The Abdus Salam
International Centre for Theoretical Physics

United Nations
Educational, Scientific and
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IAEA
International Atomic Energy Agency

2148-28

Fifth ICTP Workshop on the Theory and Use of Regional Climate Models

31 May - 11 June, 2010

Ensemble seasonal forecasting with RegCM3 over Ethiopia

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ENSEMBLE seasonal forecasting of East African rainfall with RegCM3

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Earth System Physics Section, The abdus salam ICTP

Outline

- Introduction
- Spatial variability
- Temporal variability
  - seasonal mean
  - sub seasonal
- ENSO cases
- Summary and future work

Introduction

- Rainfall is the most important climate parameter for most part of Africa
- The challenge is it exhibits high spatial and temporal variation
- Need for early warning system at local scale (i.e. high resolution)!
- RegCM has been used extensively for climate change studies
  - it has been validated on the ability to have an "add on" value compared to the global model
- Does it improve seasonal forecasts and able to reproduce the year to year fluctuation?
- If so could it be used as a tool for regionalized seasonal forecast?

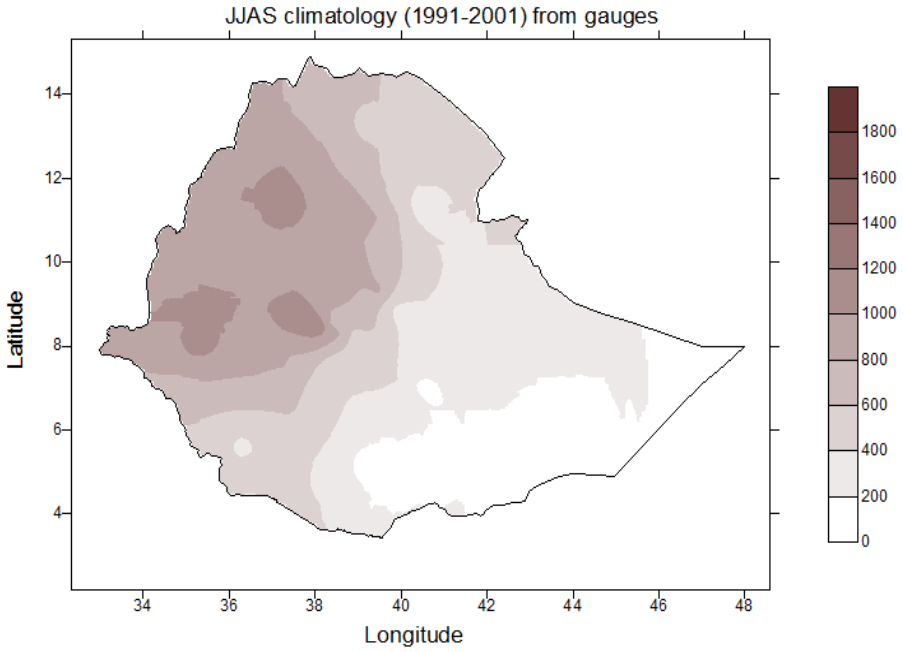
ECMWF ENSEMBLE Hindcast

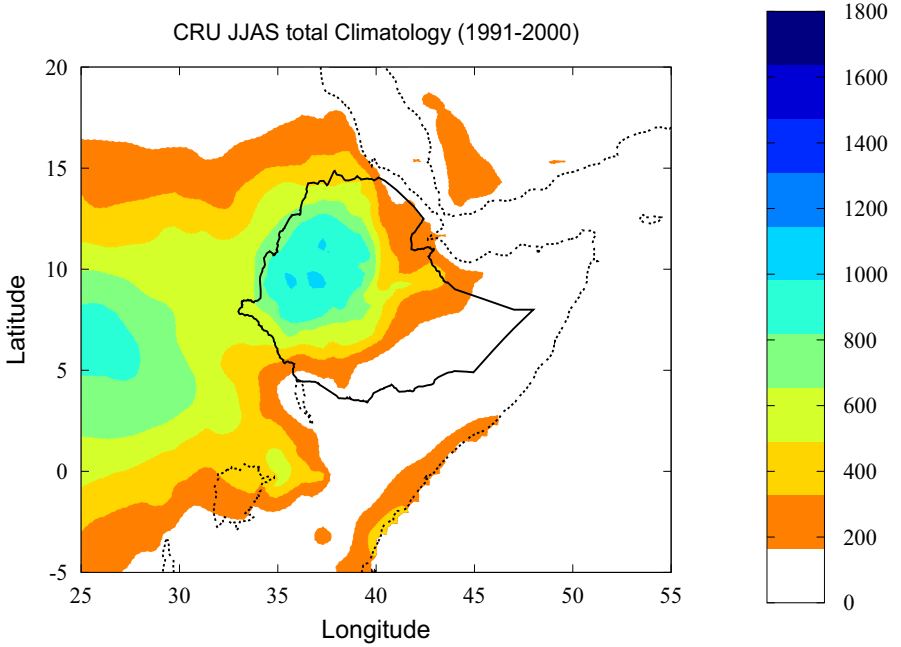
- Resolution : $1.5^0 \times 1.5^0$ in horizontal and 40L in vertical
- Hindcast period: 1991-2001
- 9 member ensembles
- addressing forecast uncertainity
  - uncertainity in initial condition: Perturbed initial conditions
  - model error: Perturbed physics
- Two start dates (May and November): we use the May 1st start
- 6 month hindcast (May 1st - November 1st)

