We would like to thank the reviewer for his comments. We propose here a response to his concerns on the implemented radiative module.

1. My first comment goes on the new implemented radiative module. It is said to mimic the direct radiative effect of sulphate aerosols. However, since the Khodri paper is not listed in the references I have no way of checking the validitiy of this module. I assume both the shortwave and longwave radiation of the aerosols are simulated. Correct? I also assume the volcanic aerosols are only implemented in the stratosphere? How many layers are there in the atmosphere model?

Optical properties are indeed implemented in the stratosphere and only the aerosol direct effects are treated as in most modeling studies using AOD to mimics the radiative impact of volcanic eruptions. Quantifying the role of direct and indirect effect is still a challenging issue but as shown bellow modeling direct effects only, gives quiet satisfying results. A detailed account of the climate response to volcanic eruptions in the IPSL model is presented in another paper currently in preparation. We propose to add in the revised manuscript more details concerning the parameterization used (see below). We report here additionally on the key validation results to address the reviewer's concerns for the shortwave and longwave radiations and winter warming.

Details concerning the parameterization used are the following: Vertically the atmosphere in our model is divided in 19 hybrid sigma pressure levels with 4 layers above the tropopause. Due to the rather coarse vertical resolution, the optical properties of stratospheric sulfate aerosols in the visible band are evenly spread over the first two layers of the stratosphere. The optical properties were computed assuming a fixed sulfate aerosol droplet size distribution with a standard deviation of 1.8µm and an effective radius of 0.5 µm corresponding to the average size of the Mt Pinatubo aerosols. As in Gao et al, all volcanic aerosols originate in the tropics where they last for few months then spread poleward before decaying 3 years after the eruption started. The responses of TOA reflected solar flux in August 1991 are shown on Figure 1A as zonal averages between 40°N and 40°S in order to be comparable to ERBE observations (Minnis et al, 1993). The model displays an overall agreement with the observations, shortwave anomalies associated with the volcanic eruption reaching 10 Wm-2 between 10°S and 10°N in both model and observations. All these points will be added in the revised version of the manuscript.

As for the simulated transient response, we choose to focus on the Mount Pinatubo eruption in June 1991 to check the validity of our model since it is one of the best documented. We base our analyses on an ensemble of 5 simulations each starting in January 1991 from different years chosen randomly in the control run. Figure 1B shows a good consistency with satellites observations (not shown) even though the peak anomaly is overestimated by about 1.5 Wm-2. The averaged shortwave anomalies between 60°S and 60°N yield an mean value of about 5 Wm-2 between the end 1991 until late 1992, mostly as a result of solar radiation reflection, before returning to normal by late 1994. This result is broadly similar to other modeling studies using monthly mean optical thickness (Bender et al, 2010; Soden et al, 2002). Even though the impact over longer radiation is much smaller and barely detectable above the interannual variability as in observations, a small reduction of upwelling infrared radiation occurs mostly within the tropics from August to September 1991 while in October the LW changes are not significant. The situation reverses significantly and gradually during 1992 as the tropical AOD disperse toward higher latitudes. ERBS satellites also observed similar transient changes in LW radiations. Minnis et al 1993 incriminated the role of both direct and indirect increases in the albedo over both cloudy and cloud free areas to explain the small but significant longwave trapping in August-September 1991. Since we do not include the indirect aerosol effects in our model, such feature is mostly due to increased clear-sky albedo associated with increased atmospheric optical depth. These results will be presented in more details in a forthcoming paper (Khodri et al. in prep.)

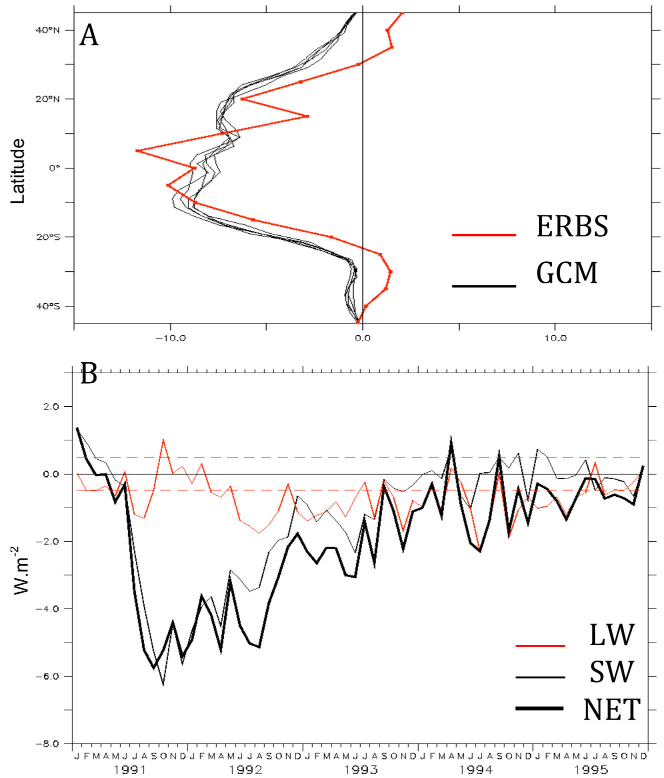


**Figure 1.** Anomalies in absorbed shortwave (SW) and emitted longwave (LW) radiative fluxes at the top of the atmosphere (TOA) following the Mt Pinatubo eruption in June 1991. **(A)** Comparison of August 1991 TOA SW observed anomalies (W.m-2) from Earth Radiation Budget Satellite (ERBS) observations and 5 members simulation ensemble with the IPSLCM4_v2 model. The simulated anomalies are computed as the differences between the Mt Pinatubo simulations and the control run. ERBS TOA SW radiative fluxes anomalies are expressed relatively to a 1985 to 1989 base climatology. **(B)** Simulated monthly and global mean times series of TOA SW, LW and Net flux averaged across the 5 member ensembles and between 60°N and 60°S. The red dotted line indicates the level of one standard deviation for the LW radiations in the control run.