometric profile of a coastal model is a function that maps elevations the cumulated dataset values (of the datasets included in the coastal model)
- It maps an elevation e to the sum if all dataset values of all grid cells that have an elevation no higher than e and that have hydrologically connectivity to the ocean not higher threshold than θ.

Remark:

- In applications the coastal model is often filtered by hydrologically connectivity in a preprocessing step so that the θ does not have to be taken into account in the computation of a hypsometric profile.

Hypsometric profiles - Example

	0	1	2	3	4	5	6	7	8	9	10
0	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
1	⊥	2.0	2.2	0.9	1.1	1.4	1.4	1.3	⊥	⊥	⊥
2	⊥	2.5	3.3	2.2	1.4	1.0	0.9	1.2	0.7	0.8	⊥
3	⊥	2.8	3.0	4.2	5.6	0.7	0.8	2.0	1.6	0.6	⊥
4	⊥	⊥	3.2	3.7	4.2	0.6	0.5	1.2	1.5	0.8	⊥
5	⊥	⊥	2.9	2.2	1.5	1.2	1.4	1.2	⊥	⊥	⊥
6	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥

Hypsometric profiles - Example

Assuming that the CM is extended with an dataset that maps grid cells to area, where each grid cell is mapped to 1.0 (imlpying a edge length of 1.0). ($\theta \geq 5.6$)

0	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
1	⊥	2.0	2.2	0.9	1.1	1.4	1.4	1.3	⊥	⊥	⊥
2	⊥	2.5	3.3	2.2	1.4	1.0	0.9	1.2	0.7	0.8	⊥
3	⊥	2.8	3.0	4.2	5.6	0.7	0.8	2.0	1.6	0.6	⊥
4	⊥	⊥	3.2	3.7	4.2	0.6	0.5	1.2	1.5	0.8	⊥
5	⊥	⊥	2.9	2.2	1.5	1.2	1.4	1.2	⊥	⊥	⊥
6	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
	0	1	2	3	4	5	6	7	8	9	10

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area																							

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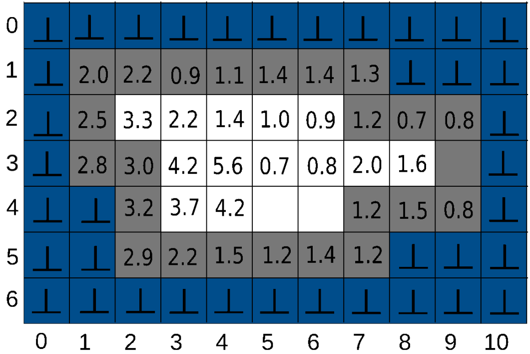
0	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
1	⊥	2.0	2.2	0.9	1.1	1.4	1.4	1.3	⊥	⊥	⊥
2	⊥	2.5	3.3	2.2	1.4	1.0	0.9	1.2	0.7	0.8	⊥
3	⊥	2.8	3.0	4.2	5.6	0.7	0.8	2.0	1.6	0.6	⊥
4	⊥	⊥	3.2	3.7	4.2	0.6		1.2	1.5	0.8	⊥
5	⊥	⊥	2.9	2.2	1.5	1.2	1.4	1.2	⊥	⊥	⊥
6	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
	0	1	2	3	4	5	6	7	8	9	10

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0																						

Hypsometric profiles - Example

Assuming that the CM is extended with an dataset that maps grid cells to area, where each grid cell is mapped to 1.0 (imlpying a edge length of 1.0). ($\theta \geq 5.6$)



elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0																					

Hypsometric profiles - Example

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0	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
1	⊥	2.0	2.2	0.9	1.1	1.4	1.4	1.3	⊥	⊥	⊥
2	⊥	2.5	3.3	2.2	1.4	1.0	0.9	1.2		0.8	⊥
3	⊥	2.8	3.0	4.2	5.6		0.8	2.0	1.6		⊥
4	⊥	⊥	3.2	3.7	4.2			1.2	1.5	0.8	⊥
5	⊥	⊥	2.9	2.2	1.5	1.2	1.4	1.2	⊥	⊥	⊥
6	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0																				