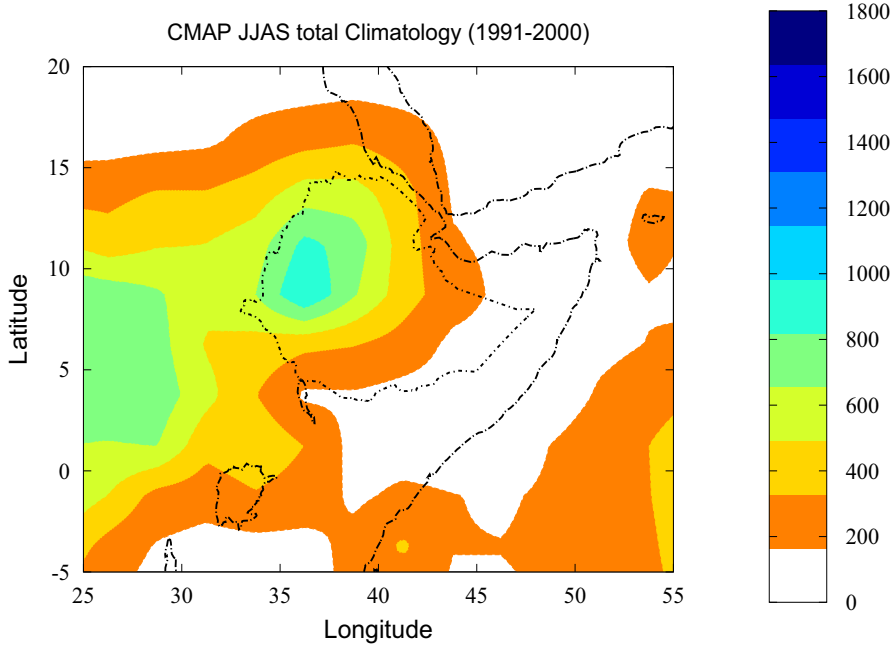
RegCM setup

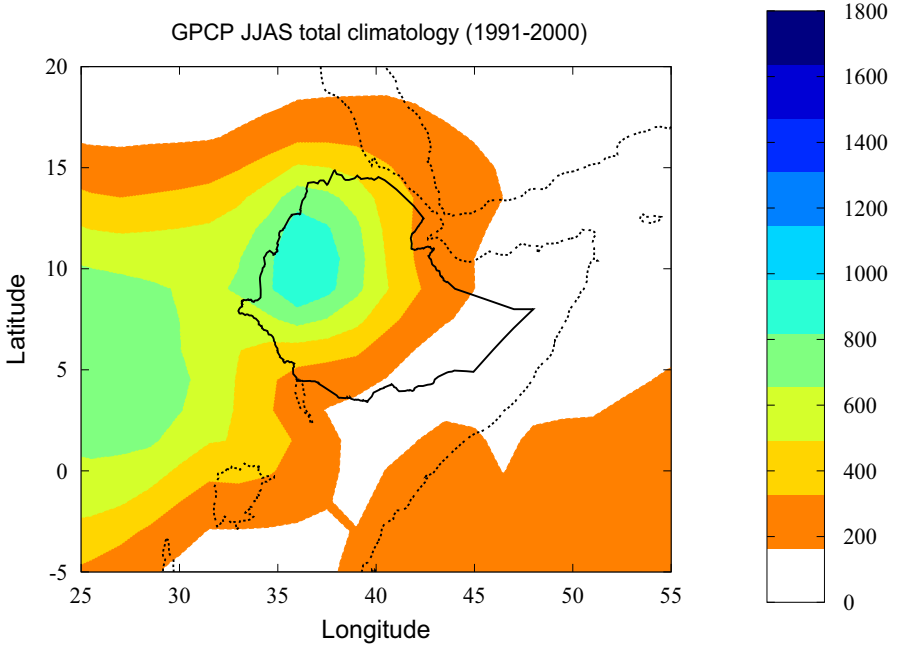
- Resolution : 30km (128x112) in horizontal and 18 level in vertical
- For the boundary:
  - 9 ECMWF ENSEMBLE members
  - ERA-Interim
- Hindcast period:
  - for the ECMWF ENSEMBLE May 1 to November 1 for the period 1991-2000
  - for ERA Interim Jan 1991 to Jan 2001
- Convection scheme: Grell scheme with FC closure

