Modelling wind driven rain for building façades

Simulation using the software COMLEAM

Summary

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In order to develop emission scenarios for substance leaching and emissions into the environment, appropriate assumptions regarding the amount of runoff water are an important prerequisite. In the case of vertical building components, wind driven rain (WDR) is a relevant factor. WDR represents the fraction of vertical rainfall that is deflected and thus driven onto vertical surfaces by the force of wind.

Applying the international standard ISO 15927-3, which describes the calculation of WDR, is a typical approach to estimate runoff water from different building geometries. For this reason, WDR at two buildings with equal façade orientation but different wall heights was calculated. Using real meteorological data from a period of 20 years in Hamburg, resulting WDR and runoff were simulated with the modelling software COMLEAM (COnstruction Materials LEAching Model) developed by HSR.

The results showed significant influence on the amount of WDR and the resulting façade runoff for both the exposition of a façade and its height. The lower building showed 25 % more WDR irrespective of a façade's orientation. For both buildings, façades in the main weather direction to the west received five times more WDR compared to façades in the opposite. Furthermore, façades facing the main weather direction were exposed to heavy rain events, resulting in more than 5 L/m^2 of WDR that were absent on the other façades. At the higher building approximately twofold of the façade runoff compared to the lower building is expected even though the amount of WDR was higher for the lower building. The seemingly inconsistent behavior reflects different scales used for WDR and runoff. Wind driven rain is a specific unit (L/m^2), while façade runoff takes the façade into account and refers to the length of the façade at the bottom (L/m).

The amount of runoff water is a key factor for the assessment of environmental risks of harmful substances leached from façades. This parameter is representing the importance of a vertical building component and thus is the basis for any mass flow. Coupling runoff water with substance leaching in the model enables the assessment of environmental exposure.