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Interactive Comment

Interactive comment on "Role of radiatively forced temperature changes in enhanced semi-arid warming over East Asia" *by* X. Guan et al.

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We appreciated the insightful suggestions and comments provided by reviewers. The responses to the reviewer's comments and suggestions have been stated as below.

Review of ' Role of radiatively forced temperature changes in enhanced semi-arid warming over East Asia

Reviewer #2:

This is an interesting study. The authors investigated the surface temperature change over East Asia using a new technique that can identify and separate the dynamically induced temperature (DIT) and radiatively forced temperature (RFT) changes. They show evidences that the DIT and RFT make 43.7 and 56.3% contributions to the SAT over East Asia, respectively. The DIT changes connected to the North Atlantic Oscillation (NAO), Pacific Decadal Oscillation (PDO), and Atlantic Multi-decadal Oscillation (AMO) are investigated. The radiatively forced SAT changes are responsible for the regional scale enhanced semi-arid warming (ESAW). Such enhanced warming is also found in radiatively forced daily maximum and minimum SAT. The results are helpful to our understanding of regional climate change. The manuscript is generally well written and I recommend accepting it for publication after a moderate revision. Specific comments (based on page sequence):

1. While the manuscript has provided an excellent statistical analysis of surface temperature changes associated with internal atmospheric modes such as NAO, PDO, and AMO, the authors should acknowledge that the relationships are mainly based on statistical analysis, and the underlying dynamical and physical mechanisms deserve further studies.

Response: We totally agree and thanks your suggestion, more could be done to establish the temperature change with dynamic factors and explore the mechanism of internal atmospheric modes, we have another paper which is under reviewing by JGR now, and discussing the influence of different dynamic factors on the variability of dynamic temperature change, which concentrate on the dynamical and physical mechanisms. Three major teleconnection indices (NAO, PDO and AMO) have been listed in this paper aim to illustrate the effective of the dynamical adjustment method in dividing the raw temperature into dynamically induced temperature and radiatively forced temperature.

2. The authors said they focus on the area between 30 and 50N, but actually they talked about a larger domain from 20 to 53N.

Response: Sorry for the type mistake, it has been corrected.

3. The authors do not mention how the relative contributions (the percentage) for DIT and RFT are calculated. Please clarify this in the method description.

Response: The method of relative contributions (the percentage) for DIT and RFT has been added in the method section.

4. The authors do not provide the information of CMIP5 models used in the study. They claimed that the ensemble of CMIP5 model reflects the GHG forcing. Actually many models includes the anthropogenic aerosols, even land use. Taking this into consideration, authors should rethink their explanation for the peak of RFT. The authors should also list the models they used in the analysis by a table.

Response: A table of CMIP5 model list used in the study has been added in the manuscript as table 1. And the explanation for the peak of RFT has been reorganized, the revised one contains the discussion on the impact of GHG forcing, anthropogenic aerosols, and land use on the regional RFT.

5. The authors should provide the information of effective sample number for the significance test in Figure 11. Low- pass filtering (11-yr running mean) was used for the NAO index (may also for the AMO and PDO indices) in this study. This may substantially reduce the independent sample number. So the "significant" signal in Figure 11 may be questionable.

Response: The sample number for the significance test in Figure 11 is 110. In Fig. 11a, we applied the 11-year running mean to NAO (remove the high frequency signal), not the dynamically induced temperature time series. We did not do the Low-pass filtering to the PDO and AMO indices .We agree with reviewer's comment that the filter process will reduce the degrees of freedom. Fig. 1 as below is similar with Fig. 11 of the manuscript, but without 11-yr running mean to NAO. In order to avoid the problem of freedom change after filter, we use the Fig. 1 as below to replace Fig. 11 of manuscript.