JJAS Climatology -observation

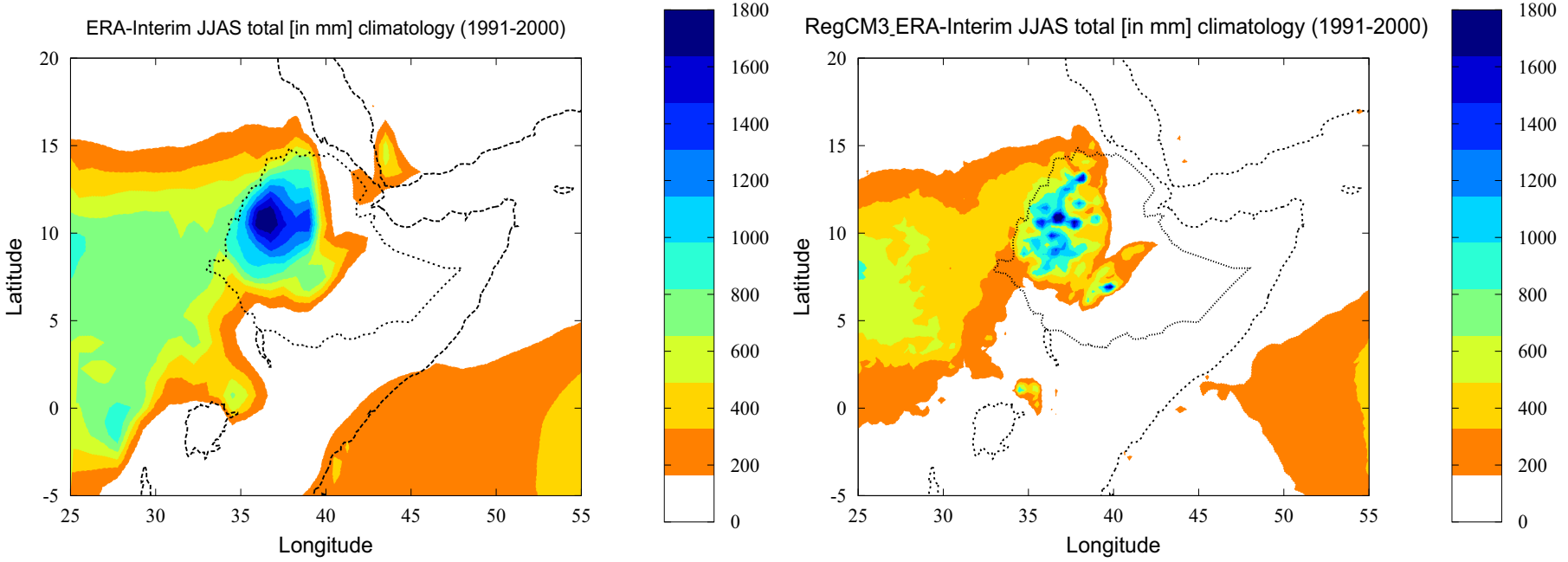




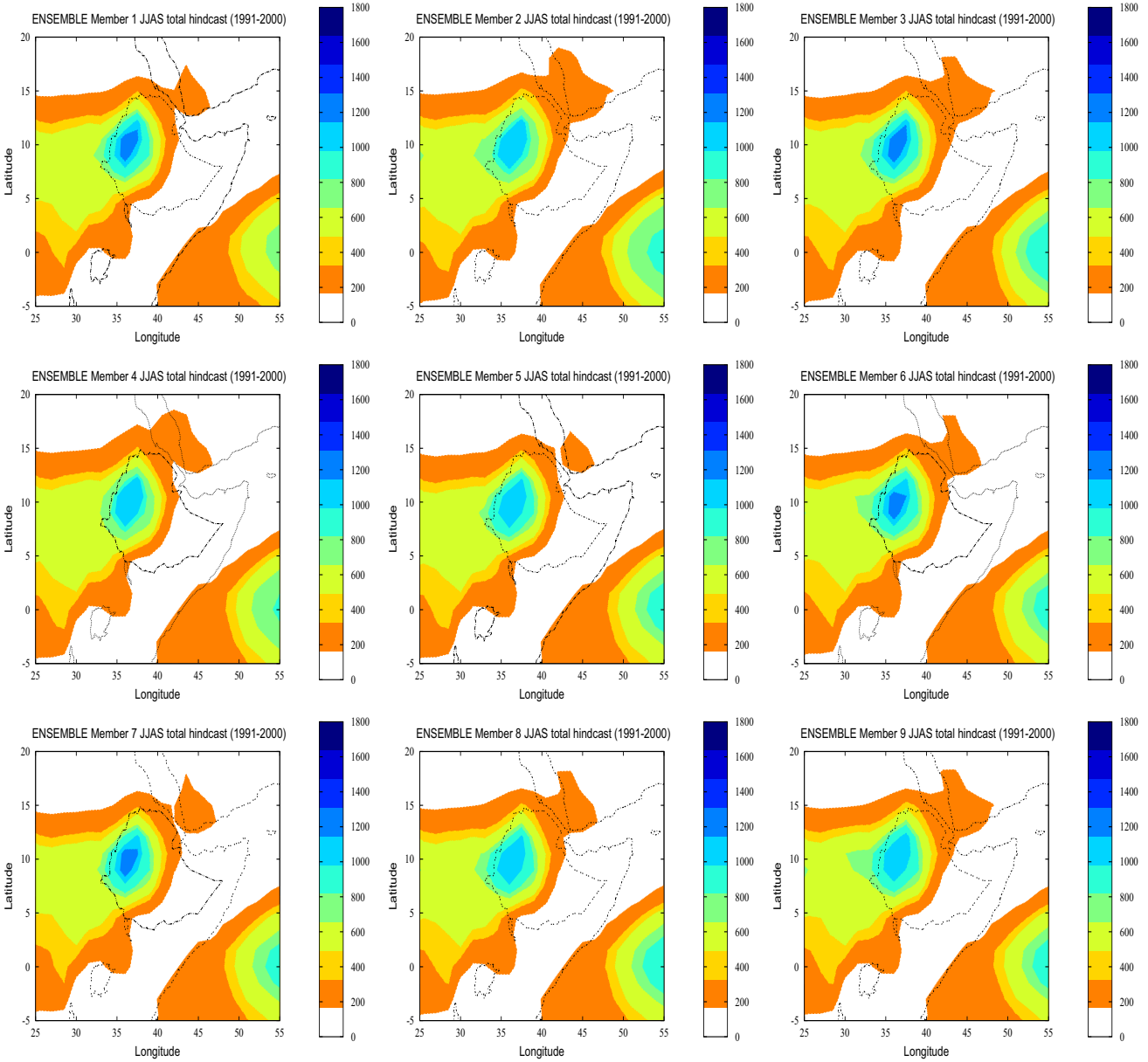




JJAS Climatology -ERA-Interim

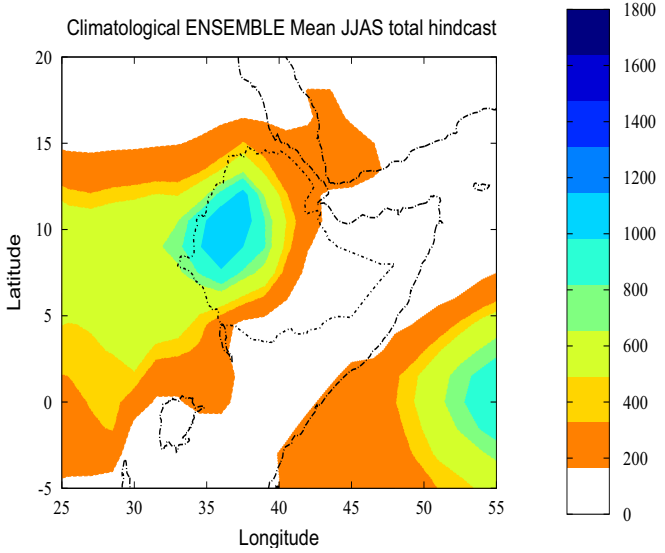


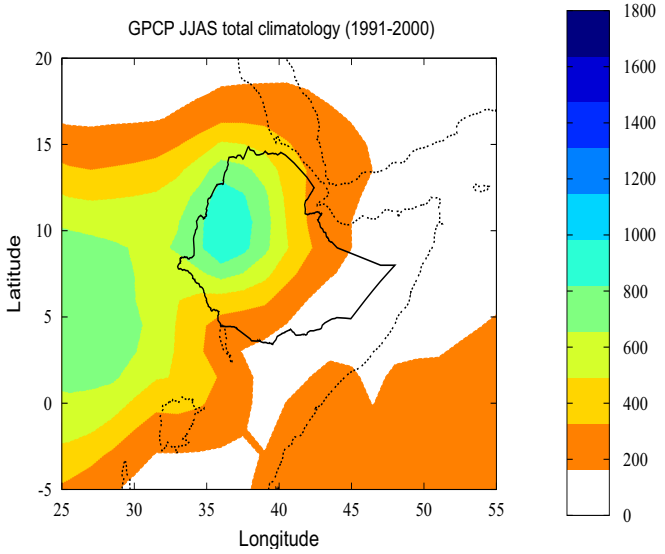
ECMWF Climatology



Individual ensemble members