Hypsometric profiles - Example

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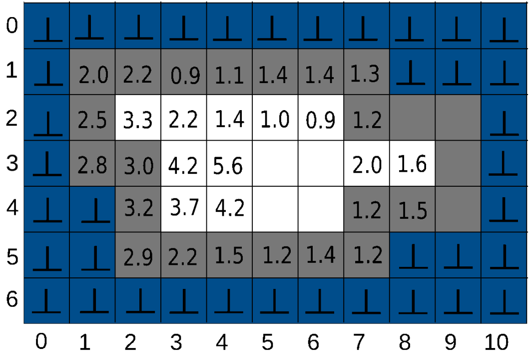

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0																			

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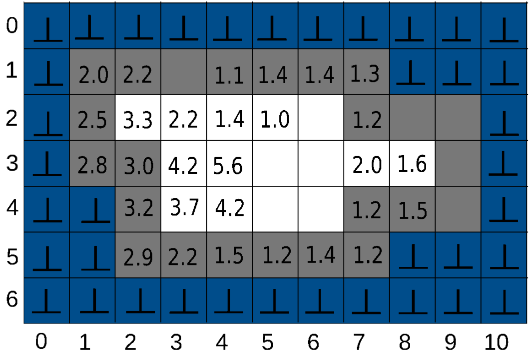

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0																		

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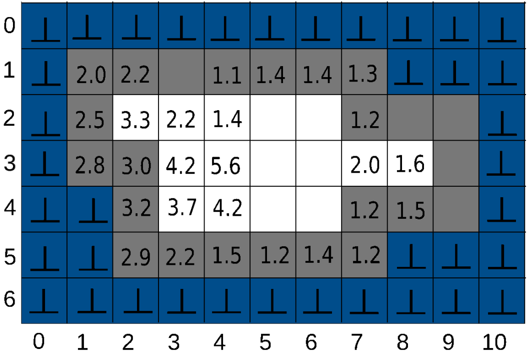

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0																	

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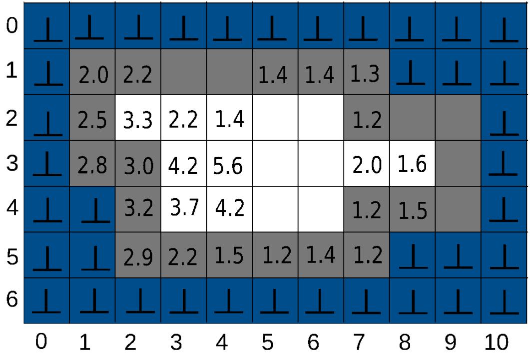

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0																

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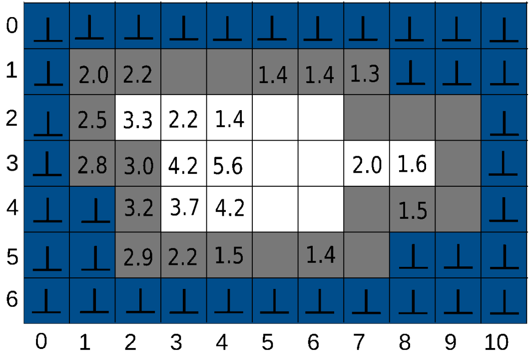
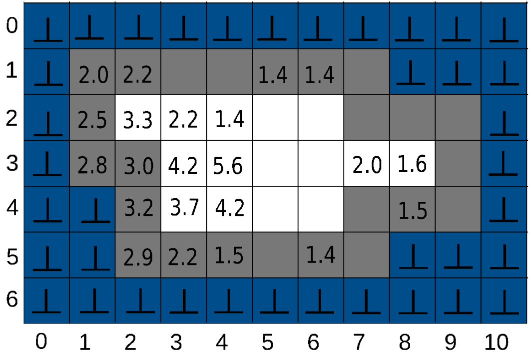


elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0															

Assuming that the CM is extended with an dataset that maps grid cells to area, where each grid cell is mapped to 1.0 (imlpying a edge length of 1.0). ($\theta \geq 5.6$)



elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0														

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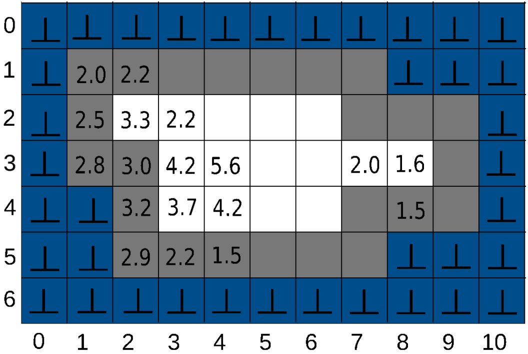

