Urban Climate Map Application in High Density Cities: A Case Study of Macau

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Background:

1. Planned reclamation areas A and B have the potential to affect the ventilation in the present city districts and in the planned reclamation areas.
2. To evaluate the impact of the planned reclamation areas on the ventilation within the present city districts, a GIS-based Existing Analysis of Wind Environment (GIS-based Existing Analysis of Wind Environment).
5. GIS-based Existing Analysis of Wind Environment:
   - Central Coverage Ratio Map (100m)
   - Building Volume Density Map (100m)
   - Frontal Area Density Map (100m)
   - Sky View Factor Map (100m)
   - Green Space Ratio Map (100m)
6. Wind Environment Evaluation of Macau Existing Condition:
   - 10m Prevaling Wind Direction (Annual/Summer/Winter)
   - 10m Median Wind Speed (Annual/Summer/Winter)
   - Sky View Factor (Plan 1, 2, 3)
   - Building Volume Density (Plan 1, 2, 3)
   - Ground Coverage Ratio (Plan 1, 2, 3)

Micro-scale CFD Simulation of New Reclamation Areas:
This study investigates the potential hole ventilation in Macau using the parallelized large eddy simulation model (PARIS). The aim of the study is to analyze the ventilation in Macau’s present city districts and in the planned reclamation areas. It is to evaluate the impact of the planned reclamation areas on the ventilation within the present city districts, as well as how these new physical quantities are related to the wind direction and velocity. This study is commissioned by The Land, Public Works and Transport Bureau (DSSSP) of the Macau Government.

Wind Environment Evaluation of New Reclamation Areas:
1. Planned reclamation areas A and B have the potential to affect the ventilation in the present city districts and in the planned reclamation areas.
2. In case of south-east wind, zones A and B have decreased ventilation in the eastern districts.
3. In case of north wind, zones A and B have increased ventilation in the western districts.
4. In case of north wind, zones C, D, and E significantly reduce the ventilation in many districts of Taipa.
5. Most of the planned reclamation areas themselves will be well-ventilated, regardless of the wind direction. Only in zone A will be some parts with a moderate ventilation due to the high value of ground coverage and frontal area density.

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