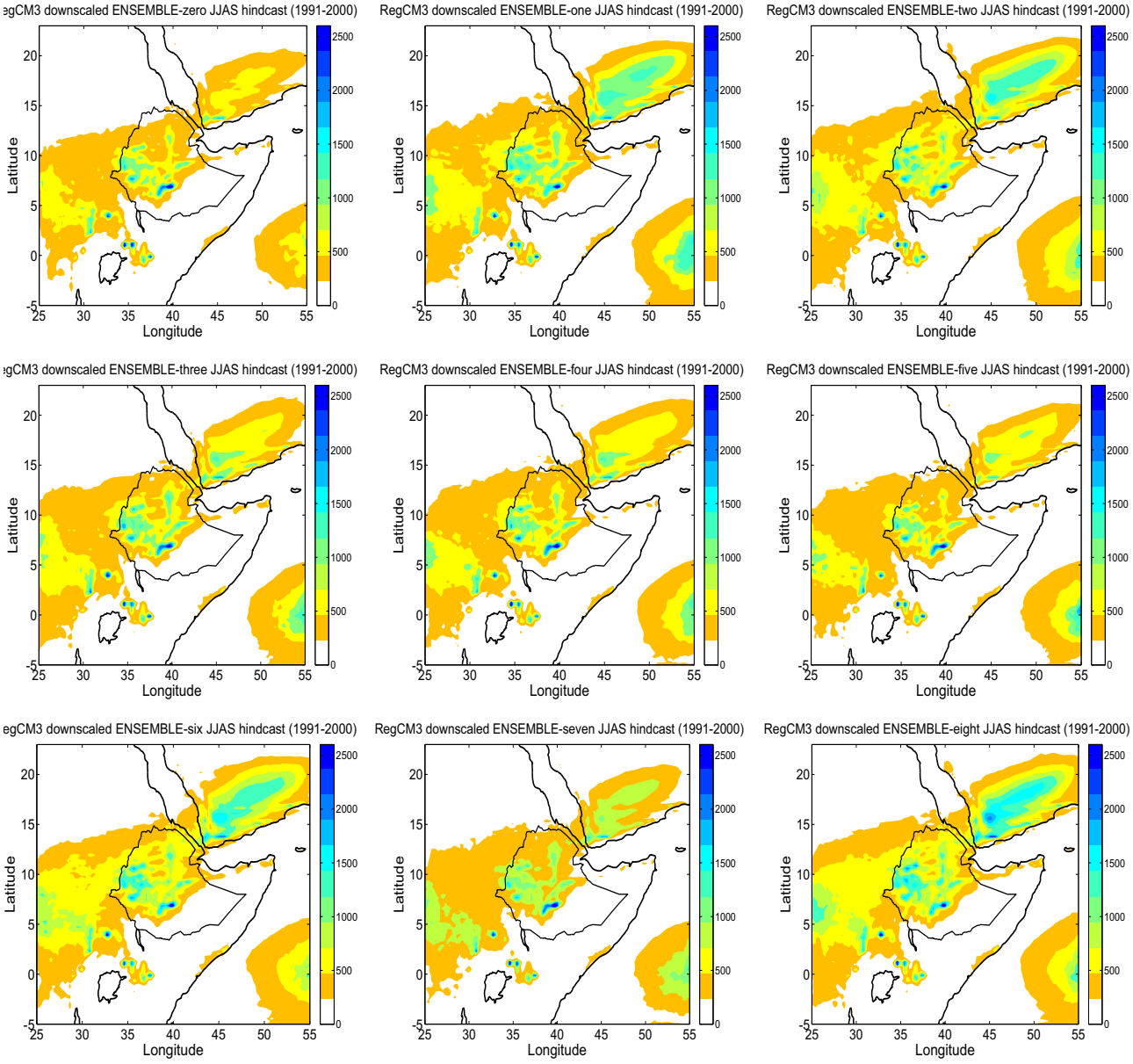
ensemble mean





GPCP

RegCM Climatology



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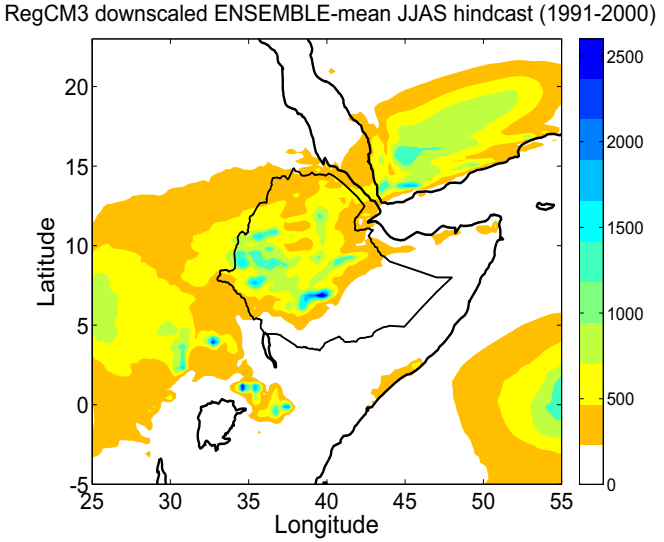
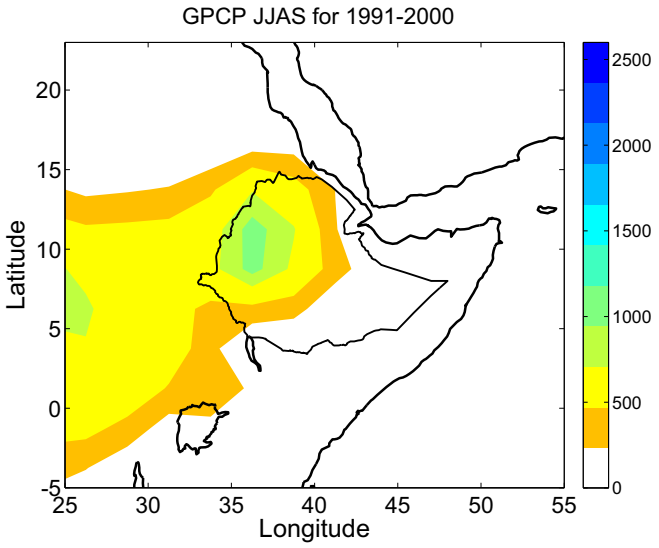
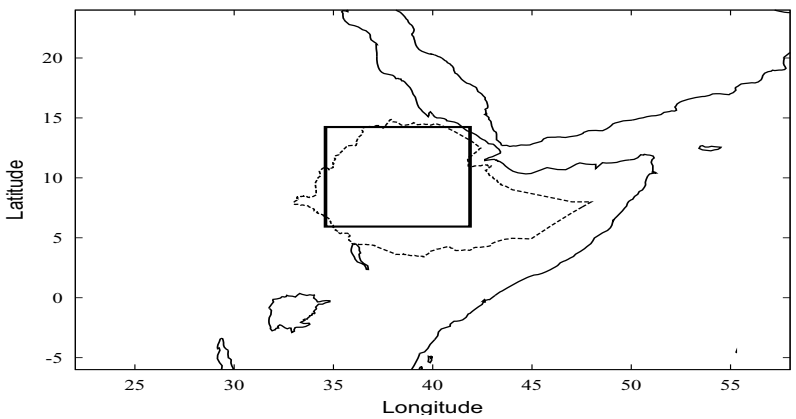




