Geophysical Research Abstracts
Vol. 19, EGU2017-10199, 2017
EGU General Assembly 2017

Observation and modelling of fog at Cold Lake, Alberta, Canada

Di Wu (1), Faisal Boudala (1), Wensong Weng (2), Peter A. Taylor (2), Ismail Gultepe (1), George A. Isaac (2,3)

(1) Cloud Physics and Severe Weather Research Section, Environment and Climate Change Canada, Toronto, Ontario, Canada, (2) Department of Earth & Space Science & Engineering,York University,Toronto, Canada (pat@yorku.ca), (3) Weather Impacts Consulting Incorporated, Barrie, Ontario, Canada

Climatological data indicate that the Cold Lake, Alberta airport location (CYOD, 54.4ºN, 110.3ºW) is often affected by various low cloud and fog conditions. In order to better understand these conditions, Environment and Climate Change Canada (ECCC), in cooperation with the Canadian Department of National Defense (DND), installed a number of specialized instruments. The ground based instruments include a Vaisala PWD22 present weather sensor, a multi-channel microwave profiling radiometer (MWR) and a Jenoptik CHM15k ceilometer. The focus here will be on understanding the micro-physical and dynamical conditions within the boundary layer, on the surface and aloft that lead to the occurrence of fog using a high resolution 1-D boundary-layer model, ground based measurements, Geostationary Operational Environmental Satellite (GOES) data and predictions from the Canadian 2.5 km resolution NWP model (HRDPS - High Resolution Deterministic Prediction System).

Details of the 1-D model will be presented. The condensation of water vapour into droplets and the formation of fog in the Earth's atmospheric boundary layer can involve a complex balance between vertical turbulent mixing of heat and water vapour, cloud micro-physical processes and radiative transfers of heat. It is a phenomenon which has been studied for many years in a variety of contexts. On land, surface cooling via long wave radiation at night is often the trigger and a number of 1-D (one dimensional, height and time dependent) radiative fog models have been developed. Our turbulence closure includes the turbulent kinetic energy equation but we prefer to specify a height, roughness Rossby number and local stability dependent, "master" length scale instead of somewhat empirical dissipation or similar equations. Results show that low cloud and fog can develop, depending on initial profiles of wind, temperature and mixing ratio, land surface interactions and solar radiation.

Preliminary analysis of Cold Lake observational data indicates that the surface-based in situ measurements agree well with aviation weather observation METAR reports and are comparable with model simulations. Both the HRDPS model and microwave radiometry data indicate low level fog and cloud formation but the depths and intensities differ considerably depending on environmental conditions. Causes for this are under investigation with the high resolution 1-D boundary-layer model.