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The importance of observational correlation for aerosol retrievals over the ocean

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The next generation of aerosol remote sensing instruments utilize multispectral, polarized observations at many viewing angles to retrieve aerosol, cloud and surface properties. Optimal estimation methods are often used, where a radiative transfer model is iteratively modified until it matches observations. One advantage of this approach is that retrieved parameter uncertainties can also be determined as a byproduct of the optimal estimation, provided that the observational error is known. For the sake of simplicity, most retrieval methods assume that the set of remote sensing observations are independent, which means the observation error covariance matrix used during retrieval is diagonal. This may not, however, be sufficient for instruments such as the Aerosol Polarimetry Sensor (APS) on the NASA Glory satellite, which makes upwards of 250 views at different angles for each scene. This high angular resolution implies that observations at similar viewing angles are indeed correlated, especially for spatially homogeneous scenes such as in cloudless regions over the ocean. We present an investigation of the significance of specifying measurement correlation during optimization. Radiative transfer simulations of retrieval error for aerosols over the ocean will be used to test various methods for creating error covariance matrices with off-diagonal elements, and determine the sensitivity of retrieved parameters to these changes.