



## Surface-layer turbulence and Monin-Obukhov similarity theory revisited

Sergej Zilitinkevich (1,2,3)

(1) Finnish Meteorological Institute, Helsinki, Finland (sergej.zilitinkevich@fmi.fi), (2) University of Helsinki, Finland, (3) University of Nizhny Novgorod, Russia

Since first publication in 1954, the Monin-Obukhov Similarity Theory (MOST) remains universally recognised. MOST still underlies calculation of (i) turbulent fluxes at the Earth surface and (ii) turbulent viscosity, heat-conductivity and diffusivity in the surface layer in both atmospheric science and applications including weather, climate and air-quality modelling. In spite of principal inconsistencies in unstable and strongly stable stratifications, MOST has not been seriously questioned. Silent reluctance to revise MOST is not surprising. Its major drawbacks root in the fundamental drawbacks inherent to common vision of turbulence, factually based on the paradigm originated from Kolmogorov (1941, 1942). However, Kolmogorov considered only the shear-generated turbulence in neutrally stratified flows. Subsequent extension of the paradigm to essentially stratified flows was performed by Kolmogorov's followers who just assumed it applicable. In this paper we demonstrate major drawback of MOST, identify its limits of applicability and revise basic paradigm of the theory of turbulence. We also outline advanced theory of the surface-layer turbulence accounting for its self-control in stable stratification and unconventional nature of the buoyancy-generated "anarchy turbulence" in unstable stratification. Wherever it is grounded MOST is kept untouched.