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Web Processing - Standardized GIS Analyses for Cable Route Planning

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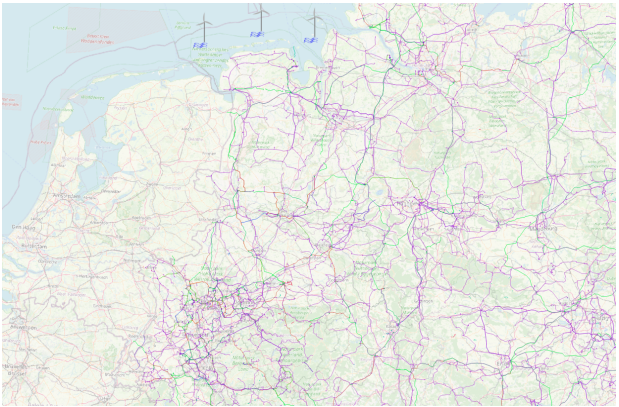


Figure: Map of the medium and high voltages power lines in Western Germany, OpenStreetMap[1].

[1] G. Boeing, „OSMnx: New methods for acquiring, constructing, analyzing, and visualizing complex street networks“, Computers, Environment and Urban Systems, Bd. 65, S. 126–139, Sep. 2017.

Recap & Follow Up

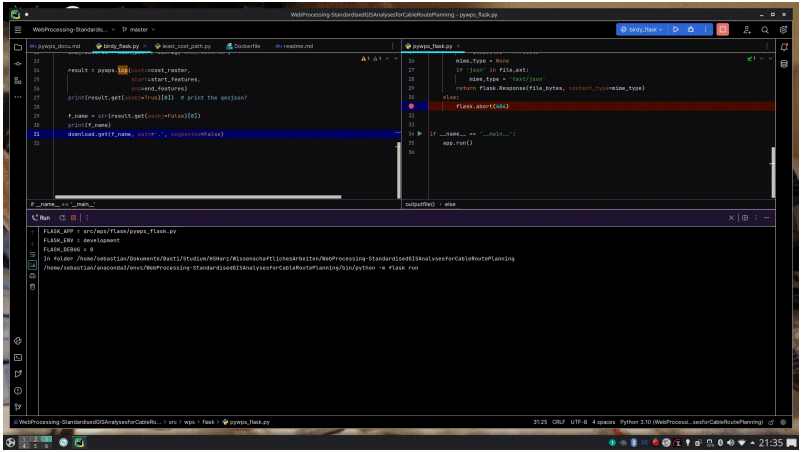
Recap

- rasterisation
- cost raster
- Least Cost Paths
- Web Processing Service (Start)

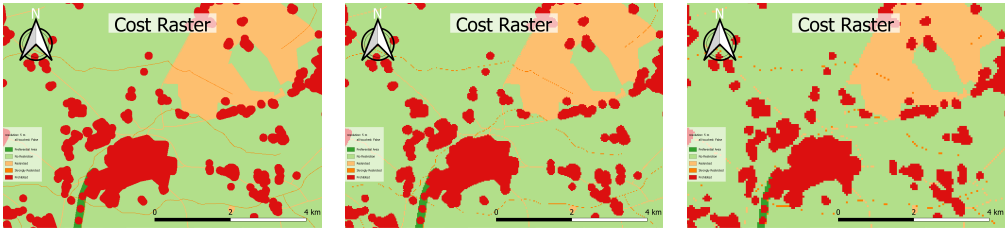
Follow Up

- Web Processing Service (Concluded)
- from cost raster to Least Cost Path
- comparing paths
- speed-up
  - clipping
  - down sampling and superposition
  - validation

Web Processing Service (Concluded)



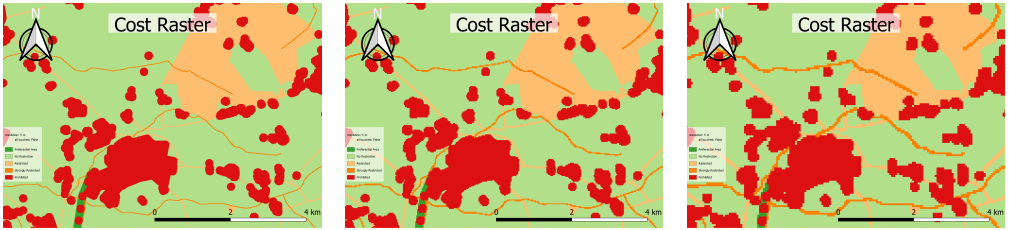
Recap: Sampling Resolution



(a) 10 m (b) 25 m (c) 50 m

Figure: Maps of the cost raster for all touched set to False for different resolutions.

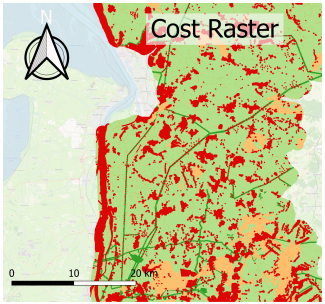
Recap: Sampling Resolution



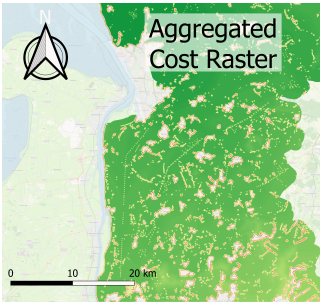
(a) 10 m (b) 25 m (c) 50 m

Figure: Maps of the cost raster for all touched set to True for different resolutions.

