Regional climate change in Turkey estimated by RCM pseudo warming run

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1. Introduction

This study intends to provide the scenarios of likely climate change in precipitation, temperature and insolation in Turkey after the global warming. Climate change is estimated by a downscaling technique using regional climate models from the global warming data estimated by GCMs. Regional climate models also allow to estimate the effects of land-surface conditions upon the regional climate system in Turkey. Before downscaling, we have to validate the method and clarify the uncertainty of the models.

2. Validation of RCM

One-year simulation was carried out by a regional climate mode, TERC-RAMS (Yoshikane et al., 2001), assuming the boundary condition given by NCEP/NCAR reanalysis data. Model output is compared with station observation data. Detail will be presented separately by Mr. Iizumi.

3. Pseud warming

In generally, one of the largest difficulty in the downscale process using a nested regional climate model, is the bias of GCMs, especially shift of a regional scale climate system may gives serious error in the nested model (Wang et al, 2004). To avid this difficulty the boundary condition was assumed by a linear coupling of the re-analysis data (observation) and the trend component of the global warming estimated by GCMs. This assumption may valid when the trend of the global warming is small enough and allows neglecting the nonlinear interaction between the trend and the interannual variation of the climate systems. By this method, prediction will approach to the simulation using re-analysis data when the difference of the grobal warming is small and allow to esimation of the difference by smaller number of ensemble of run. Downscaling by this method gives similar results as the nested RCM directly drived by daily GCM products for monthly mean precipitation in January. Figure 3 shows precipitation difference between 1990's and 2070's estimated by the pseud warming method. Precipitation decreases in Blue areas. Figure 4 shows monthly precipitation of July: observation in 1998, simulation using NCEP/NCAR reanalysis data in 1998, pseud warming (2070's), simulated using GCM (1990's) and predicted using GCM(2070's), from left to right, respectively. The method of the psued warming seems to give more reasonable precipitation in Turkey in July during 2070's.

4. Data set of RCMPW-V2

Data set of RCM pseudo warming run ver. 2 is now going to be distributed to the all member of ICCAP. This data set includes the simulation run of RCM using NCEP/NCAR boundary conditions and pseud warming run (in 1999 + 80). The data set includes three hourly precipitation, temperature, wind velocity and downward short wave radiation (insolation) at the observation stations in the entire Turkey (537 stations).

5. Problems on "RCM pseudo warming run ver.2 (RCMPW-V2)"

1. The data set does not contain data on 31st every month, containing only 30 days in a month.
2. Trend components during 80 years were estimated every month (monthly mean) using GCM prediction, so that there is some discontinuity at the end of the month, especially in atmospheric temperature.
3. Differences in precipitation or

temperature between 1999 and the psued warming strongly depend on month, since it does not seem to be an operational error (may be caused by nonlinearlity of the weather system). It would be desire to estimate other years, too.

4. The altitude of the ground elevation of the observation station is not always agrees with that of the nearest grid point. This may give some error on temperature near complex topography. Precipitation often strongly depends on the location in these areas.
5. Diurnal range of temperature seems to be underestimated because the lowest grid points are rather high, namely 52.4m.
6. The data set does not contain ground level data of the stations and grid point data.

6. Other Comments

Surface level data are the grid point values of the RCM at the lowest level (52.4m above the ground surface) over the nearest grid point from the observation station, without statistical downscaling, namely without the "model output statistics". Data corresponding to the observation stations in Cukuroba are obtained by the 8.3km grid model, while others are by the 25km grid.