EMS Annual Meeting Abstracts
Vol. 13, EMS2016-350, 2016
16th EMS / 11th ECAC


# Cloud cover estimation using all-sky images: state of the art algorithms, its results and applicability

Mikhail Krinitskiy

P.P.Shirshov Institute of Oceanology of the RAS, Sea Atmosphere Interaction And Climate Laboratory, Moscow, Russian Federation (krinitsky@sail.msk.ru)

Short- and long-wave radiation is an important component of surface heat budget over sea and land. For estimating them accurate observations of the cloud cover are needed. While massively observed visually, for building accurate parameterizations cloud cover needs also to be quantified using precise instrumental measurements. While there already exist several state of the art land-based cloud-cameras that satisfy researchers needs, their major disadvantages are associated with inaccuracy of sky-images processing algorithms which typically result in the uncertainties of 2-4 octa of cloud cover estimates with the resulting true-scoring cloud cover accuracy of about 7%. We developed new generation optical package for cloud cover estimating, which provides much more accurate estimates and also allows for measuring additional characteristics.

New algorithm, that has been developed for the package, is based on the synthetic controlling index, namely the "grayness rate index". This index demonstrates higher sensitivity to thin clouds, compared to other massively used indexes. It also allowed for the development of a technique for the detection and suppression of the effect namely the "background sunburn effect". This makes it possible to increase the reliability of the detection of the optically thin clouds and to significantly increase the accuracy of cloud cover estimation. New algorithm is focused on the accurate determination of the clouds in various sky image states. To solve this problem we use machine learning techniques along with some other signal processing approaches. Errors for the cloud cover estimates significantly decreased down resulting the mean squared error of about 1.5 octa. Resulting true-scoring accuracy is more than 38%.

The other new approach of cloud cover estimation using all-sky imager is machine learning algorithms applied to the problem directly. The accuracy of this approach varies depending on algorithm choice. We will demonstrate results of our research on this theme. The best accuracy we have reached is more than 96%. We will demonstrate some approaches and the most influential statistical features of all-sky images that lets the algorithm reach that high accuracy.

With the use of our new optical package a set of over 120‘000 samples has been collected in several sea missions in 2014-2016 along with concurrent standard human observed and instrumentally recorded meteorological parameters. We will demonstrate the results of the field measurements and will discuss some still remaining problems and the potential of the further developments of the package.