Retrieving Cloud Information with Neural Network Ensembles

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The global distribution and the physical properties of clouds in the Earth's atmosphere are of great importance for a number of disciplines including weather forecasting, climate change, hydrology and atmospheric chemistry/physics. An increasing number of satellite based sensors measure the backscattered solar light, which in one way or other depends on the clouds properties. The accurate and fast retrieval of clouds information solving this inverse problem is an area of active research. This paper presents a novel approach for retrieving macrophysical cloud information out of the oxygen A-Band using neural network ensembles. The absorption depth in the oxygen A-band in and around 760 nm, depends on the cloud coverage, the cloud-top height and the optical depth of the cloud. Radiative transfer models are used to simulate the oxygen A-band absorption and neural networks are trained to retrieve cloud information using these simulations. The neural networks basically compute the inverse of the radiative transfer model, but this inversion is an ill-posed problem. Therefore an ensemble of distinct inverse solvers (neural networks) is combined to produce a more robust and less sensitive retrieval algorithm. The resulting system is extremely fast, and the retrieved cloud information compares well with that of traditional algorithms and with cloud information obtained from other sensors.