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
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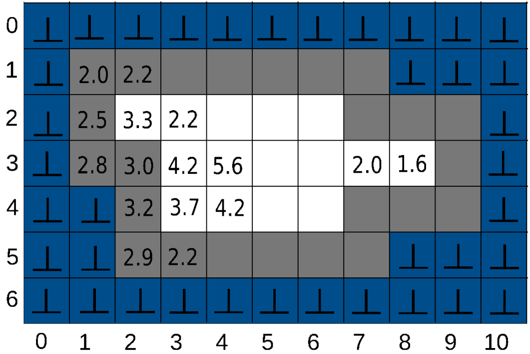

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
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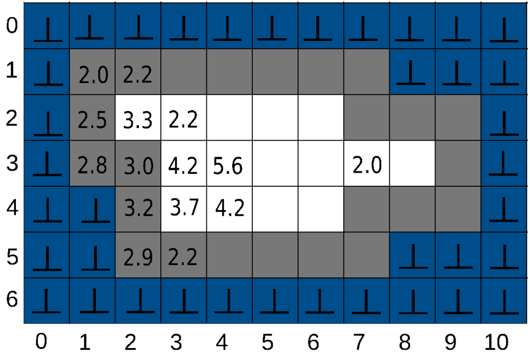

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
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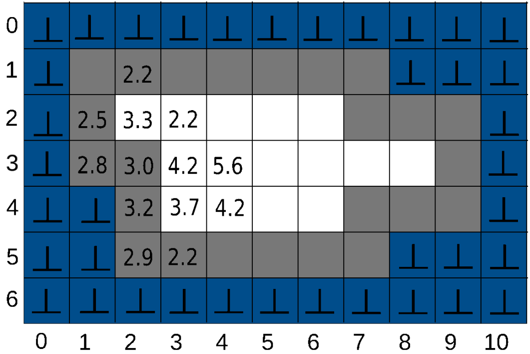

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0										

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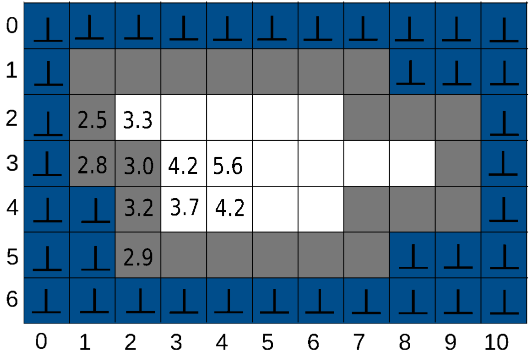

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0									

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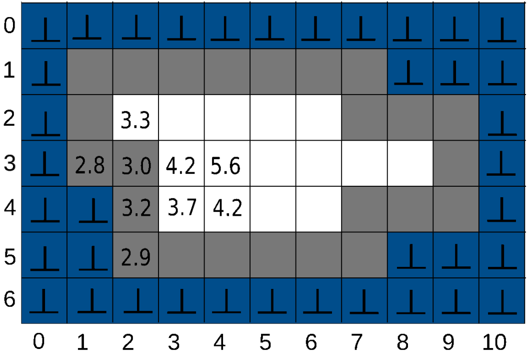

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0								

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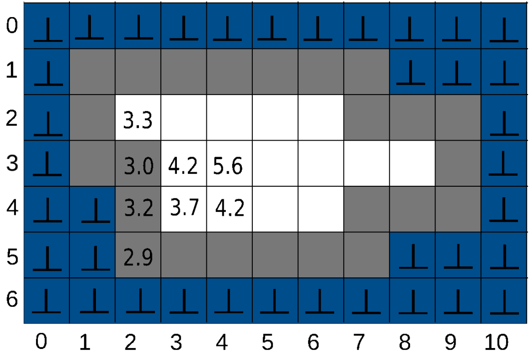

