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Biogeosciences Discussions

Interactive comment on "The variability of radiative balance elements and air temperature on the Asian region of Russia" *by* E. V. Kharyutkina et al.

Anonymous Referee #1

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Background

The purpose of this study is to investigate the spatial and temporal variability of surface radiative and heat balances over the Asian Territory of Russia (ATR) (45–80 N, 60–180 E) during the period of 1979–2008 using JRA-25, NCEP/DOE AMIP reanalysis and observational data. It is shown that since the beginning of the 90s of XX century there is an increase of reflected earth-atmosphere short-wave radiation. This is consistent with cloud cover and downward shortwave radiation at the surface. Annual averaged radiative balance values at the top of the atmosphere are negative which is consistent with negative annual averaged air temperature.

General Comments

1. The confidence in the results presented depends on the quality of the model outputs for the region under investigation. It is well known that most models have problems at high latitudes. For instance, in the study of Sorteberg et al. (2007) for the Arctic (70-90ïĆřN) annual SW down and upward radiation from four observational estimates and IPCC AR4 models over 1980-1999 were used to show a spread of values over that region. Therefore, there is a need to first establish confidence in the data used. The authors mention results of evaluation against ground observations as described in two independent papers however, the reader does not get a clear view what exactly was done there and to what extent those studies credibly evaluate the model results used. Moreover, on page 4338 the authors claim:

"It is found that radiation unit in JRA reanalysis data, like radiation unit in reanalysis data NCEP/DOE AMIP-II, impartial characterizes the distribution of total radiation over Western Siberia, including mountain regions, although the annual averaged values of total radiation derived by reanalysis JRA should be reduced by 10–15 %." Whys should it be reduced? Based on what? If it is reduced, how will it impact the findings of this study? Usually, independent data are used to test if observed trends in one product are consistent with trends in other products.

2. Since clouds control the magnitude of radiative fluxes reflected to space and reaching the surface, an inner consistency should be expected when looking at cloud distributions and reflected and transmitted shortwave radiation. Therefore, as stated in the Conclusion section: "Regional variations of solar radiation flux obtained by reanalysis data are mainly conformed to total cloudiness and air temperature changes. In general, anomalies of shortwave and longwave radiation play a major role in the air temperature variability during the whole year." This is kind of obvious.

3. The paper is not clearly written. At places, it is not possible to understand what the authors wanted to say. For instance:

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a) p. 4333- “The downward solar irradiative fluxes of ISCCP-FD, NCEP AMIP/DOE and ERA-40 show similar spatial variability, while the downward longwave irradiative fluxes of CASPR, NCAP AMIP/DOE and ERA-40 show similar spatial variability”.

b) “However, downward shortwave radiation at the top of atmosphere, as compared with satellite data, and the net surface flux, contribute to large energy budget residuals in ERA-40.”

c) “Estimation of sensible heat flux variability from the types of relief was executed by Foken (2008).”

d) p. 4334- “It is used opto-acoustic method in the long and short ranges.”

e) Even the title: “The variability of radiative balance elements and air temperature on the Asian region of Russia” has a problem. Perhaps the authors meant:” The variability of radiative balance elements and air temperature over the Asian region of Russia”.

4. In the discussion, there is no transparency. It is not clear when the authors switch from one set of results to the other. The Introduction is also confusing, merging several topics that do not seem to be relevant to this study. For instance, there is the following statement: “Calculation accuracy for the territory of Romania was 20 %.” Why is it important here? On page 4341 it is stated: “For surface air sensible and latent heat fluxes can be calculated as (Budyko, 1958):” If the analyzed heat fluxes come from the two referenced models, why does the reader need to know how Budyko did the computations?

In summary, the paper in its present formulation is not ready to be accepted for publication.

Reference cited:

Sorteberg, A., W. Kattsov, J. E. Walsh, and T. Pavlova (2007), The Arctic Surface Energy Budget as Simulated with the IPCC AR4 AOGCMs, Climate Dynamics, 29, 131-156, doi: 10.1007/s00382-006-022209.

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