

Review for manuscript

J. Burdanowitz, C. Klepp, and S. Bakan

An automatic precipitation phase distinction algorithm for optical disdrometer data over the global ocean

General comments:

This manuscript presents a novel method for estimating automatically the precipitation phase from the disdrometer and auxiliary meteorological data in time scale of minutes over the ocean. The method is extension to earlier developed statistical model using now more variables in the regression analysis, and showing an improvement in accuracy reaching to 91% for two phases and to 81.2% including also mixed phase. The method is applied to an interesting and valuable data set of over four years of data from the Atlantic Ocean. And as stated in the manuscript, validation data sets for the satellite retrievals over ocean are rare and therefore this research is significant for ground validation e.g. with NASA GPM mission. The proposed algorithm can be applied to similar instruments and utilized as verification of climate models.

The scientific quality of the manuscript is good, the method is well explained, and the testing utilizing the four scores, accuracy, bias, misclassified and uncertain cases, are profoundly described and clarified with tables and figures. The results are compared to earlier studies in objective and quantitative manner, and explanations to found discrepancies are discussed. There are some shortages in the description of error sources of the measurement, which in my opinion should be addressed, and some statements or descriptions which require more clarification. The details are shown below.

The language is good, as far as, I as non-native can control it. The manuscript is mostly well-structured and easy to follow.

My recommendation is to publish the manuscript, when the minor corrections are considered.

Detailed questions and suggestion for correction:

Reference on the page 13647 line 10 (Anagnostou et al. 1999). Is this proper reference here to present the different coastal and oceanic PSDs? The study is based on gauge and radar comparison, where in the study it is shown the different PSD shapes of different climatological conditions? The reference (Bumke and Seltmann, 2012) in the manuscript therefore reports no notable differences in DSDs in between continental and maritime areas.

Page 13647, line 22: extra-tropics, without dash.

Page 13648, line 14: "...perfectly agreed with observer's log during the Lofoten Cyclones campaign in measuring snowfall events. " This is strongly said, although the same is stated also in the reference. I would add the word "in detection of snowfall events", while measuring refers also to the quantitative analysis e.g. precipitation accumulation, and comparison in the reference in this respect is not satisfying. I would leave the word "perfectly" out.

Page 13652 line 19- Page 13653 line 10: This section is taken straight from the earlier studies of some of the authors in the manuscript, and hence it is understandable that the results are adopted. And although the manuscript is not providing precipitation rate calculated with the equations (5) and (6), but only describing it as a possible predictor variable, I would like to see some discussion of the induced errors with the adopted assumptions. The selection of lump graupel m-D relation in Lempio et al. 2007 led to strong overestimation of precipitation rate in the comparison to Geonor/manual measurements in some of the study cases and this was stated in the Lempio et al. 2007 that the theoretical assumptions are not possibly valid for all winterly precipitation. In Klepp et al. 2010 I think this has been overlooked by stating that the lump graupel is the most frequently occurring precipitation type over the cold-season Norwegian Sea. The data set given in the reference is in my opinion statistically too small for such a statement, and therefore the m-D relation cannot be applied generally as the manuscript implies. Battaglia et al. 2010 considers the error sources of Parsivel instrument in measuring the snow and many of the problems are applicable to ODM470 as well.

Page 13653, section 2.2. How the time periods of manual observations (every 3 h) are considered in the comparison to the automatic observations (1 minute resolution). Please clarify.

Page 13656, line 23: Does the maximum particle diameter mean maximum of the observed particle diameters of 1 minute? Please clarify.

Page 13658, line 11 and line 22: Clarification of the terms rain disagreement and snow disagreement, is it defined in respect to manual observations or model. This would improve also the bias score definition.