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Seamless Meteorology-Composition Models: Challenges, Gaps, Needs and Future Directions

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Seamless meteorology - composition - chemistry models (SMCM) have several advantages: They allow the consideration of two - way interactions (i.e. feedbacks), ensure synergies in research, development, maintenance and application. “Seamless” is introduced here in relation to two aspects. Firstly, at the process - scale where it refers to the coupling within a model of meteorology and composition processes to represent for example the two - way interactions between composition and radiative processes or microphysics, or the consistent treatment of water vapor. Secondly, in terms time and space where it refers to the absence of discontinuities in model behavior when used at multiple temporal or spatial resolutions to have for example consistent treatment of black carbon for air quality and climate applications. SMCMs describe the relevant processes to investigate long - standing scientific questions on the interactions between atmospheric constituents and atmospheric processes and support the creation of new environmental prediction services. This paper presents a review of the current research status of SMCMs and recommendations to address limitations in weather, climate and atmospheric composition fields whose interests, applications and challenges are now overlapping. The contribution highlights the challenges towards seamlessness and presents priority areas for research to further this path. It will present examples where SMCMs are already in or close to operational use.