Zhengen Ren, Enhanced modelling of indoor air flows, temperatures, pollutant, emission and dispersion by nesting sub-zones within a multizone model. PhD Thesis, The Queens University of Belfast, September 2002

Comparison with published data

It is general practice, when using computer simulation models to predict indoor air quality, to provide an evaluation of the model whenever possible. Ten case studies were performed in two-dimensional and three-dimensional enclosures, a ventilated room, a partitioned room, an experimental atrium, and typical residential building with a bedroom and a living room and kitchen combination. The results from the new program were compared with the results obtained by published experimental measurements, other zonal models and CFD models, and have been published [10, 11, 12] to solicit peer review and critique. Some of them are shown below.

Case 1 – Ventilated room with re-circulating flow field

The first case is to predict air flow and personal exposure in a mixing ventilated room. The mixing ventilated room is a test case described by Nielsen [13] which has been used as part of the International Energy Agency, Annex 20 work, see Figure 2. The flow field in the empty room shows a typical recirculating flow field (Fig. 3). The concentration distribution (Fig.4) shows how the concentration level increases towards the lower left part of the room. A very good agreement between COwZ and Nielsen's test [13] and CFD simulation [14] is found.

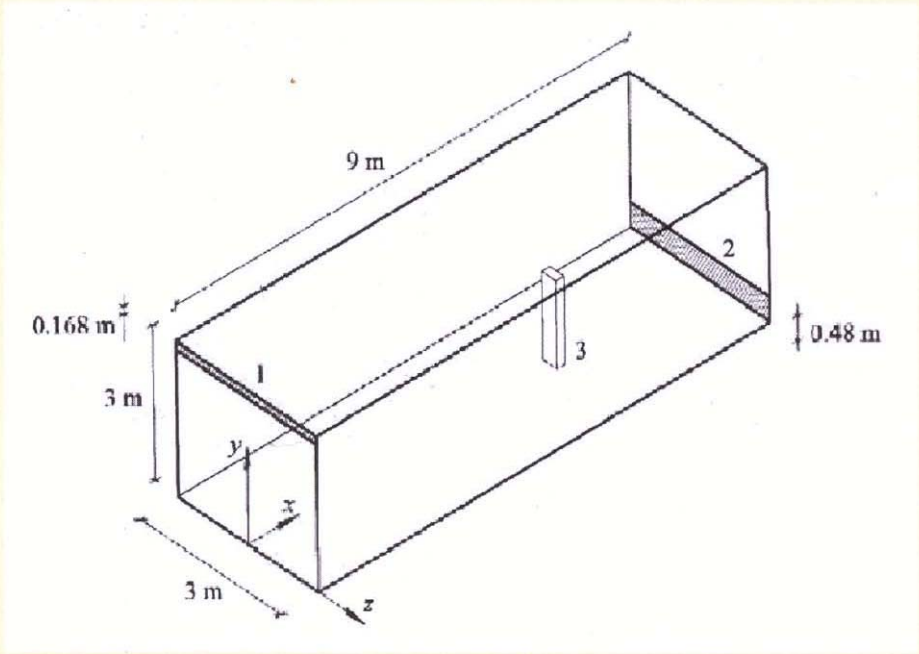

Fig 2. Geometry of the mixing ventilated room simulated by the CowZ program. The air is supplied by the inlet (1) located close to the ceiling, and the air is exhausted by the return opening (2) located close to the floor in the opposite end. The computer simulated occupant (3) is located in the symmetry plane, z = 0 m.

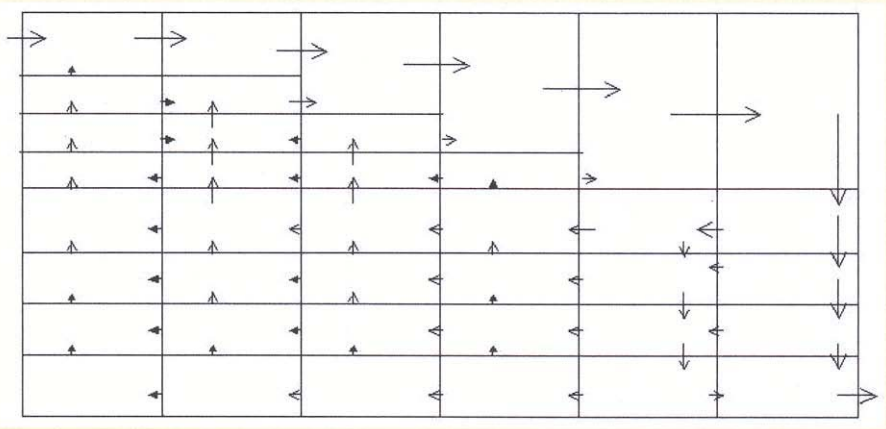

Fig. 3 Calculated air flow rates for the ventilated room. ⟶ 500Kg/h reference air flow rate.

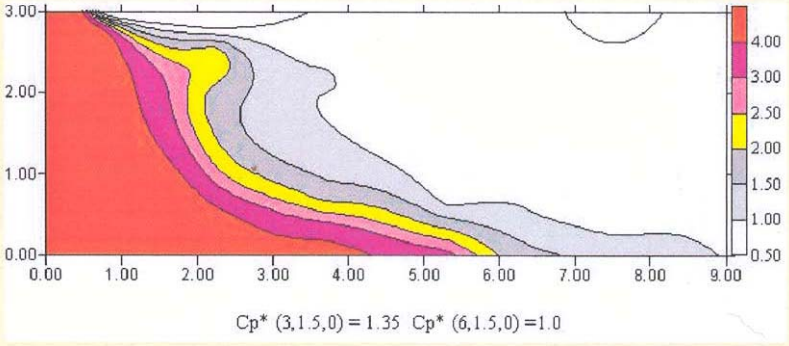

Fig. 4 Dimensionless contaminant concentration distribution in the vertical symmetry plane, z = 0 m, of the mixing ventilated room. The floor is a planar source with a constant emission rate. The dimensionless personal exposure, C_p^*, is made dimensionless by dividing by the return concentration, i.e. $C_p^*=C/C_R$.