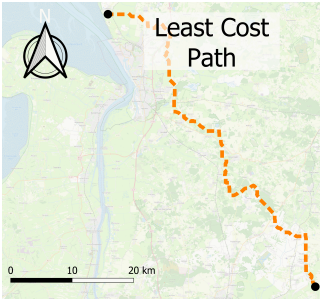
From Cost Raster to Least Cost Path



(a) Cost Raster.



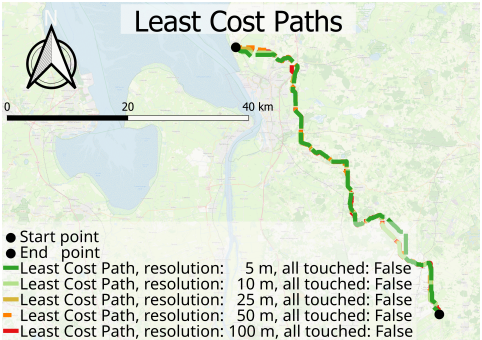
(b) Aggregated Cost Raster.



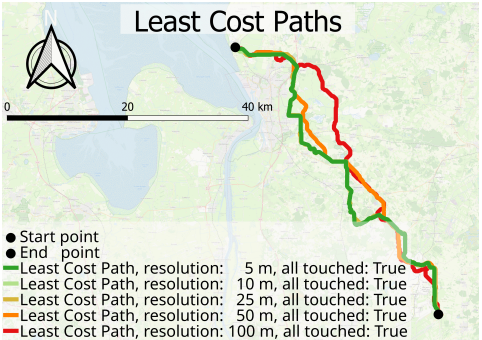
(c) Least Cost Path.

Figure: Figures of the different steps for the Least Cost Path generation for a resolution of 50 m, all touched set to False.

Comparing: Map



(a) all touched False.



(b) all touched True.

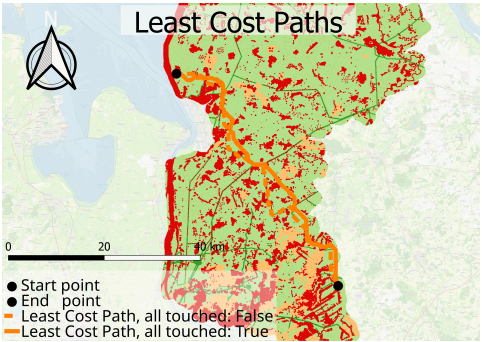
Figure: Figures of the Least Cost Paths, depending on the parameter all touched. All touched False: dashed lines, True: continuous lines. Gradation of resolutions: high (green) to low (red).

Comparing: Costs

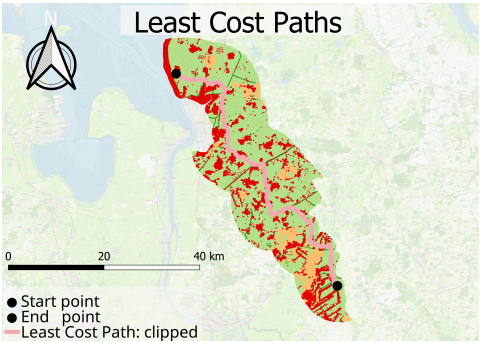
Table: Least Cost Paths: length (l) for the different resolutions (res), including the mean minimum distance (d_{mean}) and the agg. costs per resolution.

res /m	$l_{al=f}/m$	$l_{al=t}/m$	d_{mean} /m	agg. $costs_{al=f} \times m$	agg. $costs_{al=t} \times m$
5	76136.3	78002.0	126.0	93329.6	97584.8
10	75430.1	77936.6	277.9	89312.5	97311.8
25	75422.9	78422.9	313.8	83871.7	96816.4
50	76135.0	70620.0	1140.0	70451.2	115003.7
100	76283.8	74120.7	1946.4	64051.6	167226.8

Speed-Up: Clipping



(a) 50 m.



(b) 5 m, clipped.

Figure: Figures of the Least Cost Paths on the cost raster with 50 m resolution, used to clip the high resolution raster.

Speed-Up: Medium Resolution

bi-linear down sampling

- 59.3 m average distance
- closer to path from all touched True
- independent from cost ratios

weighted average cost raster

- best ration 4:1 False:True
- 40.1 m average distance
- closer to path from all touched True
- optimum: depends on cost ratio

Speed-Up: Validation

clipping

- reproduce-able best paths: 3 times out of 4
- speed-up: unpredictable

bi-linear down sampling

- distance worse than from original medium resolution
- speed-up: square of resolution

Conclusion and Outlook

conclusion

- provide Least Cost Path with WPS
- studied algorithmic speed-up
  - clipping
  - medium resolution

outlook

- non algorithmic speed-up
- set of possible paths
- stability: perturbation