GPCP

Interannual variability



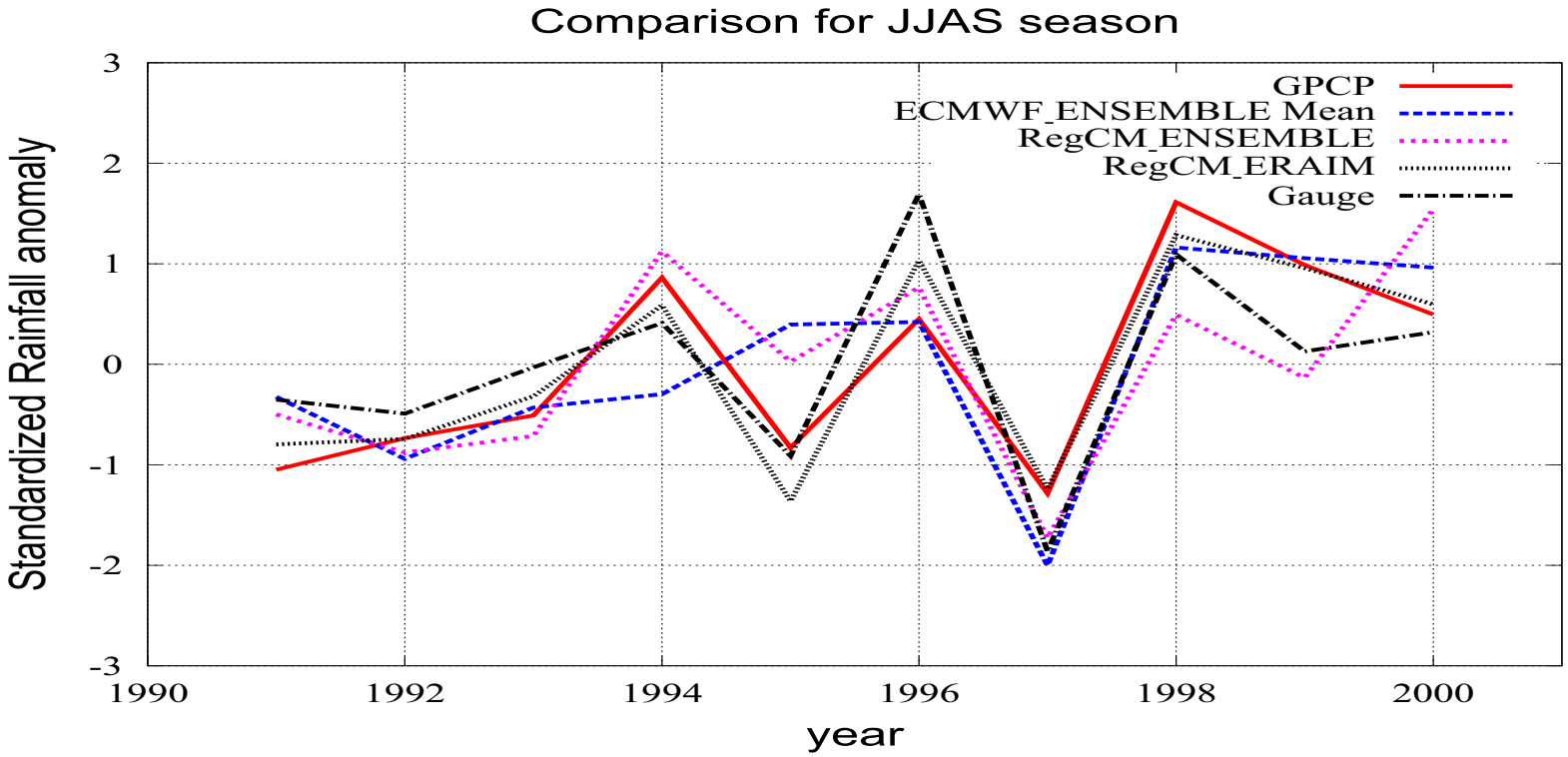
Correlation with Gauge

GPCP = 0.78

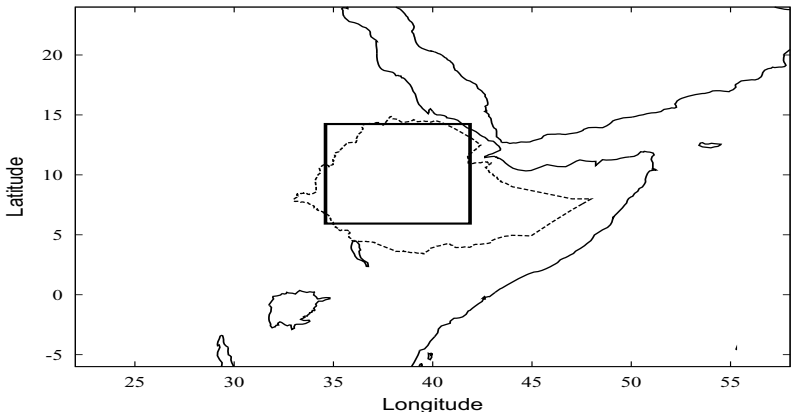
ECMWF-Ensemble mean = 0.70

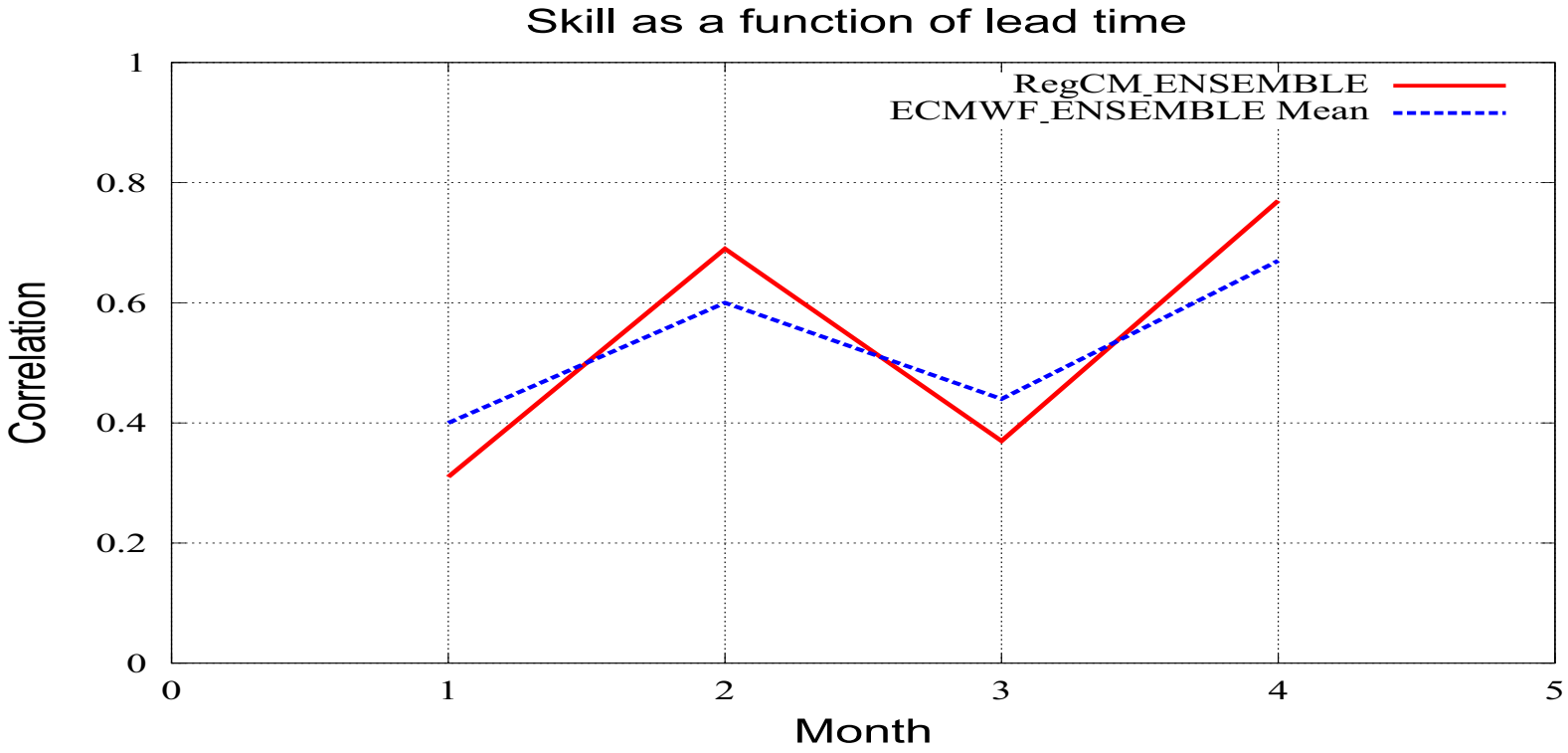
RegCM-Ensemble mean = 0.73

RegCM-ERA-Interim = 0.88

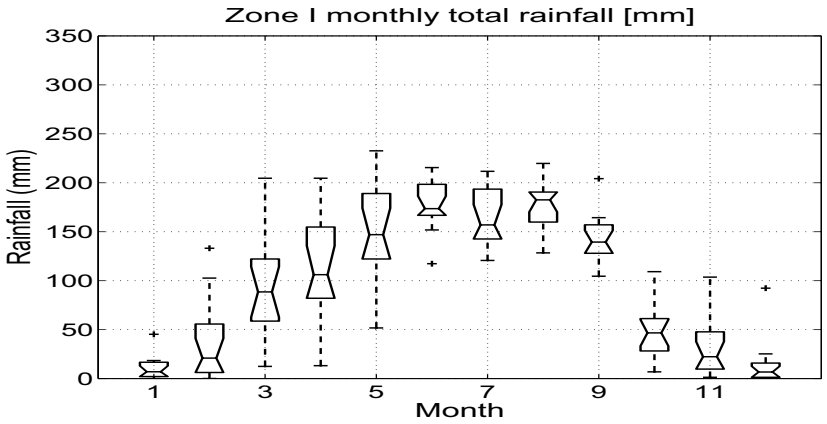


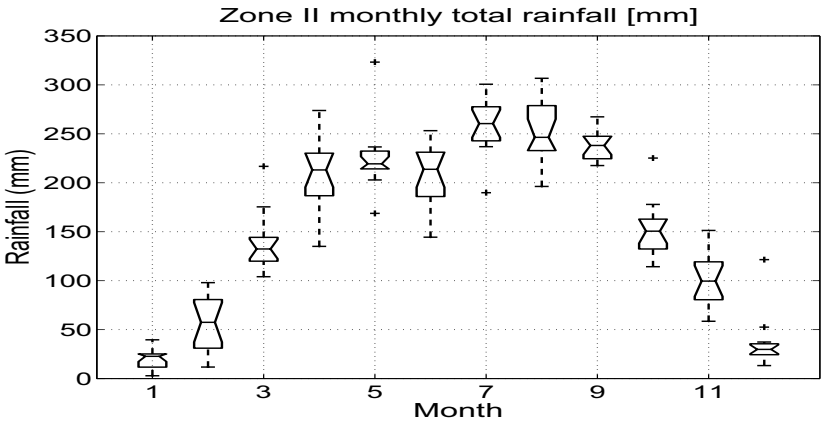
