Over the last two decades visible and high energy emissions have been observed above thunderstorms, including the so called transient luminous events occurring in a variety of forms between thunderstorm tops and the lower ionosphere. These phenomena may locally impact the Earth’s atmosphere through ion-neutral chemistry reactions leading to additional chemical sources which are as yet not included in the present picture of atmospheric chemistry and climate. Particular emphasis has been given to sprites, with models and observations suggesting a capability of perturbing atmospheric nitrogen oxides at a local level, as it is known to occur for tropospheric lightning and laboratory air discharges. However, to date model estimates of sprite-produced nitrogen oxides vary of orders of magnitude and a definite detection is missing. Can then sprite chemistry be of any relevance to the global atmosphere with transport affecting our ability of observing such perturbations? We study the climate-chemistry sensitivity to sprite-like perturbations with the Whole Atmosphere Community Climate Model (WACCM). Due to the large uncertainties affecting the available knowledge of sprite chemistry and of their atmospheric impact, a realistic simulation of the global impact of sprites on a climate chemistry model is to date unfeasible. We therefore take a top-down approach to estimate what magnitude sprite perturbations should have to become significant as compared to other relevant atmospheric processes and study the sensitivity of the model response within the given uncertainties. Preliminary results from this modeling effort are presented within the current framework of constraints available from observations.