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0							

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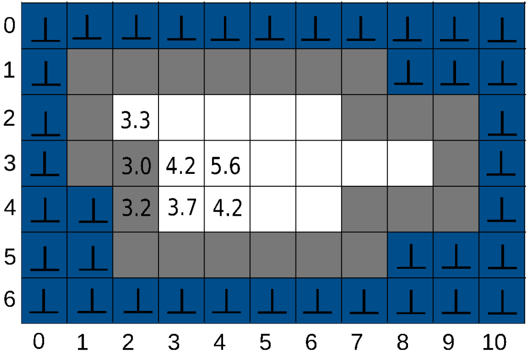

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0						

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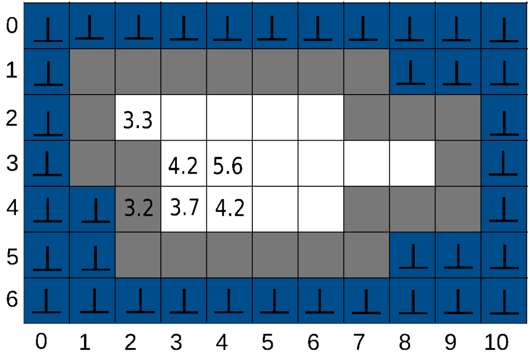

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area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0					

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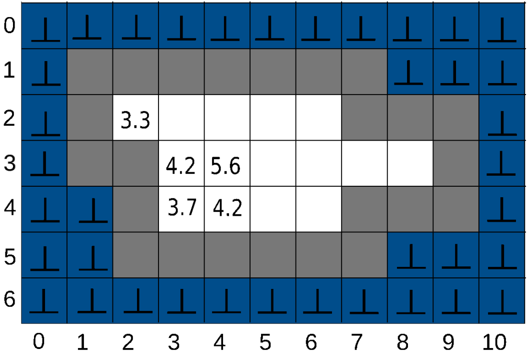

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area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0	1.0				

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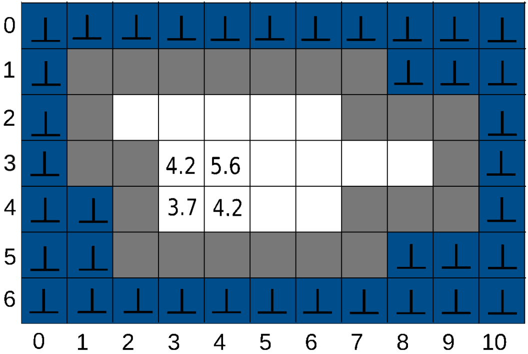

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0			

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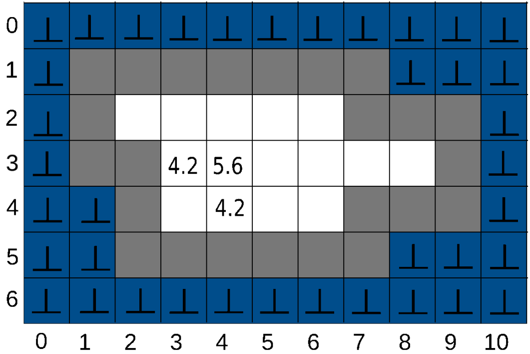
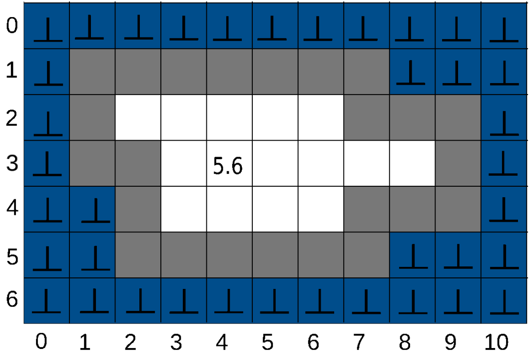


elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		

Hypsometric profiles - Example

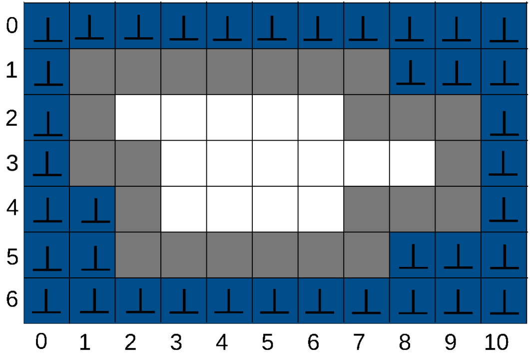
Assuming that the CM is extended with an dataset that maps grid cells to area, where each grid cell is mapped to 1.0 (imlpying a edge length of 1.0). ($\theta \geq 5.6$)



elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	

Hypsometric profiles - Example

Assuming that the CM is extended with an dataset that maps grid cells to area, where each grid cell is mapped to 1.0 (imlpying a edge length of 1.0). ($\theta \geq 5.6$)



elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0

Hypsometric profiles - Example

Assuming that the CM is extended with an dataset that maps grid cells to area, where each grid cell is mapped to 1.0 (imlpying a edge length of 1.0) the following mapping is obtained:

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	2.0	2.0	3.0	1.0	1.0	1.0	4.0	1.0	4.0	2.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0

or cumulative:

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	3.0	5.0	8.0	9.0	10.0	11.0	12.0	13.0	17.0	19.0	20.0	21.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	33.0	34.0

The (discrete) hypsometric profile is the mapping defined by this table. It shows the cumulative area below given elevation values.

Hypsometric profiles - Another example

If a connectivity threshold is given the mapping is modified accordingly. For instance, the mapping with connectivity threshold 1.0 is defined by:

	0	1	2	3	4	5	6	7	8	9	10
0	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$
1	$\perp$	2.0	2.2	0.9	1.1	1.4	1.4	1.3	$\perp$	$\perp$	$\perp$
2	$\perp$	2.5	3.3	2.2	1.4	1.0	0.9	1.2	0.7	0.8	$\perp$
3	$\perp$	2.8	3.0	4.2	5.6	0.7	0.8	2.0	1.6	0.6	$\perp$
4	$\perp$	$\perp$	3.2	3.7	4.2	0.6	0.5	1.2	1.5	0.8	$\perp$
5	$\perp$	$\perp$	2.9	2.2	1.5	1.2	1.4	1.2	$\perp$	$\perp$	$\perp$
6	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$	$\perp$

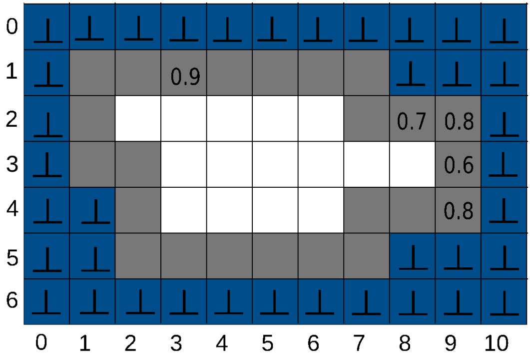
Hypsometric profiles - Another example

If a connectivity threshold is given the mapping is modified accordingly.
For instance, the mapping with connectivity threshold 1.0 is defined by:

0	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$
1	$\bot$	2.0	2.2	0.9	1.1	1.4	1.4	1.3	$\bot$	$\bot$	$\bot$
2	$\bot$	2.5	3.3	2.2	1.4	1.1	1.1	1.2	0.7	0.8	$\bot$
3	$\bot$	2.8	3.0	4.2	5.6	1.1	1.1	2.0	1.6	0.6	$\bot$
4	$\bot$	$\bot$	3.2	3.7	4.2	1.1	1.1	1.2	1.5	0.8	$\bot$
5	$\bot$	$\bot$	2.9	2.2	1.5	1.2	1.4	1.2	$\bot$	$\bot$	$\bot$
6	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$	$\bot$
	0	1	2	3	4	5	6	7	8	9	10

Hypsometric profiles - Another example

If a connectivity threshold is given the mapping is modified accordingly. For instance, the mapping with connectivity threshold 1.0 is defined by:



elevation	0.6	0.7	0.8	0.9
area	1.0	1.0	2.0	1.0
cum. area	1.0	2.0	4.0	5.0

Hypsometric profiles - continuous

- One might want to know what the values in between given points are. For instance, what the cumulative area below elevation 1.42 is.
- In order to compute intermediate values interpolation is used.
- A hypsometric profile defined like this is (not neccessarily strictly) increasing, that is $e_1 \leq e_2 \rightarrow dhsp_{cm,\theta}(e_1) \leq dhsp_{cm,\theta}(e_2)$.
- Any interpolation used should maintain this property.
- Linear interpolation is widely used.

