

Cumulative visibility analyses for wind parks in a regional context

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3 main points



Cumulative vs. individual visibility analyses

Scope and benefit of a cumulative visibility study

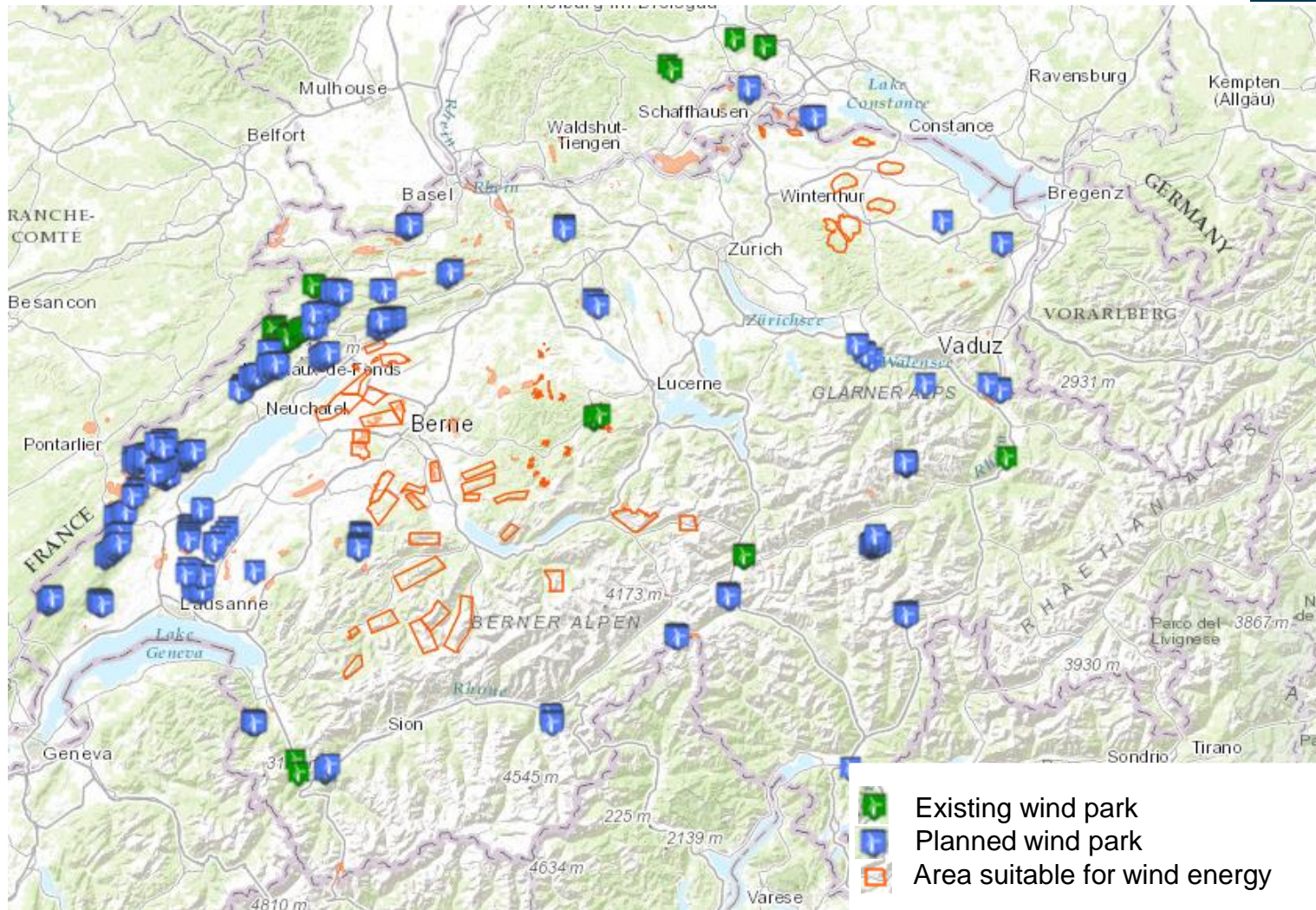
Additional aspect: selected viewpoints

Outline



1. Wind energy projects in Switzerland
2. Case study: cumulative visibility study in Bern-Mittelland
3. Methods
4. Selected viewpoints
5. Results and conclusions

