

A study on the similarity of the momentum and scalar roughness lengths over urban-like roughness

We have performed a series of wind-tunnel experiments to measure scalar concentration profiles over urban-like roughness arrays to investigate characteristics of the scalar fields over rough surfaces and to clarify the relationships between the momentum and scalar transports. The measurements of scalar concentration revealed two important features of scalar distribution: (1) the high concentration field was observed in the leeward region of each roughness element; (2) the averaged concentration became high up to the roughness height due to the updraft along roughness elements and the boundary layer thickness drastically reached to the height in spite of the short length of scalar source. In addition to the concentration measurements, we determined the roughness length of scalar based on the preliminary performed comprehensive studies on scalar transfer coefficients, momentum transfer coefficients and wind profiles. The relationship of similarity between the momentum and the scalar transport was confirmed by expressing the ratio of the roughness lengths as a function of the roughness Reynolds number.