

A Case Study of Bern's Gaswerkareal

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Introduction

An urban planning ideas competition was held for the Gaswerkareal in Bern. The winning team developed a preliminary design, which was translated into a framework and development plan. The area had not yet been considered in the cantonal climate analysis. Therefore, the aim of this analysis was to generate supplementary climate maps for the 7 ha site with its future planned development.

The microclimate analysis for the Gaswerkareal Bern was intended to serve as an important basis and argumentation tool for high-quality open spaces and to help define the appropriate measures. The main question focused on how urban densification could be achieved while maintaining a pleasant urban climate for residents and employees.

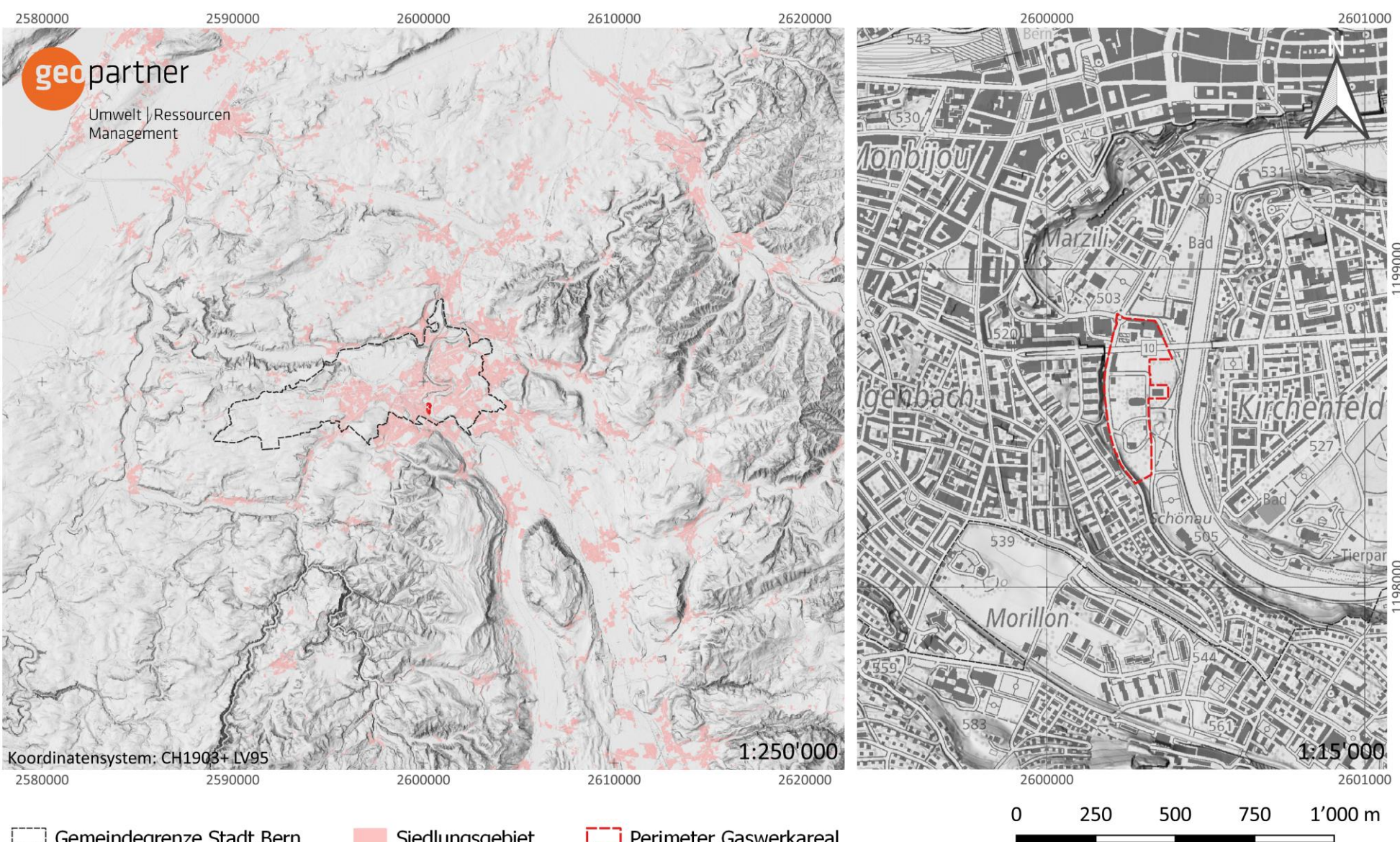


Fig. 1: Overview of the study area including building stock and topography (Data: Swisstopo).