1. Wind energy projects in Switzerland

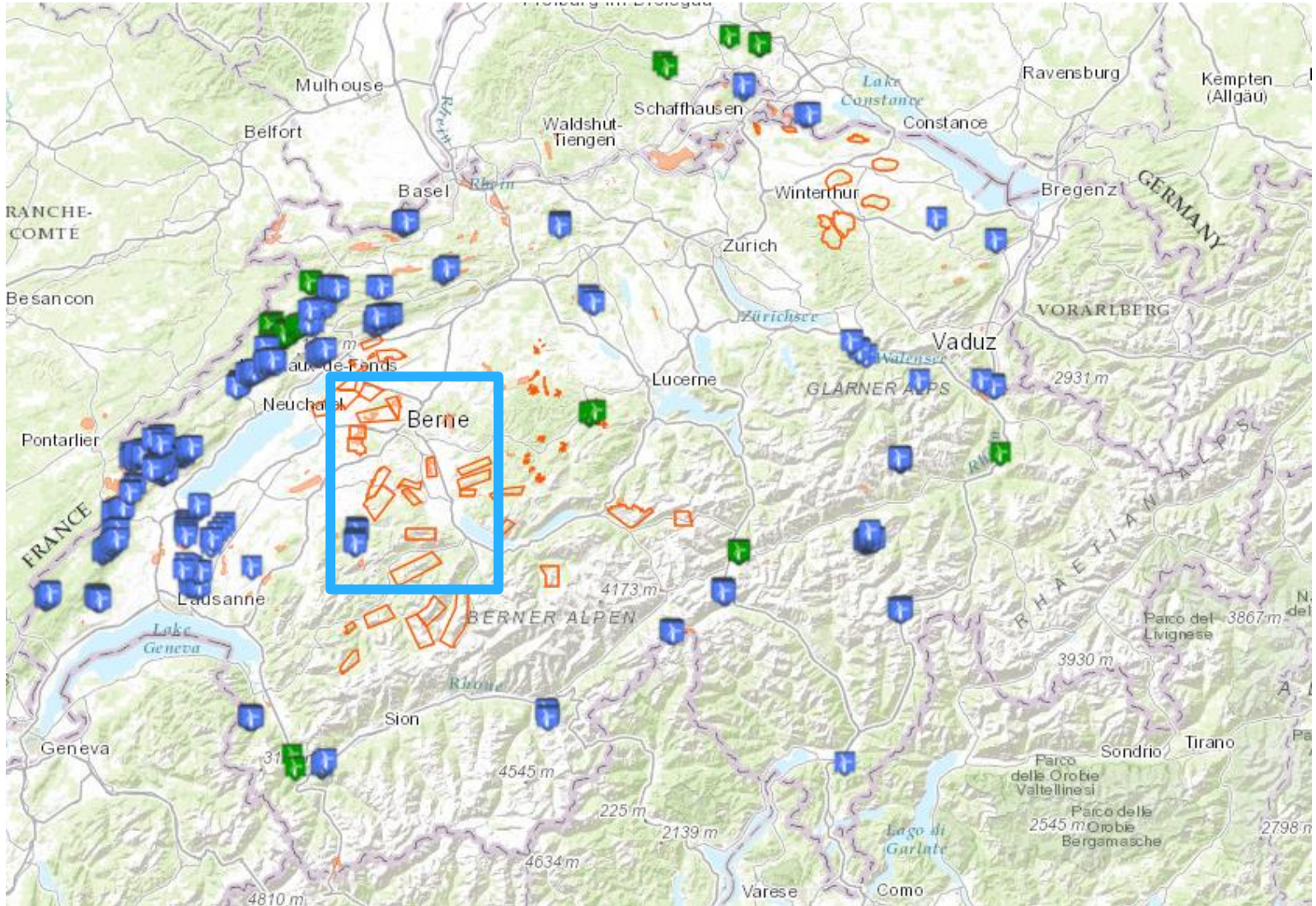


Data source: Stiftung Landschaftsschutz Schweiz

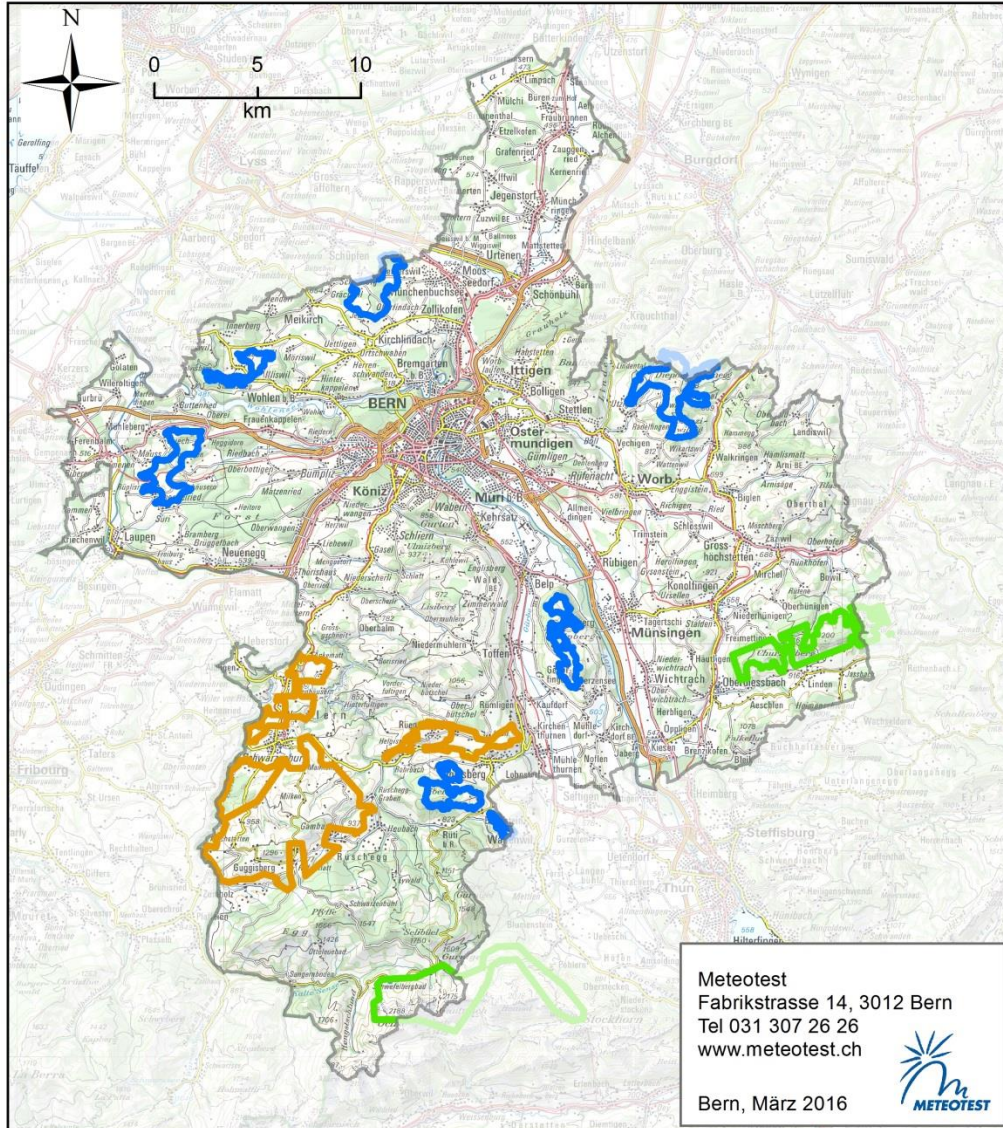
2. Case study

- Regional visibility analysis of planned wind turbines in the region Bern-Mittelland
- Incorporating wind energy into the regional land-use planning
- Visibility as one criteria to define suitable areas for wind parks
- On this level it needs a cumulative approach: incorporating all planned wind parks, not a separate view on each single wind park

2. Case study



2. Case study



Blue:
