Supplementary Information (SI): Information content and aerosol property retrieval potential for different types of in-situ polar nephelometer data

Supplementary Section S1: Pseudocode for the reductive greedy algorithm

The reductive greedy algorithm was applied to the angular sensor placement optimization problem using the following pseudocode:

Pseudocode for reductive greedy algorithm

Input: $\mathbf{K}$, $\mathbf{S_\varepsilon}$ simulated of an aerosol test case in all possible angular points p, $\mathbf{S_a}$, and target angular measurement number (h)

Assign a list of angle to available angular points ($\boldsymbol{\theta} = \mathbf{p}$)

While $N_{\boldsymbol{\theta}} > h$:
    For θ_i in $\boldsymbol{\theta}$:
        Calculate *DOFS* reduction if measurement at θ_i unavailable
        Store *DOFS* reduction in vector for intermediate results
    End of for loop
    Search angle θ_j with smallest corresponding *DOFS* reduction in the intermediate results vector
    Remove θ_j from $\boldsymbol{\theta}$
End of while loop

Output: Optimal angular configuration $\boldsymbol{\theta}$ with $N_{\boldsymbol{\theta}} = h$

Supplementary figures:

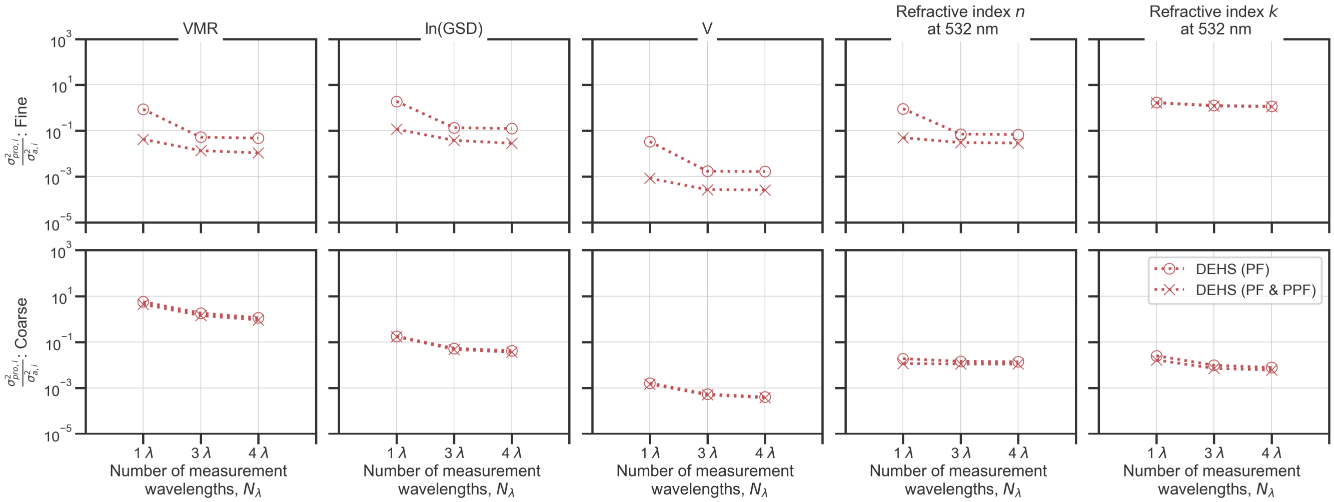

Figure S1. $\boldsymbol{\sigma^2_{pro}/\sigma^2_a}$ **values for aerosol parameters corresponding to the test case of spherical, non-absorbing aerosols (DEHS aerosols) with a priori variance values based on results from Espinosa et al. (2019).**

