Objectives
The general objective of this study is to assess the different convective schemes on the performance of RegCM4, in particular their role on improving the accuracy of the simulated precipitation field over the Horn of Africa.

The specific objectives of the study are:
- Evaluate the RegCM4 performance in representing the climatology, seasonal and inter-annual variability of precipitation over the Horn of Africa.
- Diagnose the spacial, seasonal and inter-annual variability of the Horn of Africa precipitation based on 20 years RegCM4 simulations.
- Identify the best convective precipitation scheme used to simulate precipitation over the Horn of Africa.
- Improve the selected convective scheme for better representation of precipitation over the Horn of Africa.

Model Configuration
The Regional Climate Model used in this thesis is the ICTP’s RegCM4.
- 60 km horizontal resolution, 18 vertical σ-levels and model top at 50 hPa.
- The domain covers 96 grid points in the y-direction and 224 grid points in the x-direction.
- SST is derived from the OI-Weakly.
- Surface parameters (topography, land use, vegetation, soil type etc) are determined from a 10-min archive.
- Meteorological ICBC’s are taken from ERA-Interim data.

Data and Methodology
- CMAP and GPCP datasets are used for validation.
- Both data sets are provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their Web site at http://www.esrl.noaa.gov/psd.
- The performance of the 4 different options of convective schemes is evaluated quantitatively by analyzing:
  (a) Correlation coefficient
  (b) Bias
  (c) RMSE

Clustering Algorithm
We have used CLARA analysis and found 12 homogeneous regions based on 1989-2008 rainfall climatology from the CMAP dataset.

Conclusions
- Grell-FC is the best scheme for the Horn of Africa in reproducing the observed 20-yr mean climatology, the precipitation distribution over most of the clustered region, the annual cycle with minimum positive bias and the inter-annual variability of precipitation.
- Adjusting minimum and maximum shear effect on precipitation efficiency provided an improvement on correlation over all of the clusters except over cluster 3.
- Adjusting minimum and maximum convective heating improved the bias over all of the clusters except over clusters 6 and 12.
- Evaluation of 17-yr simulated precipitation revealed that modified Grell-FC scheme (with new set of minimum and maximum shear effect on precipitation efficiency) improved the correlation over all of the 12 delineated regions and for all months, reduced the positive bias of September, October and November and captured the inter-annual variability better than the default Grell-FC scheme.