confirmed wind energy perimeter

green and orange:
testing wind energy perimeter

3. Methods

Individual visibility analysis

Software ArcGIS 3D Analyst (Viewshed Tool) and Python scripts

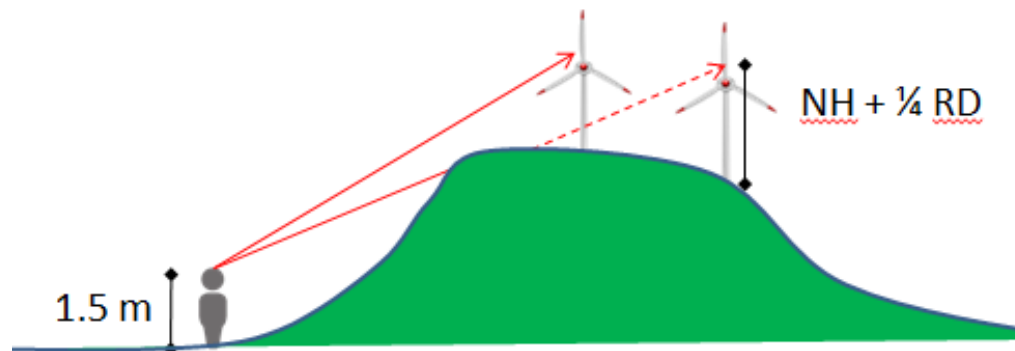
- Positioning turbines

3. Methods

Individual visibility analysis

Software ArcGIS 3D Analyst (Viewshed Tool) and Python scripts

- Positioning turbines
- Calculating the visibility at 1.5 m height for each single 25 x 25 m raster cell within the study area
- Turbine height: 154 m (hub height + $\frac{1}{4}$ rotor diameter)
- Forest height 15 m (no visibility within a forest)