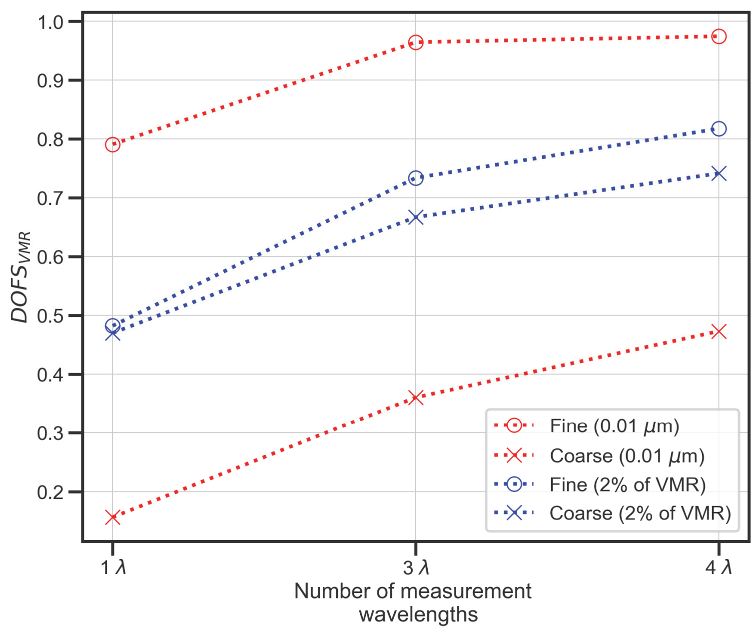

Figure S2. ***DOFS$_{VMR}$*** **values the test case of spherical, non-absorbing aerosols (DEHS aerosols) with two different a priori variance settings of atmospheric-based (red lines) and relative-based (blue lines).**

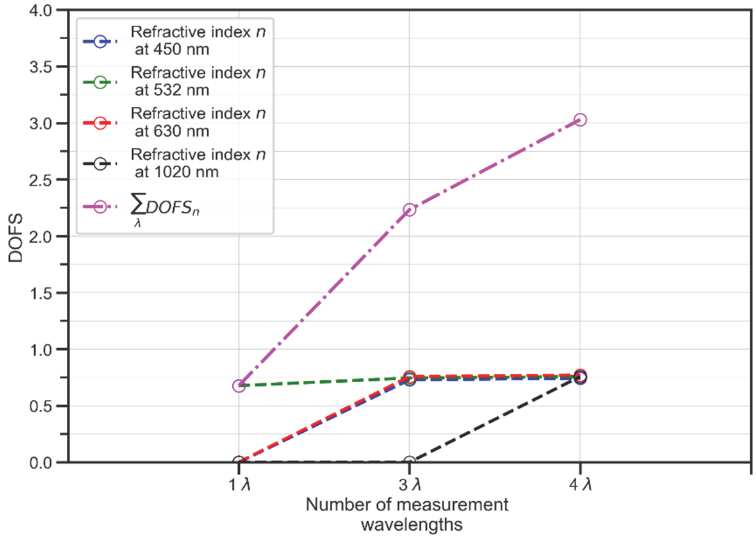

Figure S3. DOFS values for real part of refractive indices (n) at wavelengths considered in this study. The results are for a fine non-absorbing aerosols (DEHS aerosols) test case with adjusted a priori values. The magenta line represents the sum of DOFS_n over all wavelength according to the abscissa label, all other colors represent DOFS_n of a single wavelength according to the legend.

