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Aerosol impacts for convective parameterizations: Applications of the Grell-Freitas Convective Parameterization

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The Grell-Freitas (GF) cumulus parameterization is an aerosol-aware, scale-aware convective parameterization that has been used globally and regionally. This presentation will focus on one of the several developmental activities ongoing in GF: the continued development of its aerosol-aware capabilities and the impact on global forecast models. While it is well established that aerosols impact weather and climate, relatively little work has been done to represent their impact in medium-range forecasts and in convective parameterizations.

GF includes three aerosol related cloud processes: aerosol-influenced auto-conversion of cloud water to rain water, aerosol dependent precipitation efficiency, and aerosol wet scavenging based on memory and precipitation efficiency. Additionally, if aerosols are based on analysis or climatologies, they are allowed to slowly return to their original concentrations during precipitation-free periods.

In its most simplistic approach, aerosol pollution in GF is characterized using aerosol-optical depth (AOD). The method of our application is extremely efficient and can be adapted to use different aerosol or AOD products. For example, other products that could be used include the aerosol climatology used by the Thompson Aerosol-Aware Microphysical Parameterization or predicted aerosols using NOAA's aerosol prediction model, which is currently one ensemble in the Global Ensemble Forecast System – Aerosols (GEFS-Aerosols). The treatment of aerosols in GF should be most sensitive in regions with either very high or very low levels of pollution.

The impact of these changes to GF will be shown in a version of NOAA's experimental global prediction model, with