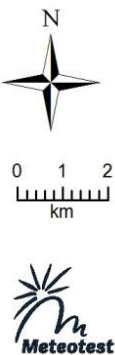
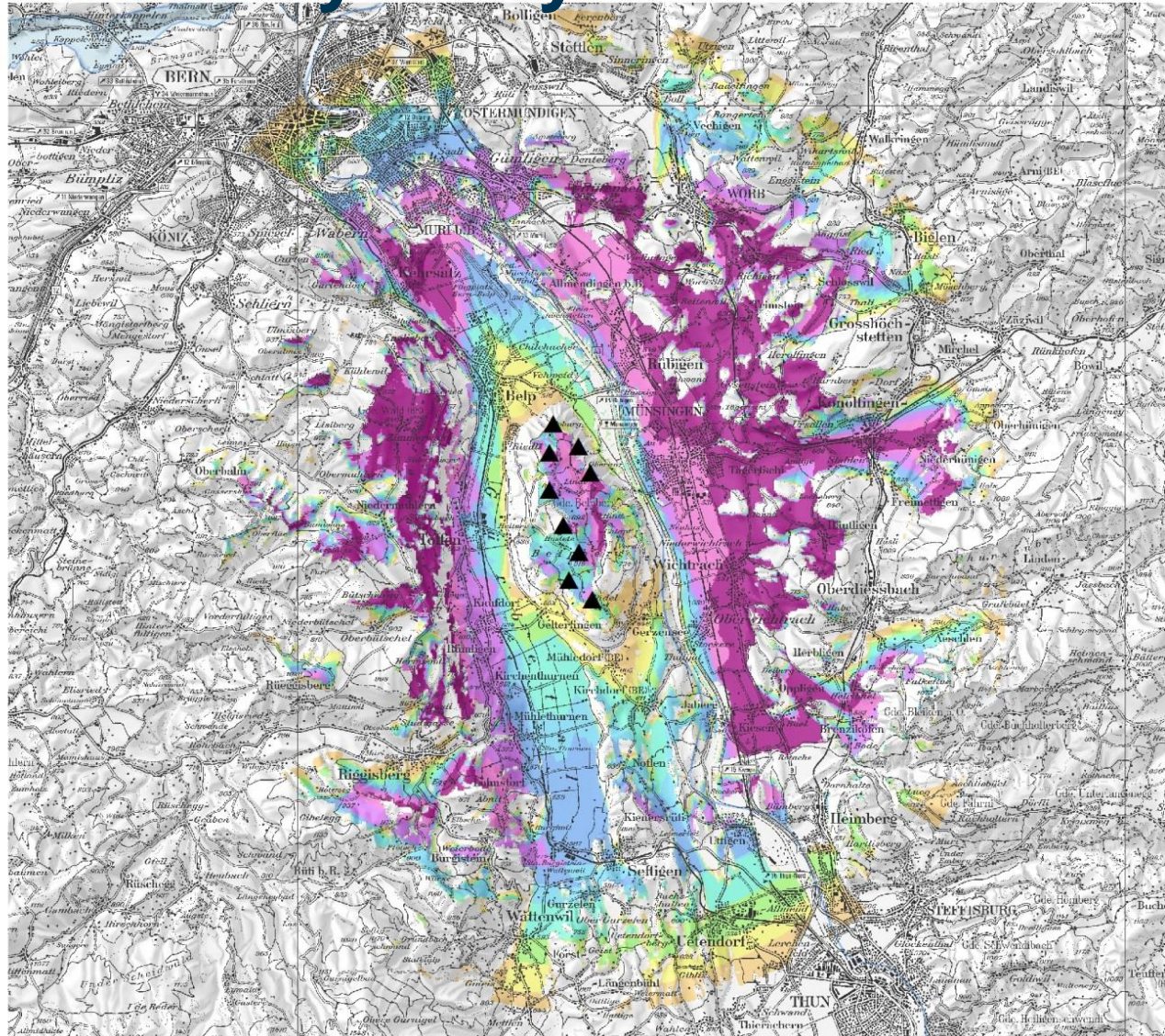
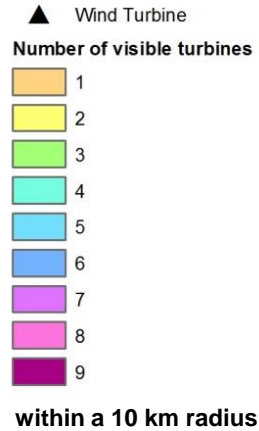


3. Methods

Individual visibility analysis



Individual visibility



Bern, June 2016

3. Methods

Distance weighted visibility

Distance:

500 m

2.5 km

5 km

10 km



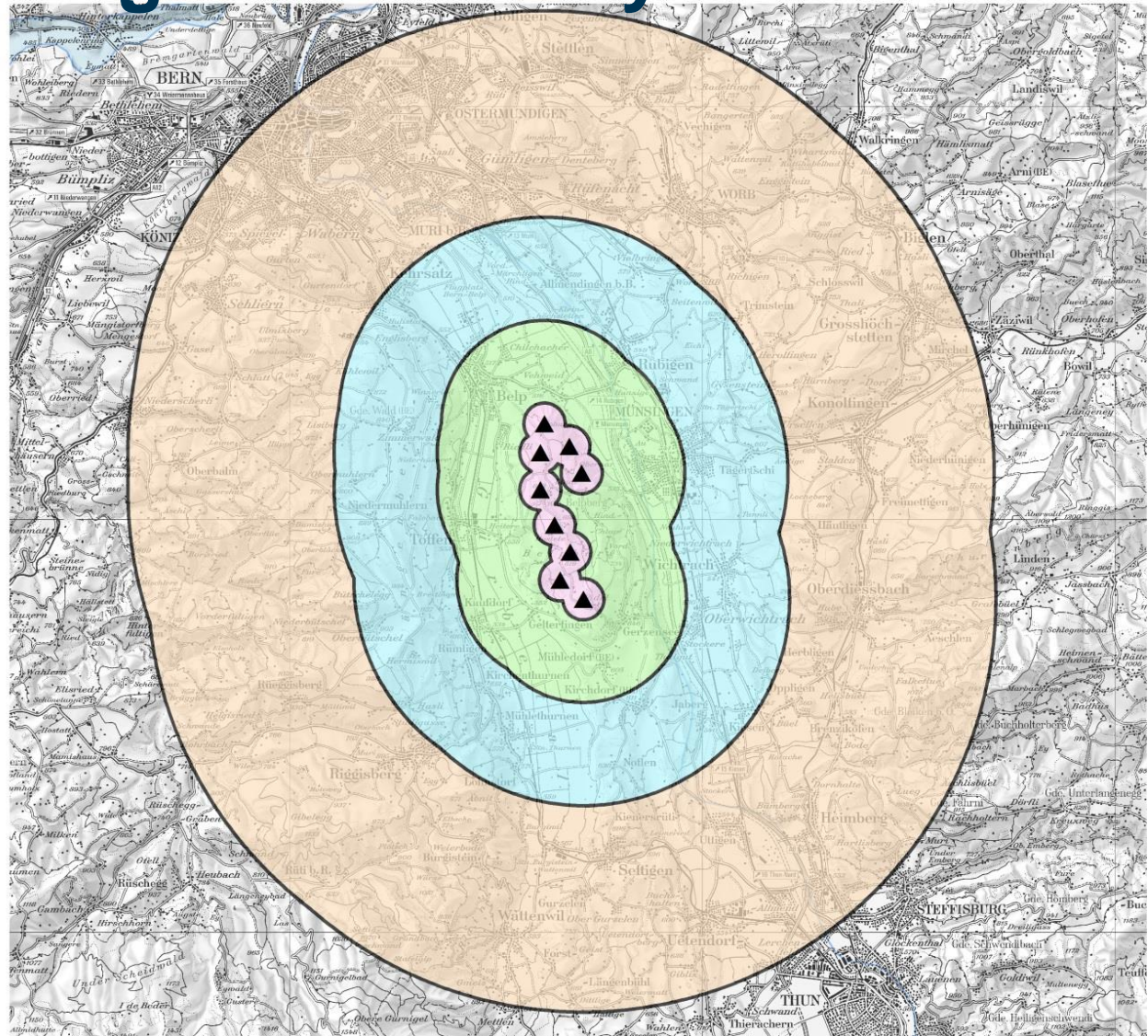
Range	Distance	Weight
Core zone	0 – 500 m	1
Immediate area	500 m – 2.5 km	0.7
Intermediate area	2.5 – 5 km	0.3
Distant area	5 – 10 km	0.05