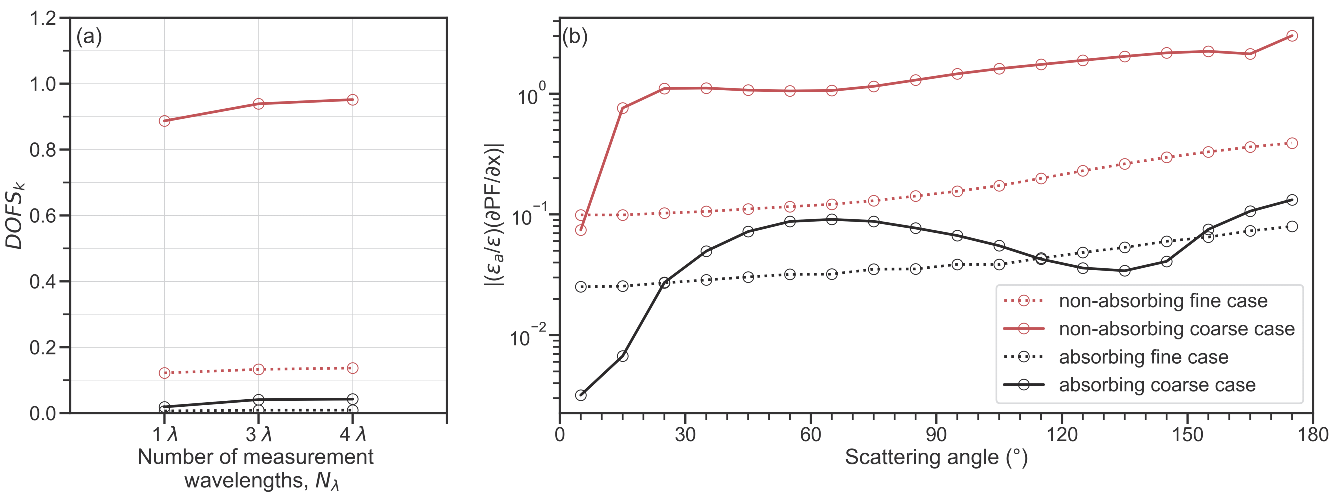

Figure S4. (a) DOFS variation for k at 532 nm over different spectral configurations with PF measurements only (b) Absolute measurement error normalized partial derivative of PF (or PPF) in respect to *k* for BrC and DEHS. The top plot is for fine particle test case (median radius of 0.2 µm) and the bottom plot is for coarse particle test case (median radius of 1.25 µm)

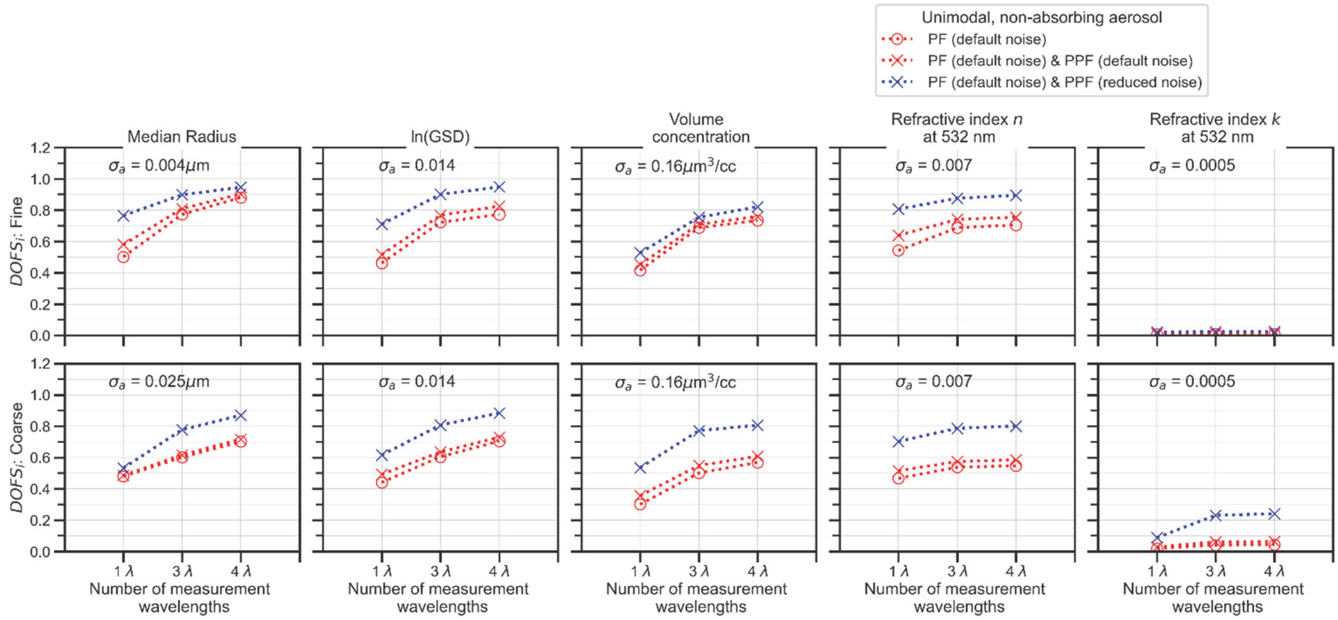

Figure S5. ***DOFSi*** **values for aerosol parameters corresponding to the test case of spherical, absorbing aerosols. The a priori values used as inputs have been adjusted to ensure that the range of DOFS values lie between 0 and 1. The blue line are the DOFS values with reduced PPF measurement noise level of 0.01 while the default noise is 0.056.**