Skill of the forecast

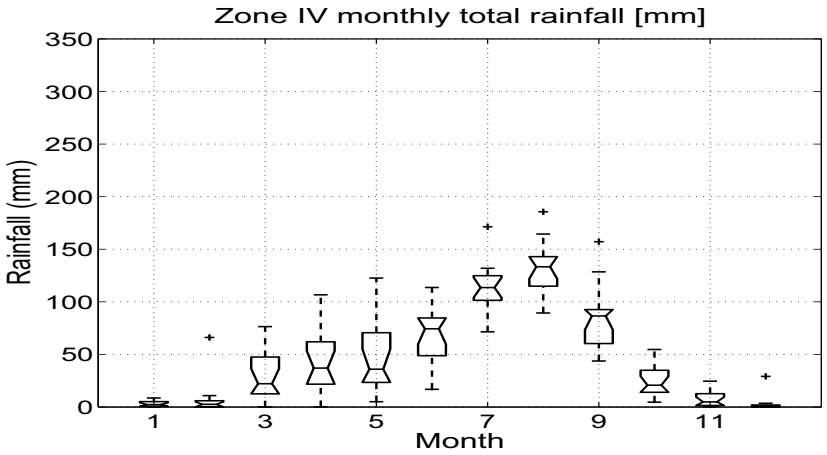


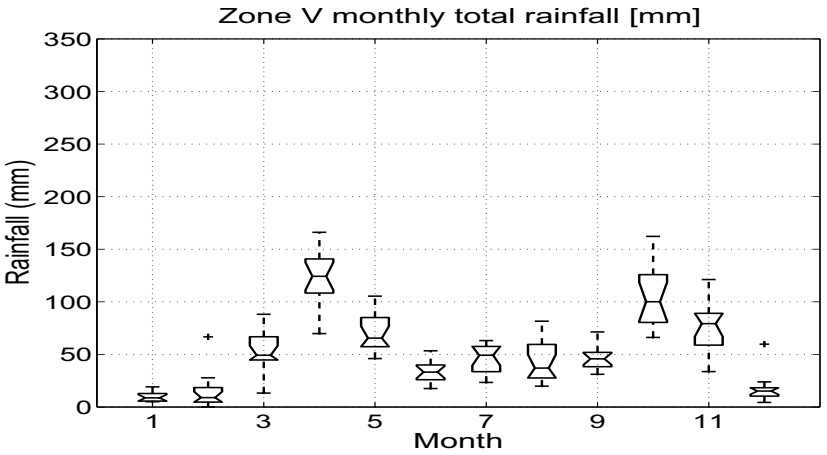


Potential Predictability

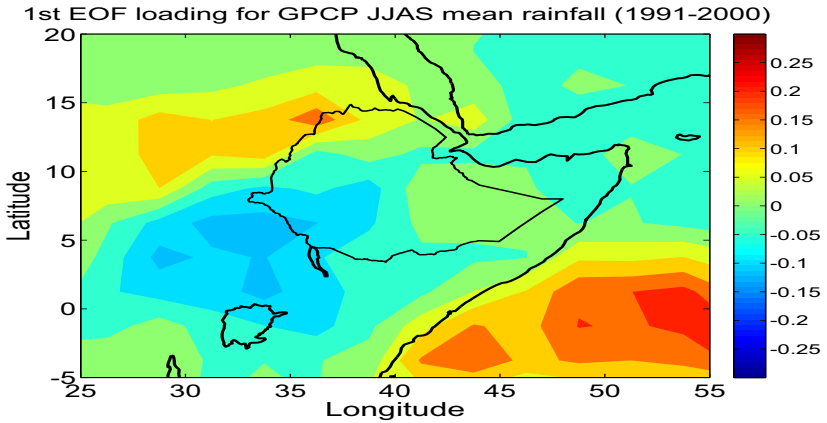








Interannual variability

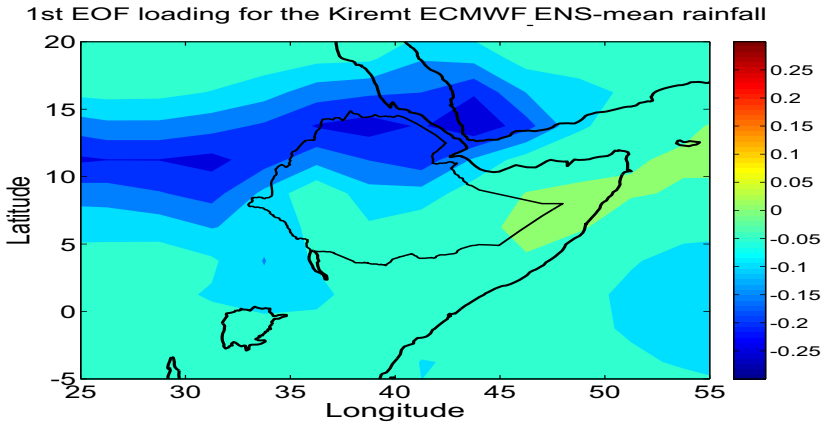


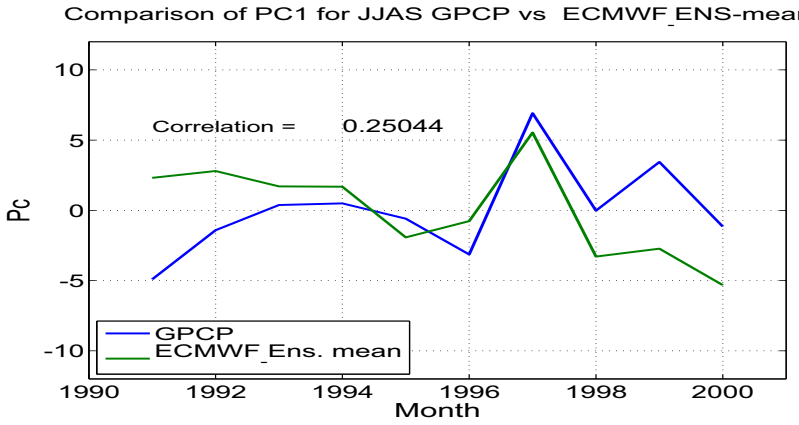
Percentage of variance explained by the first EOF