6. How do you explain the increasing/decreasing in the DIT/RFT in the heavy-rain regions (larger than 1000 mm/yr)?

Response: From the spatial distribution of contribution of DIT and RFT, it exhibits a

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larger contribution of DIT in the south of China (Fig. 4a), which is typical wet region with the annual precipitation larger than 1000 mm/yr (Fig. 1 of manuscript). And in the same area, the contribution of RFT (Fig. 4b) illustrated a relative smaller contribution of RFT. These regions are developed area, with plenty of factories and produced a great deal of industrial aerosol, which may perform a cooling effect. Therefore, the DIT takes an increasing contribution and RFT takes a decreasing contribution in these regions.

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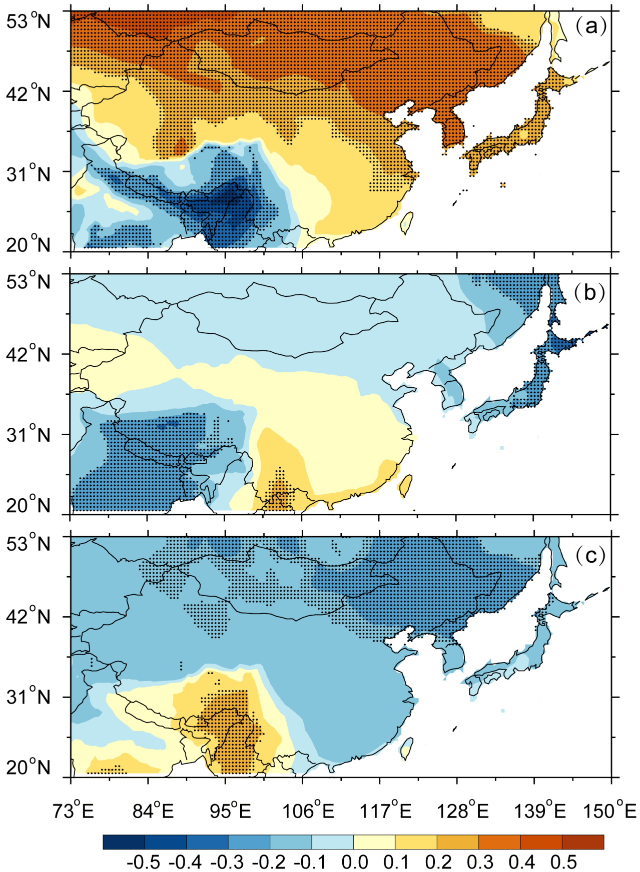

Fig. 1. Spatial distribution of the correlation coefficient between detrended dynamically induced temperature and detrended NAO (a), PDO (b), and AMO (c)

Model name	Modelling centre
BCC-CSM1.1	Beijing Climate Center, China
CanESM2	Canadian Centre for Climate, Canada
CanESM2	Canadian Centre for Climate, Canada
CCSM4	National Center for Atmospheric Research, USA
CNRM-CM5	Centre National de Recherches Meteorologiques, France
CSIRO-Mk3.6.0	Commonwealth Scientific and Industrial Research, Australia
GFDL-CM3	Geophysical Fluid Dynamics Laboratory, USA
GFDL-ESM2G	Geophysical Fluid Dynamics Laboratory, USA
GFDL-ESM2M	Geophysical Fluid Dynamics Laboratory, USA
GISS-E2-R	NASA Goddard Institute for Space Studies, USA
HadGEM2-CC	Met Office Hadley Centre, UK
HadGEM2-ES	Met Office Hadley Centre, UK
INM-CM4	Institute for Numerical Mathematics, Russia
IPSL-CM5A-LR	Institute Pierre-Simon Laplace, France
IPSL-CM5A-MR	Institute Pierre-Simon Laplace, France
MIROC-ESM	Japan Agency for Marine-Earth Science and Technology, Japan
MIROC-ESM-CHEM	Japan Agency for Marine-Earth Science and Technology, Japan
MIROC5	Atmosphere and Ocean Research Institute, Japan
MPI-ESM-LR	Max Planck Institute for Meteorology, Germany
MRI-CGCM3	Meteorological Research Institute, Japan
NorESM1-M	Norwegian Climate Centre, Norway

Fig. 2. table 1. CMIP5 models examined in this study

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