Method

Tab. 1: Overview of the calculated parameters and the simulation models used, including information on the model domain and mesh size.

	Microclimate	Cold air drainage flow
Calculated Parameters	- PET (heat stress) - Nocturnal cooling (air temperature) - Ventilation - Shading	- Cold air layer height - Cold air volume flow - Nocturnal wind field
Models and Input Data	ENVI-met - Meteorology (Model day 15th August) - Material - Buildings - Soils - Vegetation	KLAM_21 (DWD) - Land use / land cover - Topography - Buildings in core area
Model Domain, Grid and Temporal Resolution	- Area of 420 × 570 m² with a grid resolution of 2 × 2 m². The perimeter covers the entire Gaswerkareal and its immediate surroundings. - Hourly results over a diurnal cycle.	- Total area of 15 × 15 km² with a grid resolution of 25 m, core area of 0.9 × 1 km² with a grid resolution of 5 m. - Nocturnal progression (from sunset to 8 h thereafter), results extracted at any time.

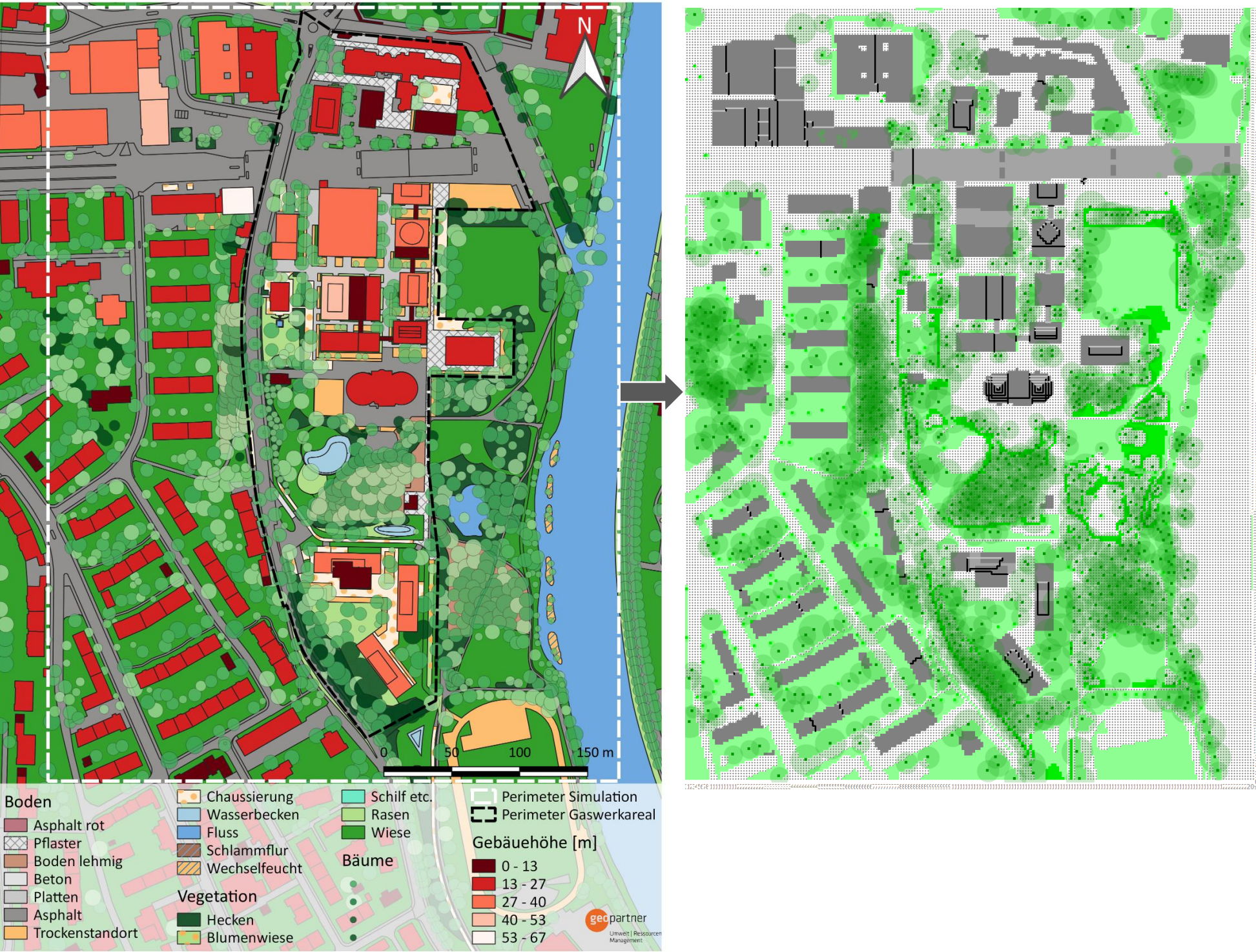
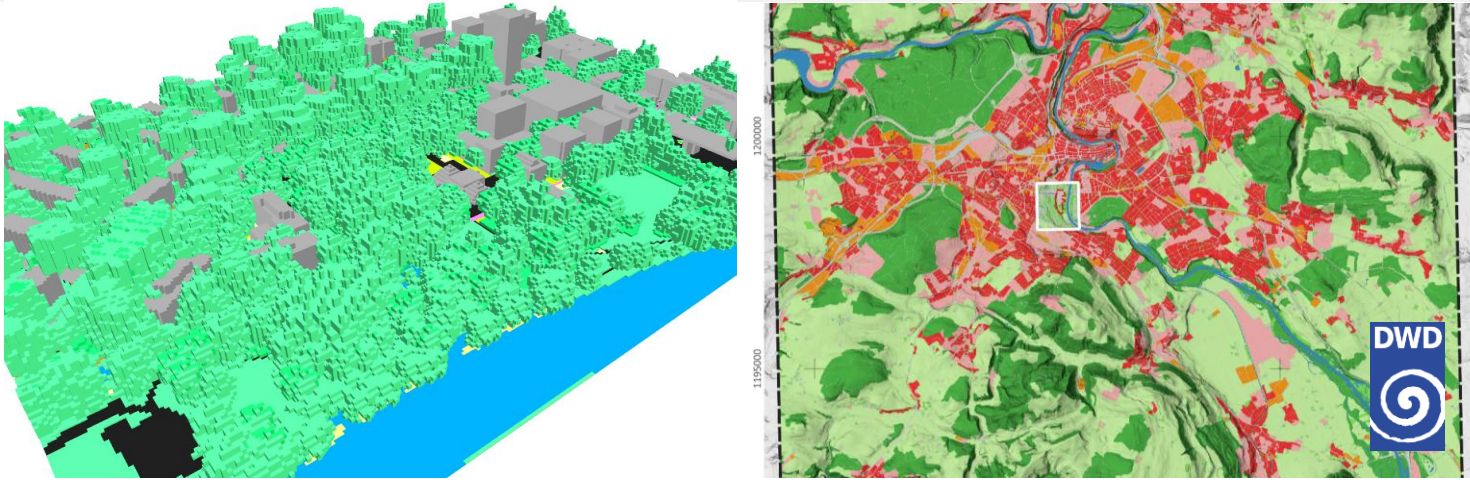


Fig. 2: GIS dataset (combination of geodata and planning data, left) as basis for the converted model environment in ENVI-met (building and vegetation layers, right).

Results

Heat stress:

For most parts, only moderate heat stress is simulated due to:

- Shading provided by tree plantings and preservation of existing trees
- Shading by buildings
- Sufficient wind circulation throughout the entire site

Strong and extreme heat stress was found in some open areas, which was partly intended (compensation areas, biodiversity areas) and unproblematic due to sufficient alternative areas for recreation and transfer within the area (groups of trees, forest, Aare river, etc.).



Fig. 3: Heat stress simulation during the day using ENVI-met.

Nocturnal cooling:

The nocturnal cooling in the investigation area was already better compared to other urban areas in the current state. Good cooling performance is maintained thanks to:

- Extensive unsealed / permeable surfaces
- Nature based environment design
- Sufficient fresh air supply and high permeability for air flow

Ventilation is somewhat restricted in the core area but remains largely intact (see cold air drainage flow map on the right).