Hypsometric profiles - continuous

Definition

Given a CM

$$cm : G \rightarrow \mathbb{B} \times \mathbb{R}^{\perp} \times (\mathbb{R}^{\perp})^n$$

a (partial linear) hypsometric profile (with connectiviy threshold *theta*) of *cm* is a function

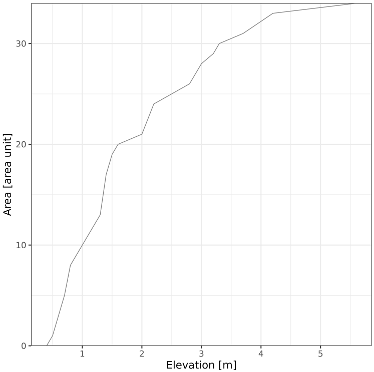
$$\begin{aligned}
hsp_{cm,\theta} &: \mathbb{R} \rightarrow \mathbb{R}_{+}^{n} \\
hsp_{cm,\theta}(e) &= \begin{cases} dhsp_{cm,\theta}(m) & \text{if } e > m \\ dhsp_{cm,\theta}(e) & \text{if } \exists(x,y) : elevation(x,y) = e \text{ and } hc_{cm}(x,y) \leq \theta \\ \frac{dhsp_{cm}(e_2) - dhsp_{cm}(e_1)}{e_2 - e_1} * (e - e_1) + dhsp_{cm}(e_1) & \text{otherwise} \end{cases} \\
\text{where } m &= \max\{z : \exists(x,y) : hc_{cm}(x,y) = z\} \\
e_2 &= \min\{z : z > e \text{ and } \exists(x,y) : elevation(x,y) = z \text{ and } hc_{cm}(x,y) \leq \theta\} \\
e_1 &= \max\{z : z < e \text{ and } \exists(x,y) : elevation(x,y) = z \text{ and } hc_{cm}(x,y) \leq \theta\}
\end{aligned}$$

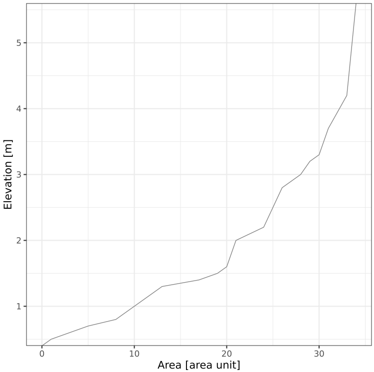
Hypsometric profiles - continuous

- The function is continous in the interval $[min, \infty)$ where $min = \min\{e \text{ and } \exists(x, y) : elevation(x, y) = e \text{ and } hc_{cm}(x, y) \leq \theta\}$.
- In implemented models that build upon hypsometric profiles there migth be an additional value added that maps all exposure data sets to zero.
- For instance, the example maps the grid cells to elvation values rounded to one digit with minimum elevation value 0.5. An additional value might be added with elevation 0.4 that
- maps all other datasets associated with this DEM to zero.
- By this addition the (partial linear) hypsometric profile becomes a continous function on $(-\infty, \infty)$.

Linear interpolation is used to compute the area in between given points:

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
area	1.0	3.0	5.0	8.0	9.0	10.0	11.0	12.0	13.0	17.0	19.0	20.0	21.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	33.0	34.0





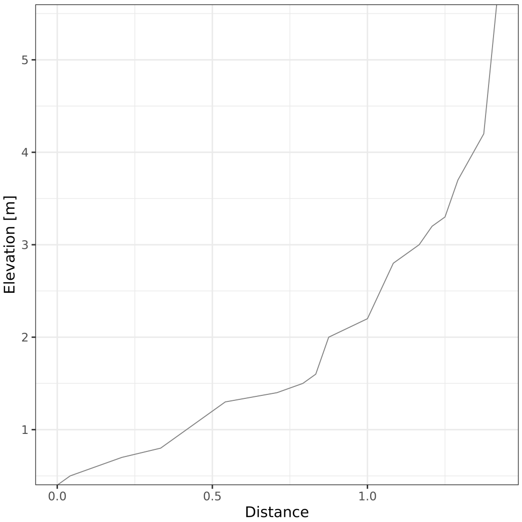
Hypsometric profiles as stylized coastal plains