3. Methods

Distance weighted visibility



Individual visibility



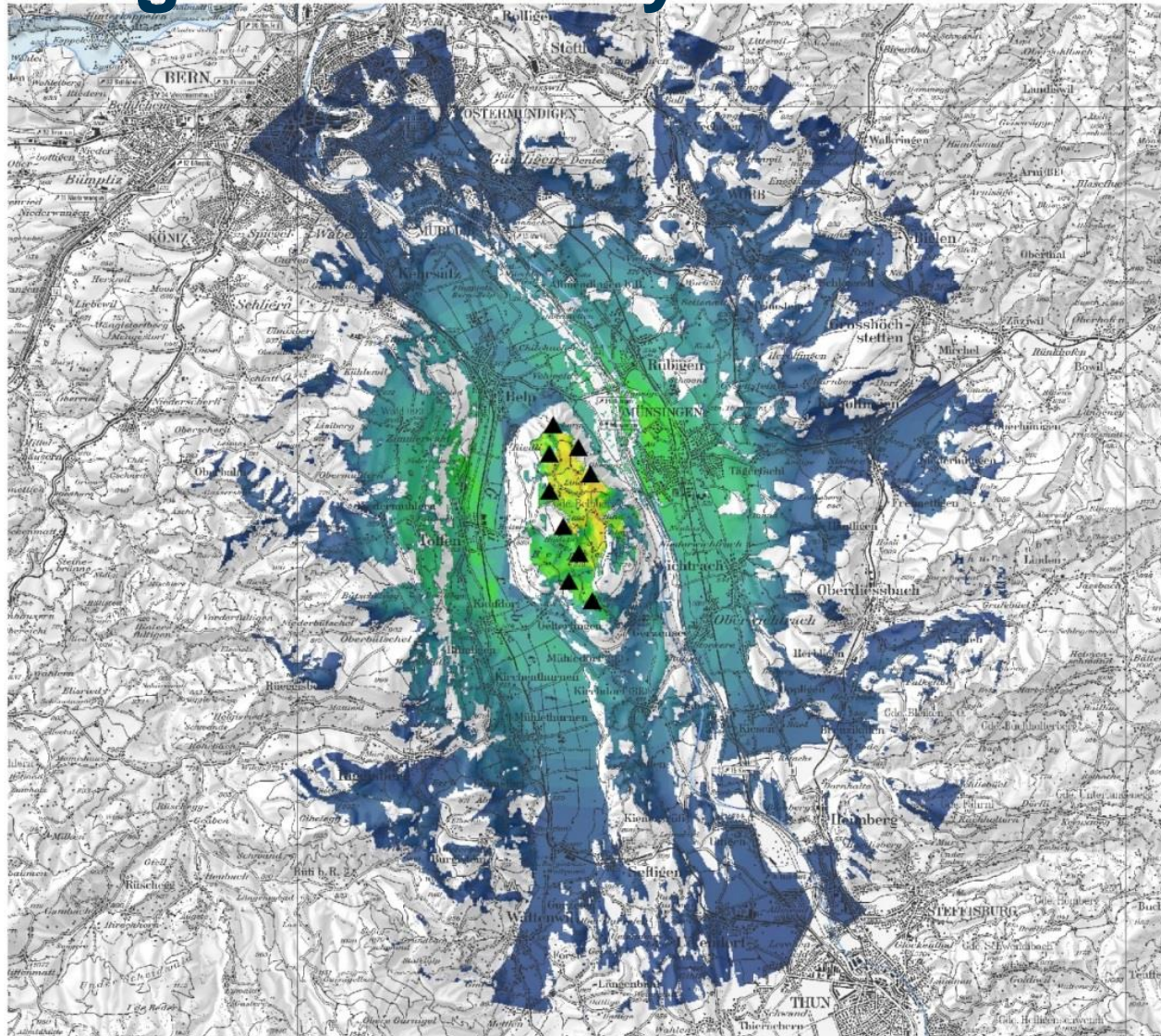
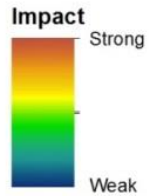
Bern, June 2016