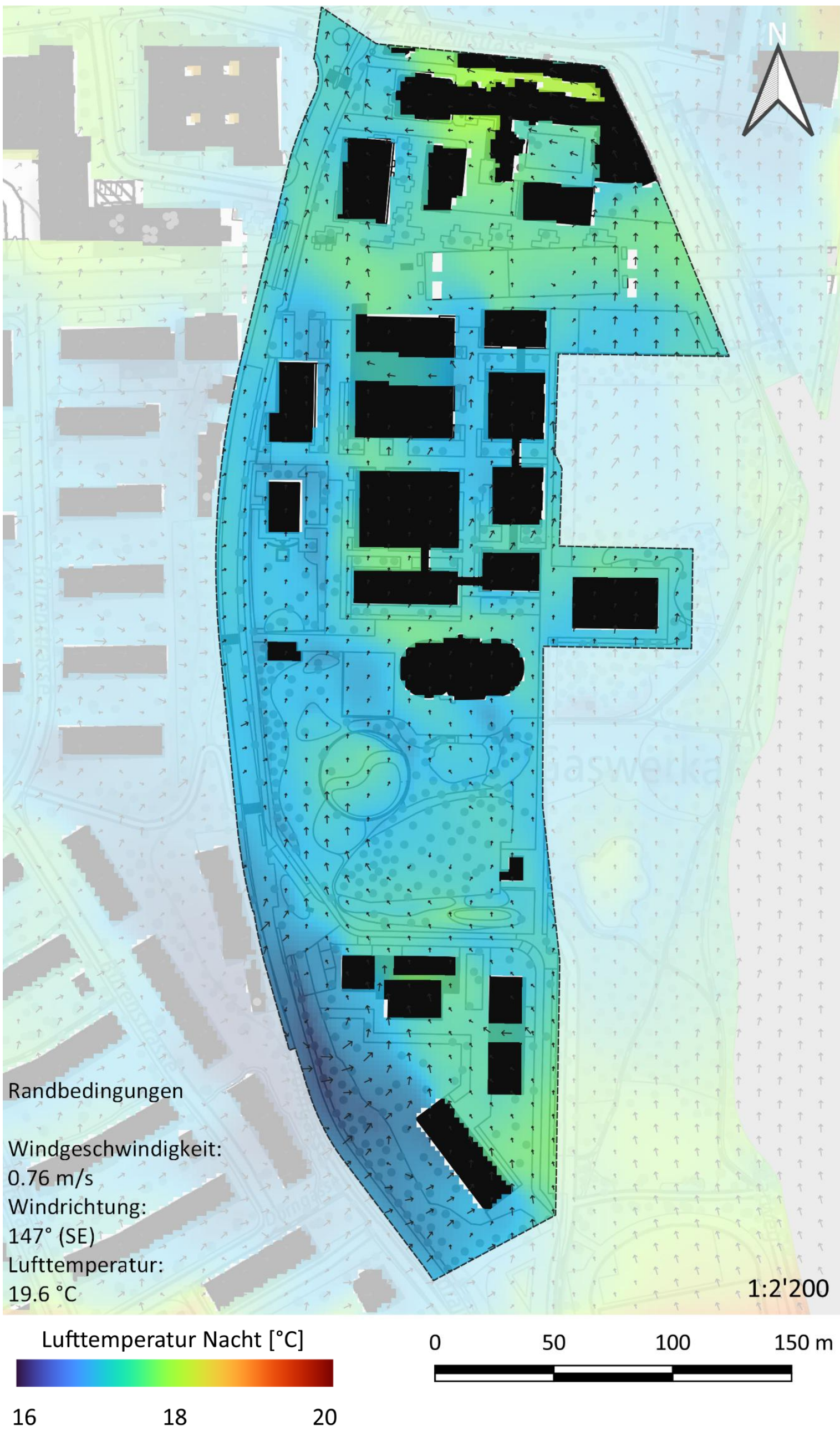


Fig. 4: Nocturnal air temperature simulation using ENVI-met.

