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Visualization of air flow and smoke spreading for realistic indoor-climate situations*

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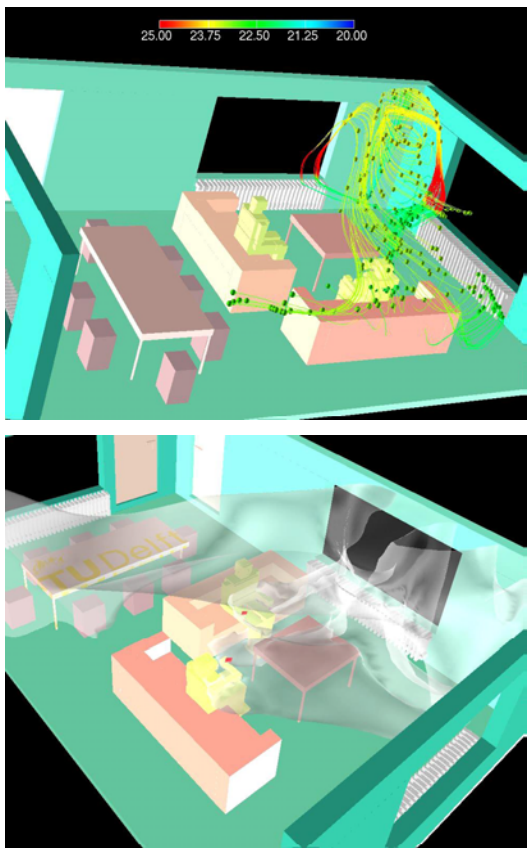

Fig. 1. Instantaneous trajectories of massless particles colored by local temperature revealing complex interactions between thermal jets (originating from the local thermally active sources - radiators) – above; passive scalar (smoke) distribution after 5 min – the smoke is released over two localized sources just above occupants hands-imitating two active smokers – below.

Numerical simulations of realistic indoor-climate situations (furnished and occupied office space with two active smokers) demonstrated that the time-dependent RANS (T-RANS) approach when combined with the passive-element treatment for representation of complex interior space can be used as a powerful tool for accurate predictions of air flow, scalar transport and wall-heat and mass transfer in complex buildings. The method can be regarded as Very Large Eddy Simulations (VLES) since the deterministic and modeled contributions to the turbulence moments are of the same order of magnitude. The simulated geometry is represented by 122x82x82 control volumes (clustered closely to the thermally active sources) and approximately 300 passive elements. The flow is buoyancy-driven with typical values of non-dimensional parameters: $Ra=1.5x10^{12}$, Pr=0.71.

* Kenjeres, S., Hanjalic, K. and Gunarjo, S. B., "A T-RANS/VLES approach to indoor climate simulations", FEDSM2002-31400, Proc. ASME 2002 Fluids Engineering Division Summer Meeting, Montreal, Quebec, Canada, July 14-18, 2002.