This manuscript seeks to comprehend the changes in regional apparent temperature and PM2.5 concentrations under the conditions of global warming and sulfate aerosol injection. This understanding is achieved through the utilization of data from multiple Earth System Model simulations, two downscaling methods, and two statistic linear regression functions. The topic is both significant and innovative. Nevertheless, several substantial concerns persist:

The methodology employed to calculate PM2.5 concentration only considers factors such as temperature, humidity, wind speed, and anthropogenic emissions. However, two critical elements have been overlooked: precipitation, and natural aerosol emission. Precipitation has a crucial role in 'cleansing' air pollutants, including PM2.5, and future alterations in precipitation patterns could considerably influence regional PM2.5 concentrations. Furthermore, natural aerosol emissions, such as dust and sea salt, constitute more than half of the average global PM2.5. In regions like Beijing, "dust storms" are a significant air pollution phenomenon in the spring, contributing substantially to PM2.5 levels. The absence of these two factors from the calculation or discussion makes the projected future changes in PM2.5 unreliable.

Both apparent temperature and PM2.5 calculations use a simple linear regression. However, there exists a high correlation between the climate variables used, such as temperature and water vapor pressure/humidity. The uncertainties arising from this calculation method need to be addressed.

In the discussion section, the authors declare, "If we consider the aerosol deposition under G4 scenarios, PM2.5 concentration will be 0-1 μg/m3 higher than that without due to deposition of the SAI aerosols (Fig. S21)." This is incorrect. The injected sulfate aerosol would primarily deposit in the coarse mode and would not augment SO4 in PM2.5 compared to the reference case during the same period.

Lastly, the abstract lacks clarity in terms of the study's conclusions. How does PM2.5 change under future climate conditions and sulfate aerosol injection? What is the influence of the two downscaling methods on studying the health impact of SAI?

It is better to use climate intervention instead of geoengineering.