



Reasons for the breakdown of the Monin-Obukhov-Theory above rough surfaces

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Since Thom (1971) it is known that above rough surfaces gradients of scalar components are smaller than predicted by Monin-Obukhov similarity theory (MO-theory). In 1989 Raupach proposed with the localized near field theory (LNF) a lagrangian approach to model source distributions in plant canopies. This theory can be used to derive a general formulation for profiles within and above plant canopies. Comparing such profiles with profiles predicted by MO-theory gives insight into the mechanisms leading to the deviation from MO-theory.

There are two mechanisms with opposite effect which lead to the observed profiles: Turbulent transport in the direct vicinity of a source is not as efficient as diffusion. Inside forest canopies this leads to the temperature maximum in the crown region. This 'near field' effect alone would lead to larger gradients. Within and direct above a rough surface turbulence is enhanced due to the interaction between surface and flow. This effect reduces vertical gradients.

As a result the observed profile form depends on the distribution of sources and sinks of the scalar in the canopy and on the distribution of turbulence in the canopy.