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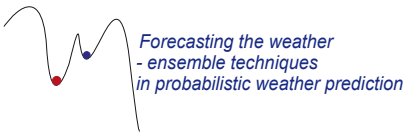

The height of the atmospheric planetary boundary layer: state of the art, new developments, and remaining problems

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The planetary boundary layer (PBL) is the strongly turbulent lower layer of the atmosphere immediately affected by dynamic, thermal and other interactions with Earth's surface. It essentially differs in nature from the weakly turbulent and persistently stably-stratified free atmosphere. To some extent the PBL upper boundary acts as a lid preventing dust, aerosols, gases and other pollutants released from ground sources to efficiently penetrate upwards, thus blocking them within the PBL. It is conceivable that the air pollution is especially hazardous when associated with shallow PBLs. Likewise, positive or negative perturbations of the heat budget at the Earth's surface immediately impact on the PBL and are almost completely absorbed within the PBL through the very efficient mechanism of turbulent heat transfer. Determination of the PBL height is, therefore, an important aspect of modelling and prediction of strong air-pollution episodes, extreme colds or heats and other dangerous weather events. Because of high sensitivity of shallow PBLs to thermal impacts, variability of the PBL height is an important factor controlling fine features of climate change. Deep convective PBLs strongly impact on climate system through turbulent entrainment ("ventilation") at the PBL upper boundary that essentially regulates development of convective clouds. This paper outlines modern knowledge about physical mechanisms controlling the PBL height and turbulent entrainment, and presents an advanced model of geophysical convective PBL.