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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Aerosol optical properties determined from sky-radiometer over Loess Plateau of Northwest China" *by* Y. Liu et al.

**Anonymous Referee #2**

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General comment Using the aerosol optical thickness retrieved from POM-01 sky radiometer and the broadband diffuse irradiance measured by CM21, the authors estimate the radiative effect of dust. The observation site, SACOL, is located near the source region of dust. Therefore, this is the effect for dust which is not polluted by anthropogenic materials. The topics of this manuscript are interesting. However, there are some issues to be solved and this manuscript needs substantial revision before it is accepted for publication.

Major comments (1) When the authors analyzed POM-01 sky radiometer data, it was assumed that surface pressure was 1 atm. The observation site is located at the altitude 1965.8 m (about 2000 m); surface pressure is about 800 hPa. Therefore, the scattering by air molecule (Rayleigh scattering) is overestimated. If it was assumed



that surface pressure is 1 atm in this manuscript, all calculation should be made again. The reviewer cannot make an accurate judgment.

(2) The authors compared between aerosol optical thickness (AOD) observed by CIMEL sunphotometer and POM-01 sky-radiometer. Why SSA is not compared? Che et al. (2008) have already made a comparison and showed that there was tendency that SSA derived from sky-radiometer was larger than that derived from CIMEL sunphotometer.

(3) The authors described that the relative difference in the AOD between POM-01 and CIMEL was about 4%. I think that 4% is not small (see comment (5)).

(4) There is no description about SBDART. More explanation is necessary. If it is assumed that the surface pressure is 1 atm, the authors should make all calculation for broadband irradiance, again.

(5) According to the authors, relative difference of broadband direct irradiances between observation and calculation was 1.8%. If AOD by CIMEL sunphotometer is accurate, AOD by POM-01 sky-radiometer is small by 4%. The error of direct irradiance is estimated following equation, F0*exp(-m*(tau+delta_tau)/(F0*exp(-m*(tau))=exp(-m*tau*(delta_tau/tau)), where F0 is the solar irradiance at the top of atmosphere, m is path length, tau is AOD, and delta_tau is difference. Substituting typical values at the wavelength 500nm,; tau=0.4, m=1.5, and delta_tau/tau=0.04, we can get the following value, exp(-m*tau*(delta_tau/tau))=exp(-1.5*0.4*0.04)=exp(-0.024)=0.024 2.4% error is nearly same magnitude as direct irradiance error. There is possibility that the error of direct irradiance is caused by error of AOD.

(6) According to the authors, when optical properties derived from POM-01 sky-radiometer were used, the calculated diffused irradiance was larger than the measured one. If it is assumed that the surface pressure was 1 atm, there is a possibility that the calculated irradiances become large due to the overestimate of air molecule scattering (Rayleigh scattering). If the scattered radiances (sky radiances) are reconstructed

within the designated limit in the analysis of POM-01 sky-radiometer data, I think that 12.16% is too large. Anyway, if 1 atm is used as surface pressure, all calculation should be made again. The accurate review cannot be done.

(7) On the assumption that CM21 measured scattered irradiance accurately, the authors adjusted SSA and ASY. There are uncertainties for measurement by CM21 such as thermal offset, cosine response error and so on. The authors should pay more attention to the measurement error by CM21.

(8) SSA and ASY are simultaneously adjusted. There is no description about this method. More explanation is necessary.

Minor comments (1) In Section 4.2 Fabs(t) ->Fobs(t) (2) eq. (4) RF->ARF

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 23883, 2011.