- The hypsometric profile can be interpreted as stylized model of a coastal plain.
- The length of associated coast can be determined. In the example used above: 24 gride cells define the coastline, edge length 1.0, so the center-to-center length is also 1.0, so the length of coast is 24.0. (There might be more sophisticated methodes to determine coast length)
- The physical distance from the coast of an elevation point can be determind by dividing the cumulative area by the coast length.
- The horizontal distance from the coast of an elevation point can be determind by geometry.

elevation	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0	2.2	2.5	2.8	2.9	3.0	3.2	3.3	3.7	4.2	5.6
distance	$\frac{1}{24}$	$\frac{3}{24}$	$\frac{5}{24}$	$\frac{8}{24}$	$\frac{9}{24}$	$\frac{10}{24}$	$\frac{11}{24}$	$\frac{12}{24}$	$\frac{13}{24}$	$\frac{17}{24}$	$\frac{19}{24}$	$\frac{20}{24}$	$\frac{21}{24}$	$\frac{24}{24}$	$\frac{25}{24}$	$\frac{26}{24}$	$\frac{27}{24}$	$\frac{28}{24}$	$\frac{29}{24}$	$\frac{30}{24}$	$\frac{31}{24}$	$\frac{33}{24}$	$\frac{34}{24}$

- The coastal plain can be though of being constructed from rectangular stripes with the apropriate width

Hypsometric profiles as stylized coastal plains



Hypsometric profiles: DIVA

locationid	area01_0	area02_0	area03_0	area04_0	area05_0	area06_0	area07_0	area08_0	area09_0	area10_0	area11_0	area12_0
CZ_ABW_00000	2.05	1.39	1.85	3.47	3.76	5.08	4.56	5.81	4.37	4.07	4.4	3.92
CZ_AGO_00000	0	0.01	0.04	4.05	7.22	10.23	5.71	4.96	8.01	4.41	2.98	3.48
CZ_AGO_00001	8.2	12.4	71.06	70.95	43.49	22.99	15.89	11.55	9.64	8.62	6.59	6.69
CZ_AGO_00002	0.25	0.29	0.5	0.94	1.86	1.75	1.79	2.5	90.18	17	16.76	13.48
CZ_AGO_00003	2.22	5.78	15.05	87.35	48.32	76.39	46.23	25.94	20.68	16.33	27.58	20.16
CZ_AGO_00004	0.08	0.65	2.05	46.44	23.53	13.06	6.2	3.89	2.52	3.83	2.45	1.8
CZ_AGO_00005	17.44	4.19	7.25	8.28	6.75	7.18	5.96	5.41	4.08	4.28	3.46	3.05
CZ_AGO_00006	0.71	0.49	1.46	4.52	6.58	5.95	6.07	5.22	4.95	4.48	4.42	4.62
CZ_AGO_00007	4.13	0.82	3.74	17.61	32.34	21.78	29.49	16.81	18.02	21.45	16.32	20.75
CZ_AGO_00008	90.92	10.71	17.94	50.61	31.46	27.78	23.77	17.92	13.94	12.16	10.51	11.23
CZ_AGO_00009	0.57	0.29	0.46	1.16	5.49	4.08	4.89	4.6	5.26	15.3	19.02	16.15
CZ_AGO_00010	0.08	0.4	29.45	16.38	13.74	6.77	9.34	3.52	19.15	9.46	12.76	11.14
CZ_AGO_00011	0.3	7.85	6.8	10.19	68.97	66.7	33.6	14.76	7.09	5.36	3.89	3.65
CZ_AGO_00012	0.21	0.19	0.22	1.3	0.38	1.05	9.95	73.98	90.49	56.46	22.43	11.95
CZ_AGO_00013	7.92	1.23	1.8	3.29	4.21	4.48	4.5	3.42	3.43	3.6	3.28	2.56
CZ_AGO_00014	0	0.03	0.06	2.85	2.01	1.95	1.13	1.02	0.84	0.79	0.92	0.81
CZ_AGO_00015	0.89	1.13	8.08	25.84	15.64	14.77	14.48	10.64	11.24	9.88	12.02	10.58
CZ_AGO_00016	4.62	1.81	2.94	4.16	5.41	7.42	7.94	8.15	8.96	8	7.68	7.68
CZ_AGO_00017	1.21	1.9	8.46	15.67	31.87	22.1	19.86	14.55	9.68	8.54	7.47	7.44
CZ_AGO_00018	0	0	0	0	0	0	0	0	0	0	0	0
CZ_AGO_00019	0	0	0	0	0	0	0	0	0	0	0	0
CZ_AGO_00020	0.25	0.83	13.91	14.74	9.76	7.8	7.8	8.3	6.02	3.75	2.94	2.46
CZ_AGO_00021	1.15	0.52	1.51	6.37	83.73	80.14	97.1	50.61	53.64	39.35	68.37	66.65