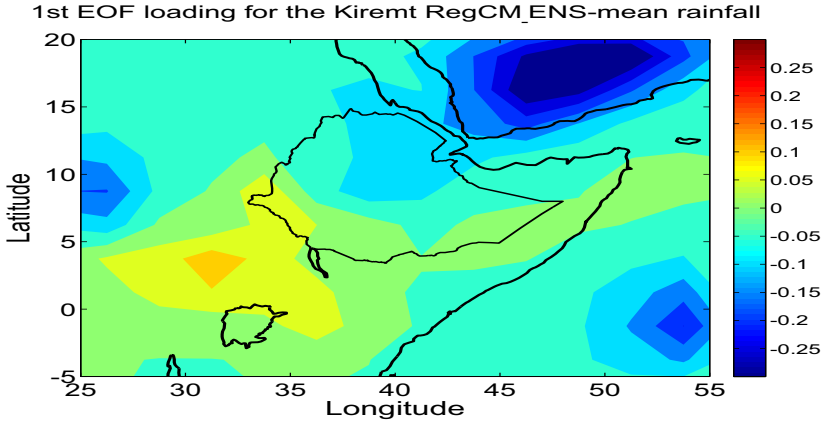
GPCP = 32.1

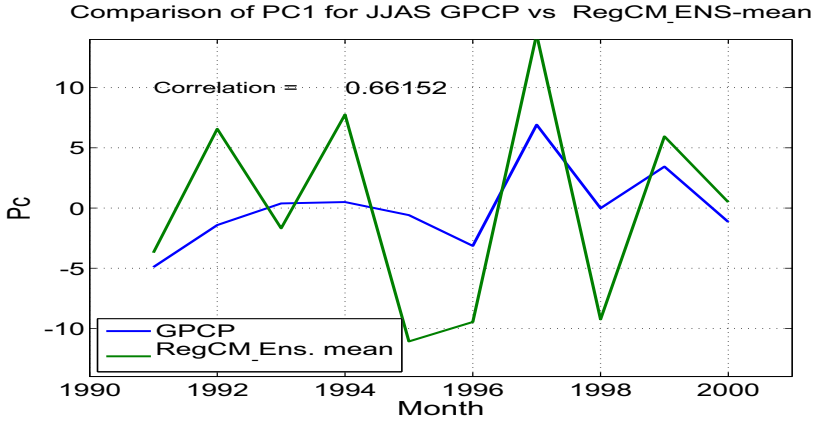
ECMWF-Ensemble mean = 46.8

RegCM-Ensemble mean = 35.6

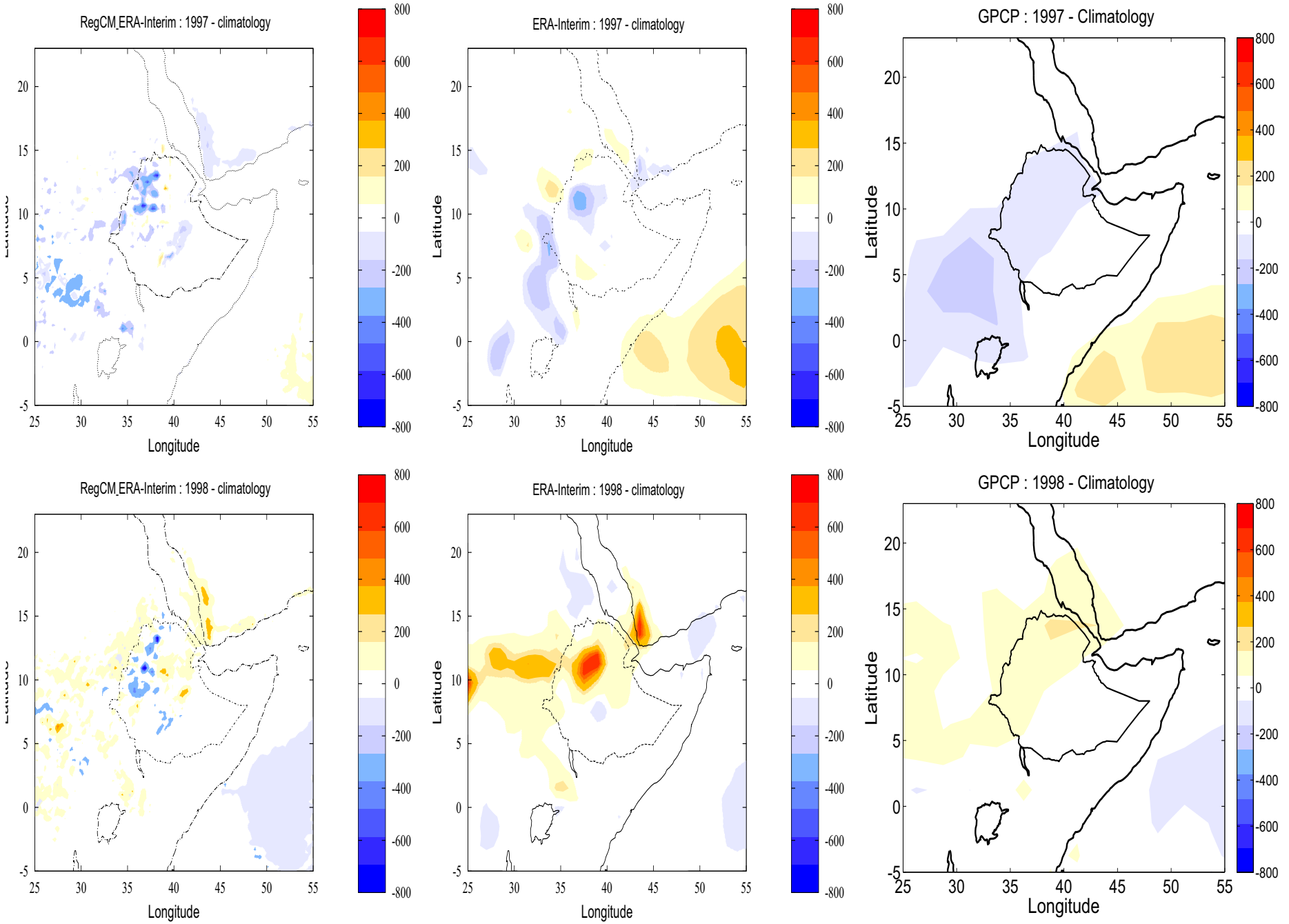




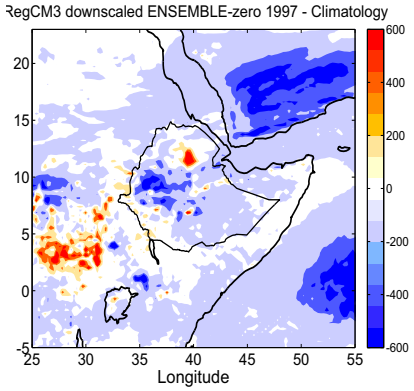


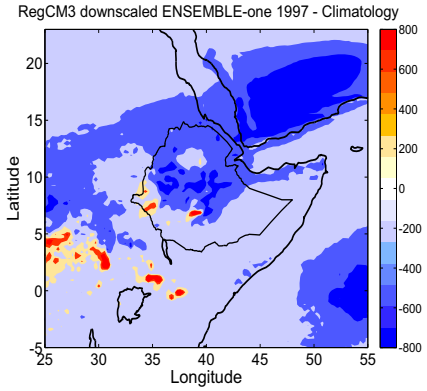