Cold air drainage flow

- Cold air drainage flow is maintained
- A sharp decline was observed only within the development area itself, because the stream can bypass on open areas

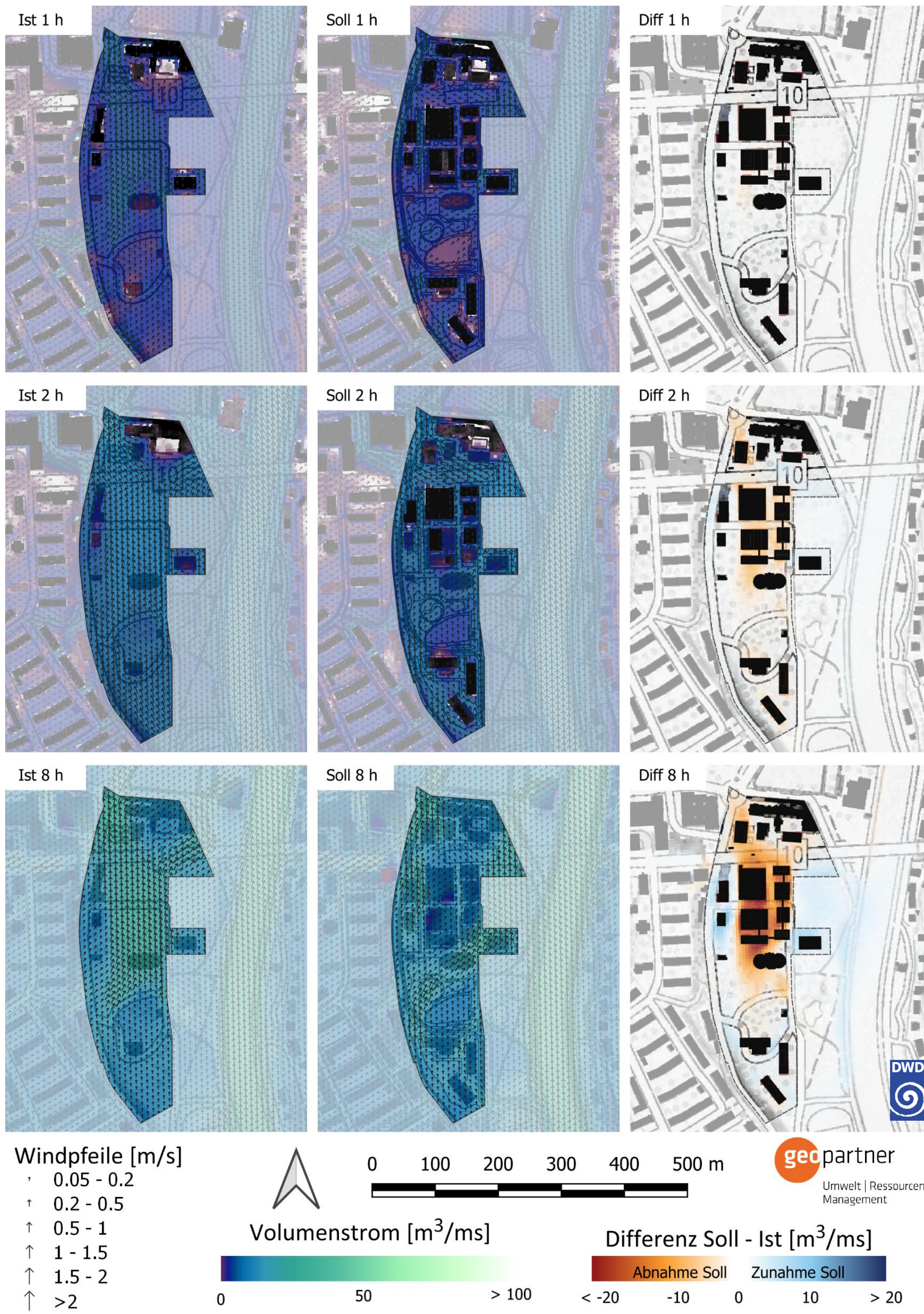


Fig. 5: Cold air drainage flow in the actual (left) and target (centre) state, as well as the difference between the two states (right), simulated using the DWD's KLAM_21 model.

