The new generation of integrated atmospheric dynamics and composition models is based on the seamless Earth System Modelling (ESM) approach to evolve from separate model components to seamless meteorology-composition-environment models to address challenges in weather, climate, and atmospheric composition fields whose interests, applications, and challenges are now overlapping. This approach considers several dimensions of the seamless coupling, discussed and demonstrated in the presentation:

- **Time scales**: from seconds and nowcasting to decadal time-scale;
- **Spatial scales**: from street-level to global scale (up & down-scaling);
- **Processes**: physical, chemical, biological, social;
- **Earth system components**: atmosphere, hydrosphere, lithosphere, biosphere;
- **Different types of observations and modelling tools**: observations-model fusion, data processing and assimilation, validation and verification;
- **Links with health and social consequences, impact assessment, services and end-users.**

A modern seamless unified modelling system that allows a single platform to operate over the full scale will represent a substantial advancement in both the science and the computational efficiency.

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