3. Methods

Distance weighted visibility



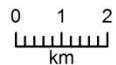
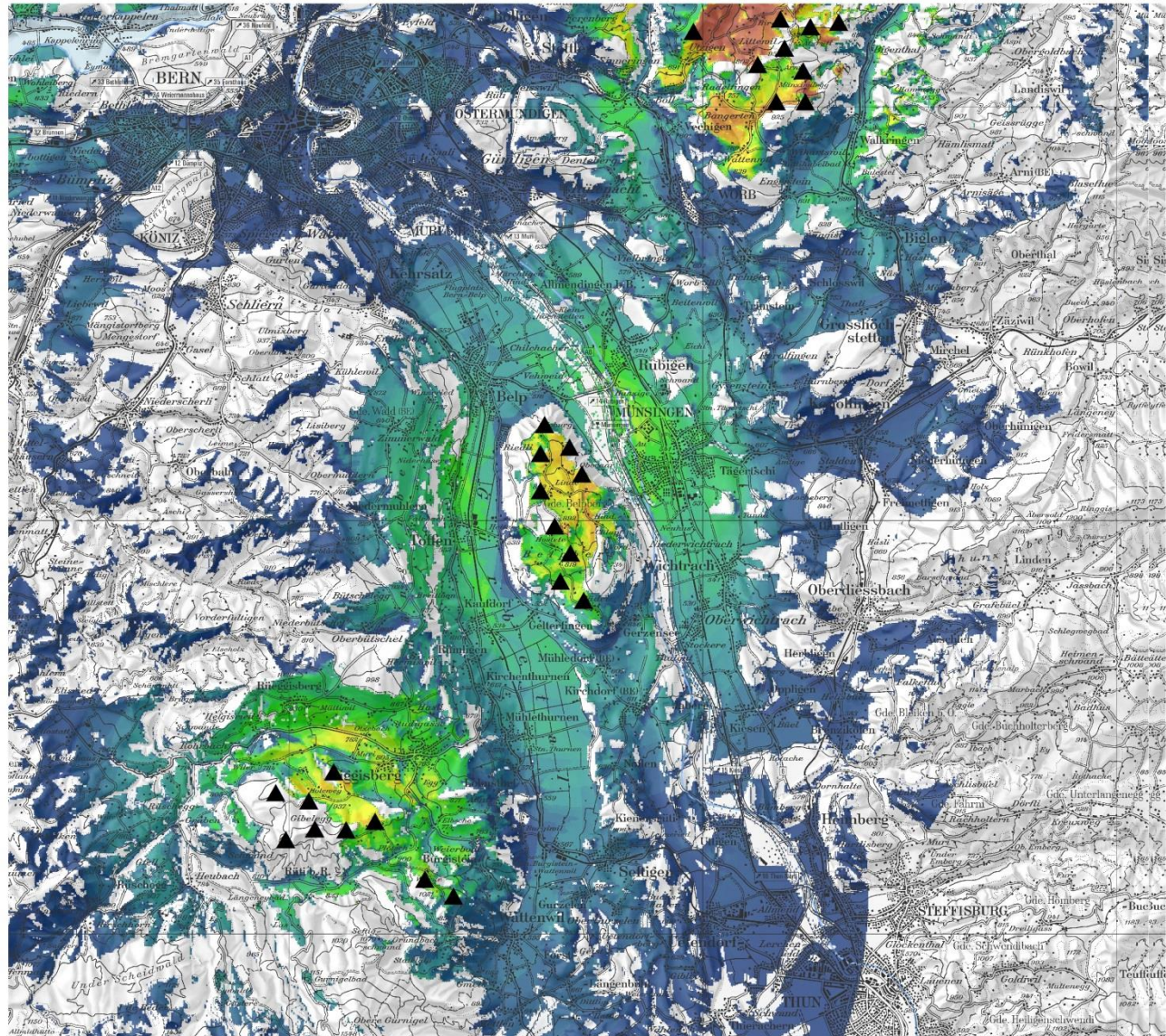
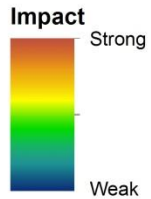
Individual visibility



