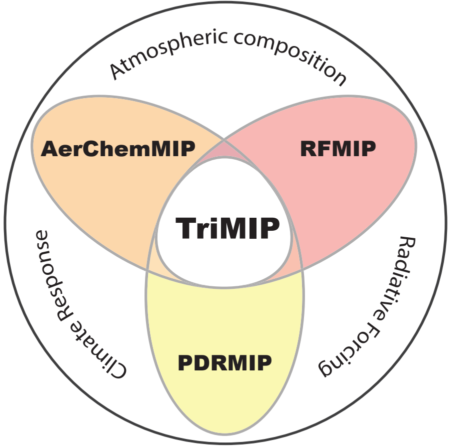
The main goal of **AerChemMIP** is to quantify the climate and air quality responses to aerosols and chemically reactive gases (Collins et al., 2017).

The AerChemMIP request for pairs of atmosphere-only and fully coupled ESM experiments for different forcing agents allows for a better understanding of the drivers of a detected climate response. The AerChemMIP experiments were novel in that they follow the "all-but-one" design, whereby the forcing of interest is held fixed. Such an experimental design seeks to minimize the contribution of non-linear climate responses that may occur under the more traditional experimental design where the emissions or concentrations of the species of interest are perturbed (Deng et al., 2020). Similarly to RFMIP and PDRMIP, AerChemMIP used fixed SST time-slice experiments to assess ERFs for individual emissions of short-lived climate forcers and feedbacks from natural emissions (Thornhill et al., 2021a 2021b).



RFMIP seeks to characterize and assess ERF in CMIP6 models and determine errors when approximating accurate line-by-line radiative transfer with fast parameterizations used in climate models (Pincus et al., 2016).

The RFMIP-ERF activity used fixed-SST simulations to quantify ERF, being inspired by similar experiments in PDRMIP. RFMIP uses a time-slice approach for some forcings (similar to AerChemMIP) and selected experiments to determine time-dependent forcing. Annually repeating boundary conditions in the time-slice experiments substantially reduces the influences of model-internal variability on ERF estimates (Forster et al., 2016, Fiedler et al., 2017). Results from RFMIP highlighted the model diversity in present-day ERFs for anthropogenic perturbations (Smith et al., 2020b, 2021, Fiedler et al., 2019), and the evaluation of IRF from ESMs against benchmark calculations from line-by-line models (Pincus et al., 2020, Freidenreich et al., 2021).

The objective of **PDRMIP** is to understand global and regional responses of precipitation statistics to different forcing agents, and irradiance (Myhre et al., 2017). Based on eleven participating aerosol-climate models, energy budgets and the hydrological cycles were inter-compared for fast (days to months) and slow (years to decades) response times (e.g., Samset et al., 2016, Sillmann et al., 2019).

PDRMIP highlighted rapid adjustments as a key in understanding precipitation responses (e.g., Hodnebrog et al., 2020, Myhre et al., 2018, Smith et al., 2018), model spreads in radiative forcing and efficacy for the forcing agents (Forster et al., 2016, Richardson et al., 2019), and responses to greenhouse gases and aerosols (e.g., Stjern et al., 2019, 2020, Tang et al., 2018, Xie et al., 2020).