Hypsometric profiles: DIVA

locationid	pop01_0	pop02_0	pop03_0	pop04_0	pop05_0	pop06_0	pop07_0	pop08_0	pop09_0	pop10_0	pop11_0	pop12_0
CZ_ABW_00000	7323.171	332.588	440.478	962.097	1047.696	1547.023	1388.308	1918.844	1441.808	1388.308	1484.607	1354.425
CZ_AGO_00000	0	0	0	16.987	31.425	50.111	28.877	23.781	39.919	21.233	15.288	16.987
CZ_AGO_00001	8651.306	648.041	763.55	1324.11	3400.729	1961.11	1634.117	1494.826	1339.398	1512.662	969.089	699.001
CZ_AGO_00002	78.139	1.699	1.699	3.397	6.795	5.945	4.247	8.493	273.485	42.467	52.659	47.563
CZ_AGO_00003	82144.093	4646.701	17943.859	15769.566	11659.644	12005.322	8965.559	6797.212	6585.728	5259.07	4967.749	4658.592
CZ_AGO_00004	0	2.548	4.247	69.645	44.165	19.535	6.795	3.397	2.548	2.548	2.548	1.699
CZ_AGO_00005	0	0	0	0	0	0	0	0	0	0	0	0
CZ_AGO_00006	0	0	0	0	0	0	0	0	0	0	0	0
CZ_AGO_00007	80.687	2.548	11.891	66.248	128.249	81.536	117.208	63.7	69.645	85.783	64.549	84.084
CZ_AGO_00008	0	0	0	0	0	0	0	0	0	0	0	0
CZ_AGO_00009	21.233	0.849	0.849	5.945	29.727	21.233	26.329	22.083	19.535	56.905	72.193	57.755
CZ_AGO_00010	1048.077	127.4	3241.055	1785.298	968.24	298.116	90.879	3.397	56.905	31.425	46.713	40.768
CZ_AGO_00011	5.945	33.124	27.179	39.919	280.28	277.732	140.989	60.303	29.727	21.233	16.137	15.288
CZ_AGO_00012	17.836	0	0.849	4.247	0.849	2.548	39.069	253.101	284.527	184.305	77.289	43.316
CZ_AGO_00013	30.576	1.699	2.548	4.247	5.945	5.945	6.795	4.247	5.096	5.096	5.096	3.397
CZ_AGO_00014	0	2.548	0.849	11.891	8.493	7.644	5.096	4.247	2.548	2.548	4.247	2.548
CZ_AGO_00015	86.632	1.699	23.781	91.728	49.261	45.864	48.412	34.823	38.22	33.973	42.467	36.521
CZ_AGO_00016	1550.882	22.932	133.345	437.407	787.332	1660.446	1706.31	1662.145	1622.226	1516.059	1368.276	1014.953
CZ_AGO_00017	4088.689	13.589	62.001	585.19	596.232	792.428	629.356	1328.357	1166.134	1042.132	1372.522	1073.557
CZ_AGO_00018	0	0	0	0	0	0	0	0	0	0	0	0
CZ_AGO_00019	0	0	0	0	0	0	0	0	0	0	0	0
CZ_AGO_00020	27536.226	1531.347	2995.598	2734.003	2398.516	3692.9	2301.693	2597.26	3345.523	2801.1	3450.84	3239.356
CZ_AGO_00021	1413.29	36.521	96.824	1867.683	1871.081	2395.119	2166.649	1630.719	1754.722	1953.466	1317.316	1526.251
CZ_AGO_00022	686.261	58.604	236.964	701.549	610.67	437.407	267.54	213.183	186.004	161.373	151.181	128.249

The end

Thanks.