Bern, June 2016

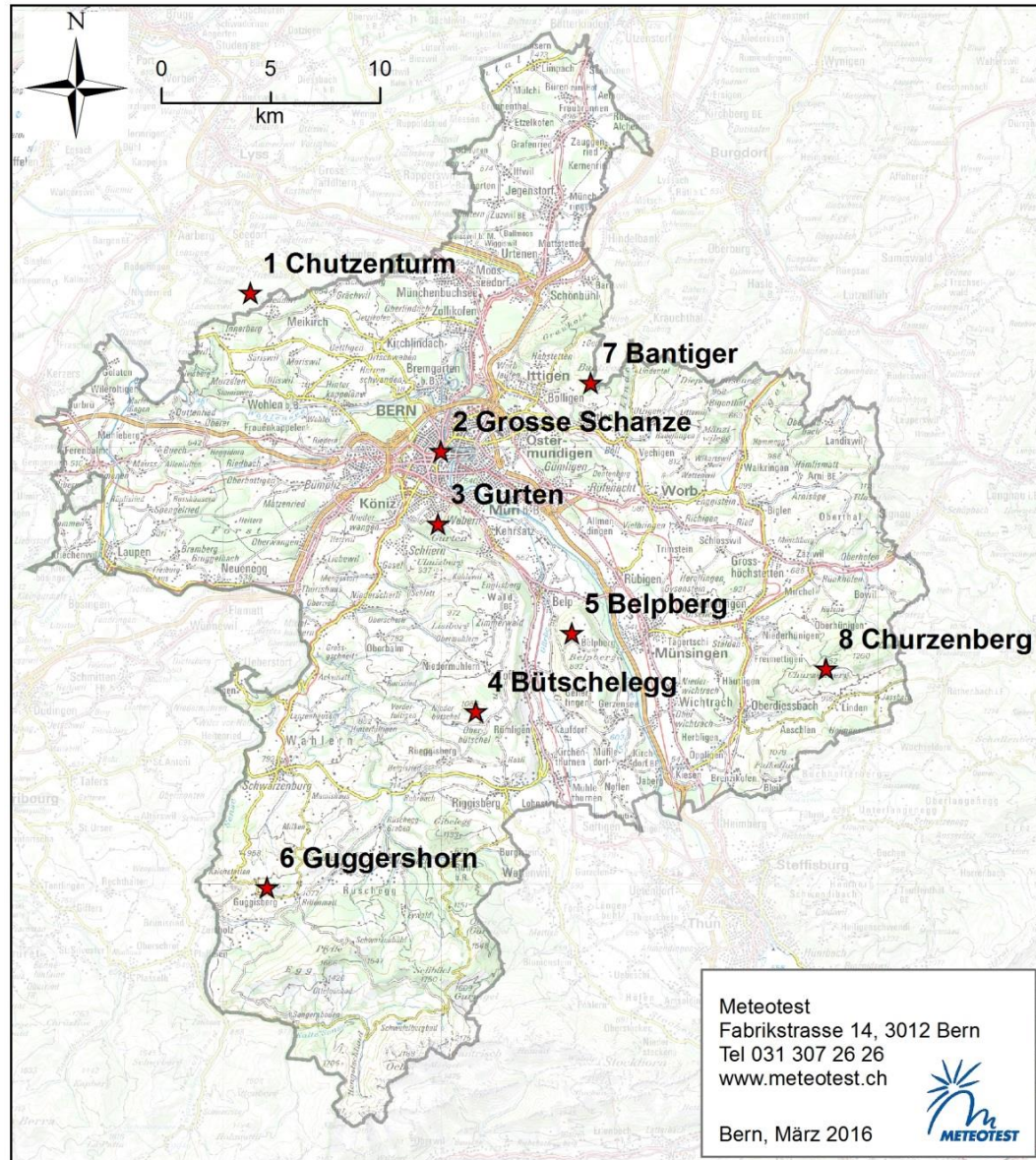
Individual vs cumulative visibility

Cumulative visibility

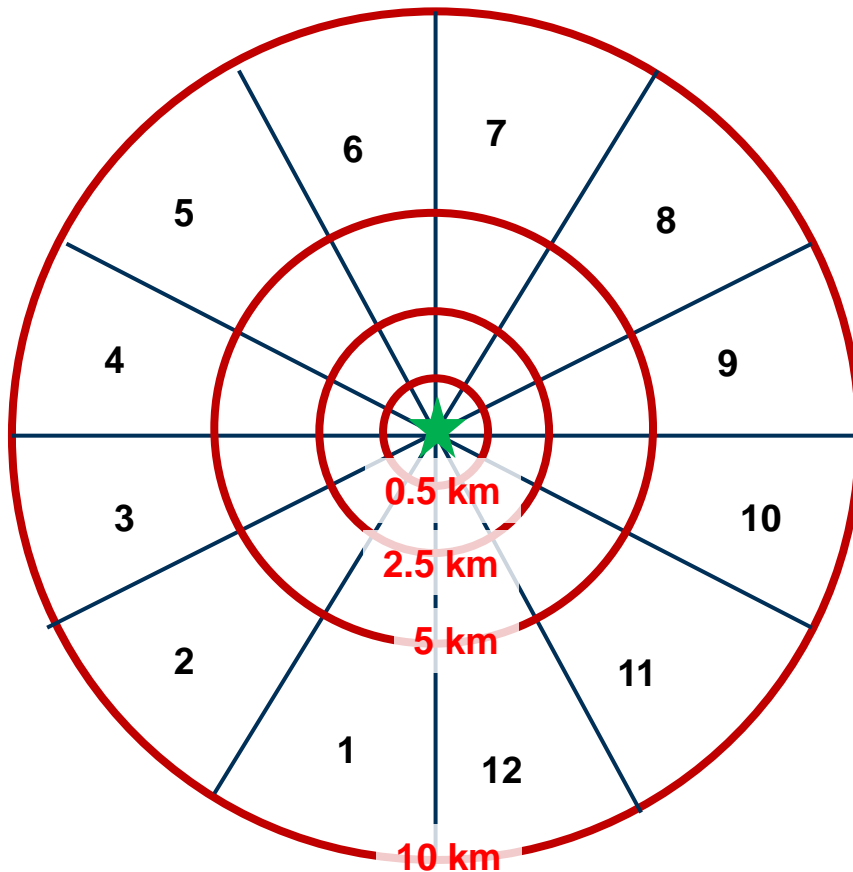


Bern, June 2016

4. Selected viewpoints



4. Selected viewpoints



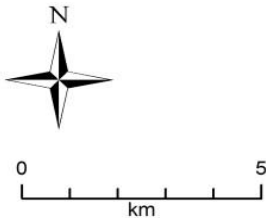
- Number of visible turbines
- Distance to visible turbines
- Field of view impairment

