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Fast methods for simulating visible satellite images

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Visible satellite images provide high-resolution information on clouds. However, so far they have not been assimilated directly for operational purposes, as multiple scattering dominates in the visible spectral range and makes radiative transfer computations with standard methods complex and slow. Only recently, sufficiently fast and accurate forward operators have become available. Here we report on the design of a lookup-table based forward operator and developments aimed at increasing its accuracy. Approximations for three-dimensional radiative transfer effects and corrections for mixed-phase clouds are addressed. Moreover, the potential of alternative approaches based on machine learning is discussed. These approaches could be competitive in terms of speed and accuracy and allow for including additional radiative transfer effects and aerosols.

Primary author: Dr SCHECK, Leonhard (Hans-Ertel Centre for Weather Research, LMU Munich)

Presenter: Dr SCHECK, Leonhard (Hans-Ertel Centre for Weather Research, LMU Munich)

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