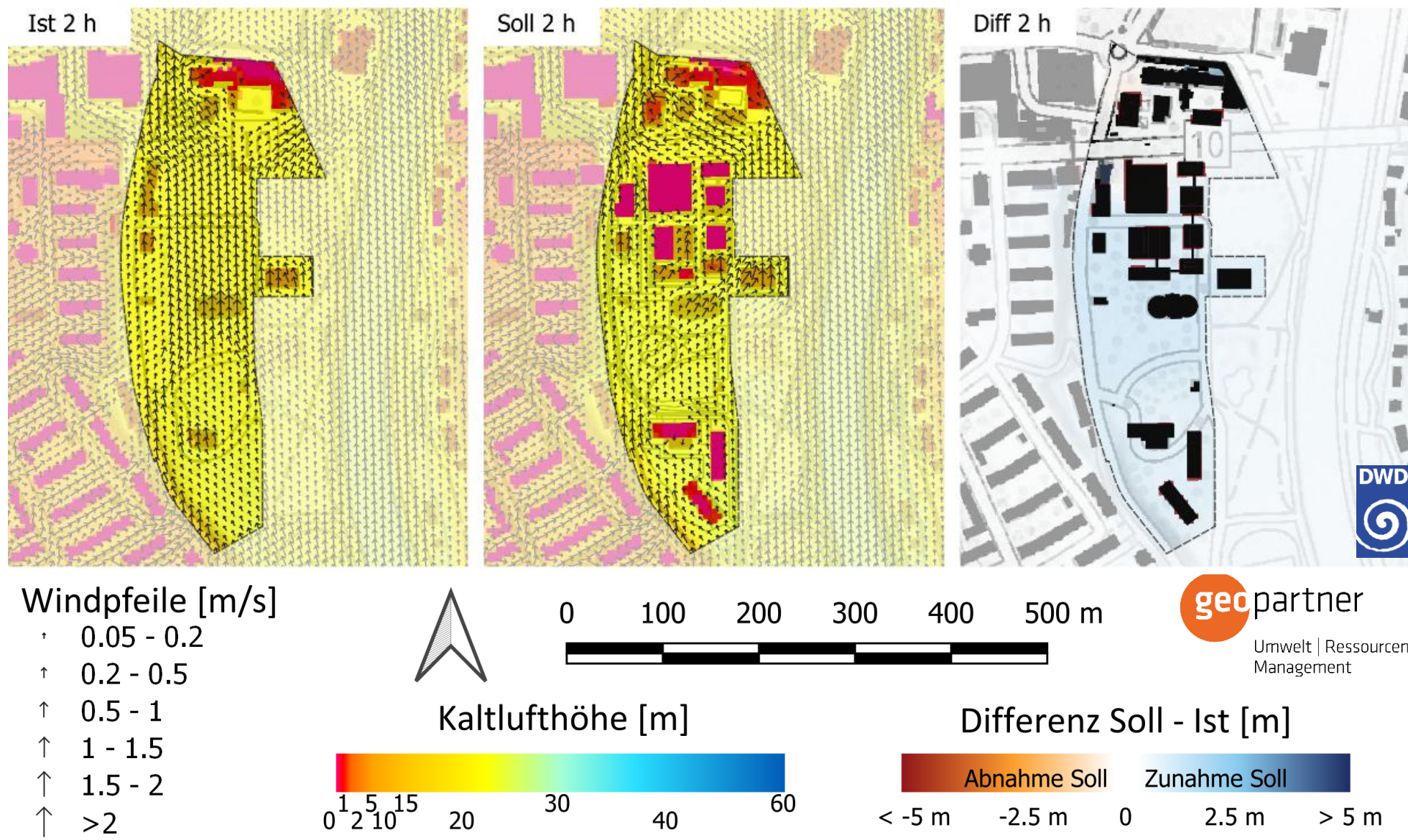


Fig. 6: Cold-air level and near-surface wind field – airflow over buildings.

Conclusion

The developed project is well-suited to future climate challenges and makes optimal use of the existing favourable conditions. The preservation of valuable existing trees and early replanting contribute to this. Two nocturnal cold-air systems are relevant to the area: the influence from the Aare Valley and that coming from the direction of Liebefeld. The large-scale flow pattern along the Aare remains intact despite the influences of the new development, as there is sufficient alternative open space available. Critical areas considering heat stress such as the Ryff factory do exist but can be improved with minor adjustments.

Negative impacts and urgent need for action are barely detected. The greatest challenge lies in implementing the preliminary design itself. The study serves as the basis for further procedures. In this context, adjustments to the project, its implementation, and follow-up measures can be simulated and reviewed.

Project Information

Climate Analysis Gaswerkareal Bern

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Purchased by: Stadtplanungsamt
Client: Fonds für Boden- und Wohnbaupolitik, p.A. Immobilien Stadt Bern
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