Karlsruher Institut für Technologie

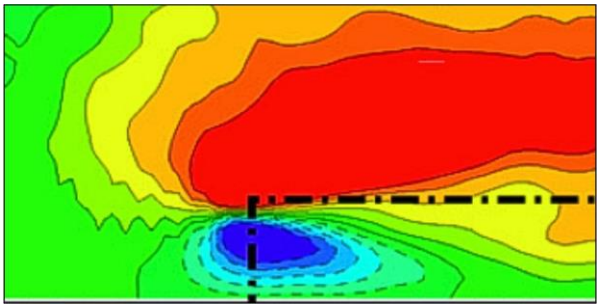
Institut für Hydromechanik
Laboratorium für Gebäude- und Umweltaerodynamik

Master Thesis:

(optional in English or German)

Large Eddy Simulation (LES) of forest flow

Flow phenomena in and above forest canopies are essential for the understanding of scalar and momentum exchange with the atmosphere. Latest research deals with the deposition of pollutants in forest canopies, the exchange of heat, moisture and gaseous species, and with storm stability of forest stands.
In the current thesis, numerical simulations of forest flow shall be performed with the multi-purpose CFD code ANSYS Fluent by means of LES. In a first step, the LES model shall be adapted to account for the effects of vegetation on flow and turbulence. This involves the implementation of additional vegetation terms in the momentum and SGS TKE transport equations [1,2]. In a second step, the adapted LES model shall be validated against full-scale measurement data of forest flow [3]. Finally, in a third step, a task according to the choice of the student in agreement with the supervisors shall be pursued. This can be either a practical application-oriented study, e.g. flow past a forest edge or forest gap with reference to wind turbine siting, or a fundamental research-oriented study, e.g. the adequate parametrization of vegetation in the modified SGS TKE model in dependency on the grid resolution.



Begin: immediately or on agreement
Requirements: first experience with CFD codes (preferably with ANSYS Fluent)

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Prof. Dr.-Ing. Dr. h.c. Bodo Ruck

gez. Dr.-Ing. C. Gromke

Literature

[1] Dupont, S., Brunet, Y. (2009) Coherent structures in canopy edge flow: a large-eddy simulation study, Journal of Fluid Mechanics, Vol. 630, pp. 93-128.
[2] Finnigan, J.J., Shaw, R.H., Patton, E.G. (2009) Turbulence structure above a vegetation canopy, Journal of Fluid Mechanics, Vol. 637, pp. 387-424.
[3] Amiro, B.D. (1990) Comparison of turbulence statistics within 3 boreal forest canopies, Boundary-Layer Meteorology, Vol. 51, pp. 99-121.