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Report on the PhD thesis of Mr. Dongxiang Wang

The thesis presented by Mr. Dongxiang Wang deals with a relevant research topic in the frame of remote sensing of the atmosphere. It is evident the outstanding relevance of the studies of the atmospheric boundary layer, ABL. The detailed study of this atmospheric layer is relevant in different fields including the air quality or studies. Active remote sensing by lidar and ceilometer is used for determining the ABL height and the advanced capacities of multispectral Raman lidar are used for a characterization of the ABL.

The thesis pursued three objectives:

1) To derive and analyse the atmospheric boundary layer height (ABLH) over the Remote Sensing Laboratory (RS-Lab) in Warsaw (52.21°N, 20.98°E, 54 m a.s.l.), Poland.
2) To investigate optical properties of aerosol within ABL using the PollyXT Raman lidar data in Warsaw, during the summer.
3) To assess properties and vertical extent of tropospheric aerosol and clouds using the synergy of active and passive remote sensing instruments during an experimental campaign in the PolWET peatland site in Rzecin (52.75°N, 16.30°E, 54 m a.s.l.).

That has been developed in three research papers, published in outstanding research journals and that constitute the core of this thesis. The thesis is structured in six chapters. After the chapters devoted to the introduction, the instrumentation and the methodology. The last three chapters present the original version of the aforementioned papers, published by Mr. Dongxiang Wang. The three papers have been leaded by Mr. Dongxiang Wang.

Key findings of the thesis include:

1) The systematic study of the diurnal cycle of ABLH over the Remote Sensing Laboratory (RS-Lab) in Warsaw (52.21°N, 20.98°E, 54 m a.s.l.), Poland.
2) Implementation of the wavelet covariance transform method (WCT) for the lidar and ceilometer, including a scaling threshold-based algorithm for homogenizing ceilometer and lidar datasets in order to improve the results' coherence.
3) The study of optical properties of aerosol, including the particle extinction (α), and backscatter coefficients (β), the linear particle depolarization ratios (δ) at 355 nm and 532 nm, the aerosol optical depth (AOD), the lidar ratio (LR), and the Ångström exponent (ÅE) within ABL using the PollyXT Raman lidar data in Warsaw during summer, based on data recorder during three years.
4) The study of correlations between different pairs of the aforementioned aerosol optical properties and the ABLH by one hand and the particulate matter (PM2.5 and PM10) and the relative humidity (RH) recorded at the ground surface.
5) Development of a new classification scheme for aerosol-cloud typing, the synergetic combination of the ESA's Mobile Raman Polarization and Water Vapor Lidar (EMORAL), the LATMOS Bistatic Doppler Cloud Radar System for Atmospheric Studies (BASTA), and the INOE Scanning Microwave Radiometer (HATPRO-G2), based on measurements

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conducted over the PolWET peatland site in Rzecin (52.75°N, 16.30°E, 54 m a.s.l.), Poland.

The scientific approaches that were employed are all robust and thorough. This thesis is the result of a remarkable amount of research efforts. There is a deep analyses of data set registered at two locations. Including one extended data set registered during several years at the Remote Sensing Laboratory (RS-Lab) in Warsaw (52.21°N, 20.98°E, 54 m a.s.l.) and an intensive field campaign developed at the PolWET peatland site in Rzecin (52.75°N, 16.30°E, 54 m a.s.l.), Poland.

Mr. Dongxiang Wang has been the first authors of the three research papers included in the thesis, which signals a clear level of independence. The three papers included in the thesis have undergone extensive scientific peer review and are of good standing. These papers include methodological development together with data processing and analyse. All papers are of robust nature, with clear scientific value to improve our knowledge on the atmospheric aerosol and on the research and monitoring capabilities of the active remote sensing in pursuing this goal. The papers demonstrate scientific maturity. The three first chapters provide an appropriate framework for the study. Although in my opinion the order of chapters 2 and 3 would be altered in order to improve the coherency.

Along the thesis, Mr. Dongxiang Wang has made a thorough review and use of the existing literature to draw new scientific conclusions. This shows that he is now a skilled scientist that has has taken advantage of the opportunity to work in a leading group in active remote sensing of the atmosphere, such as that led by Dr. hab. Iwona. S. Stachlewska.

In his PhD thesis, Mr. Dongxiang Wang evidences the capabilities of active remote sensing as a powerful research and monitoring tool in atmospheric studies. I consider that the thesis presented by Mr. Dongxiang Wang is appropriate for public defence in order to aspire to the PhD degree and I recommend distinction for this doctoral dissertation.

Sincerely,

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