4. Selected viewpoints

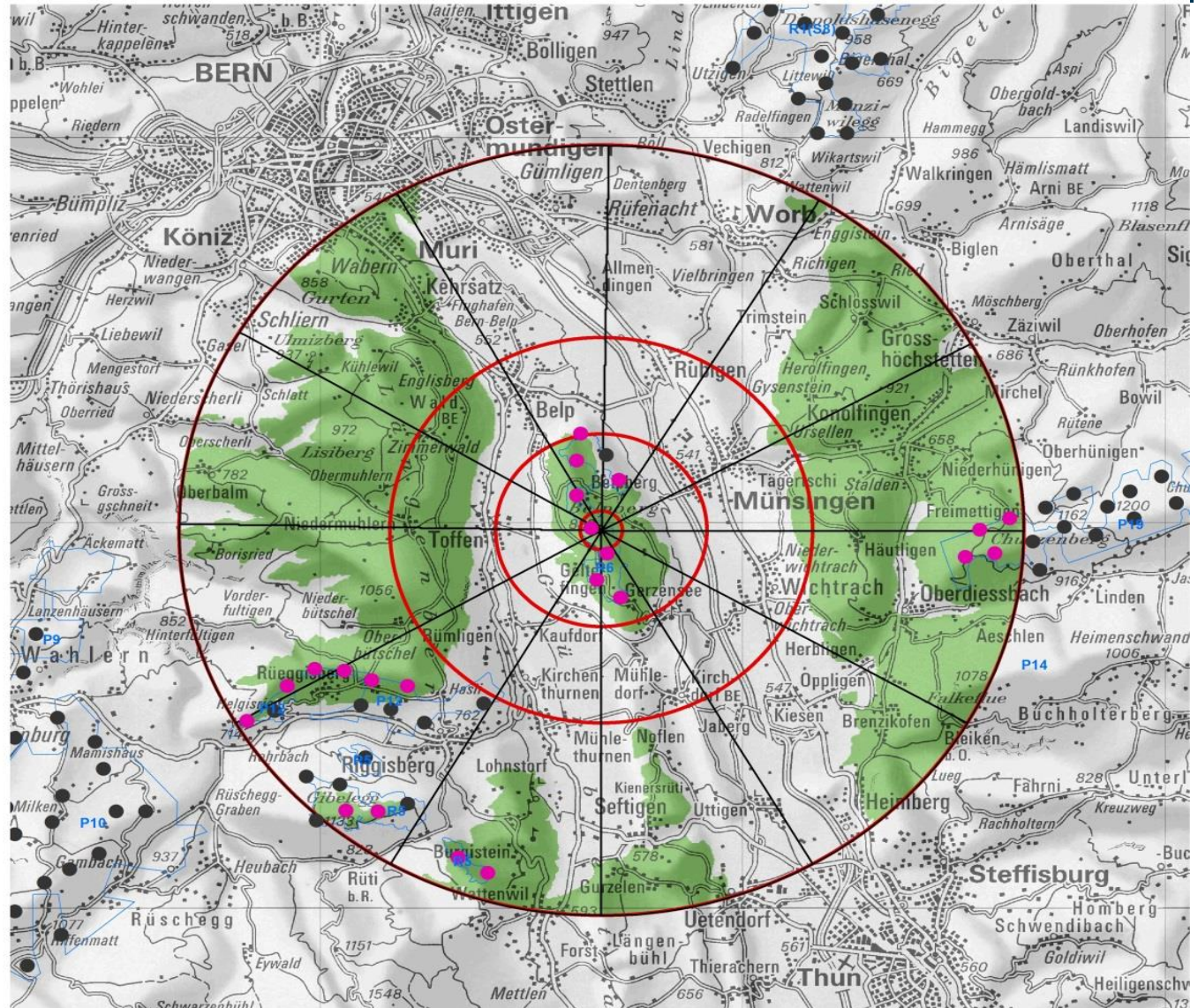
Viewpoint

FP5 Belpberg

- visible turbine
- turbine
- visible



Bern, September 2016
Background map: swisstopo



5. Results selected viewpoints

Nr	Name	Observer height	Number of turbines per distance range				Total	Weighted	Nr. sectors
			0 - 0.5 km	0.5 - 2.5 km	2.5 - 5 km	5 - 10 km			
1	Chutzenturm	41.5	0	0	5	16	21	2.3	5
2	Grosse Schanze	1.5	0	0	0	2	2	0.1	2
3	Gurten	23.5	0	0	0	7	7	0.4	2
4	Bütschelegg	1.5	0	0	3	15	18	1.7	4
5	Belpberg	1.5	1	5	2	3	12	5.7	6
6	Guggershorn	1.5	0	0	0	6	6	0.3	1
7	Bantiger	43.7	0	0	7	11	18	2.7	4
8	Churzenberg	1.5	0	0	0	0	0	0	0

5. Results case study



- For several sites, the impact to selected viewpoints is not as big as first expected
- At one specific site, the perimeter was reduced due to high impact
- One potential site won't be included to further wind energy development due to very high impact

5. Conclusions

A cumulative visibility study:

- supports the regional land-use planning process
- enables to compare the visual impact of each wind park project with each other
- helps to prioritize the wind park projects with less visual impact and concentrate on the suitable ones
- enables to define areas where there is a high risk of high visual impact

Questions? Feedback?



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