ELS-XV-2015 Abstracts
ELS-XV-2015-28
Electromagnetic & Light Scattering XV 2015, Leipzig

Extrapolation of scattering matrix data from small to large size parameters

O. Kemppinen (1,2), T. Mäkinen (1), and T. Nousiainen (1)

(1) Finnish Meteorological Institute, Helsinki, Finland (osku.kemppinen@fmi.fi), (2) Aalto University, Helsinki, Finland

Current computational methods such as the discrete-dipole approximation (DDA) allow solving for the single-scattering properties for almost arbitrary particles, if the particles in question do not considerably exceed the wavelength in size. In contrast, for larger particles often drastic simplifications are necessary, and the single-scattering properties thus obtained may be considerably in error.

As an alternative to the use of simplified model shapes, we propose a method based on extrapolation. Our method uses scattering data from smaller sizes as input, identifies size- and angle-dependent features, and extrapolates the scattering matrix data to (theoretically) arbitrarily large sizes. The method consists of two parts: training and extrapolation. Training is the more time-intensive of the two and, for large datasets, can take several hours. After initial training, each size can be extrapolated very fast. For example, for size parameters around 20 the method is several orders of magnitude faster than DDA, even accounting for the training period.

For methods such as this the proper validation is extremely important. This is far from trivial, however, because the reference data is hard to come by for complex particles for which this method is intended for, and most likely to perform well with. Here, we have chosen to perform the primary validation not with DDA results, but with spheroid ensembles, which are able to closely mimic complex particle scattering while being remarkably faster than DDA computations for real complex particles.