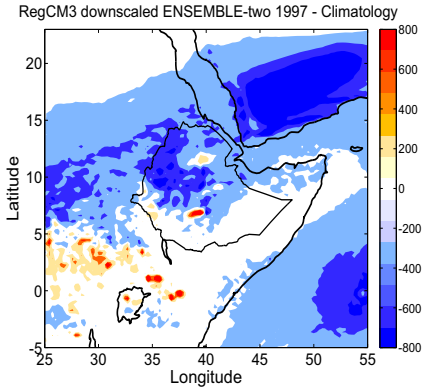
ERA-Interim/RegCM/GPCP: ENSO

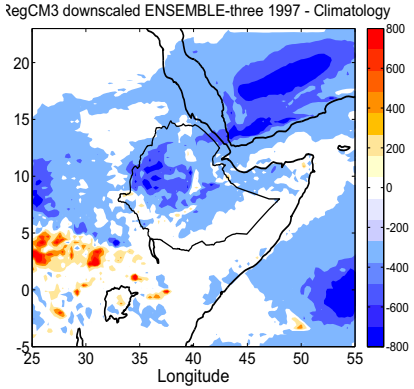


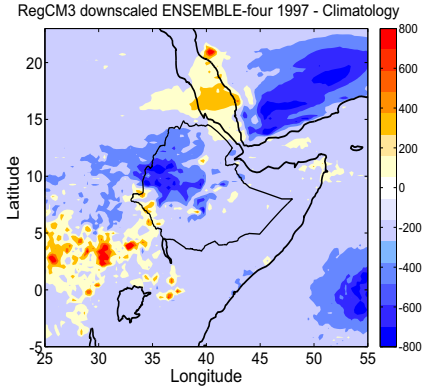
RegCM Elnino year- 1997

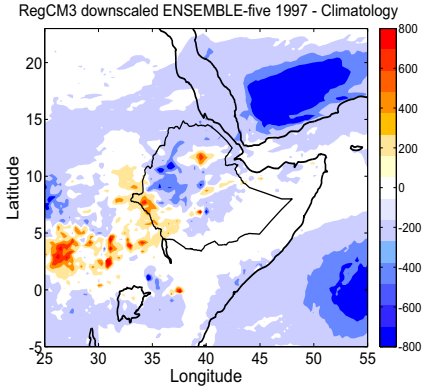


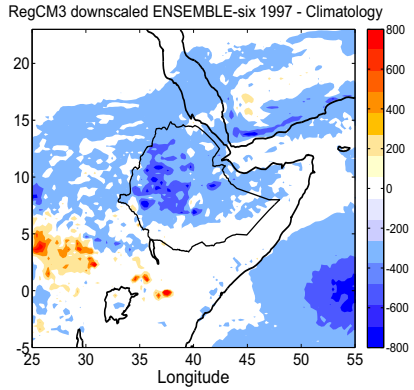


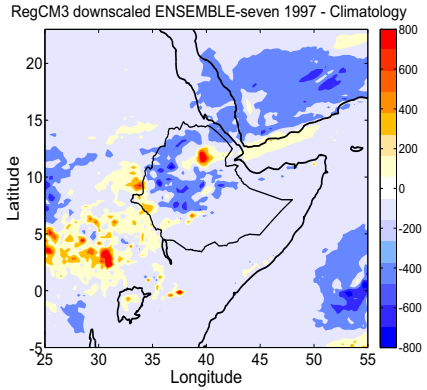


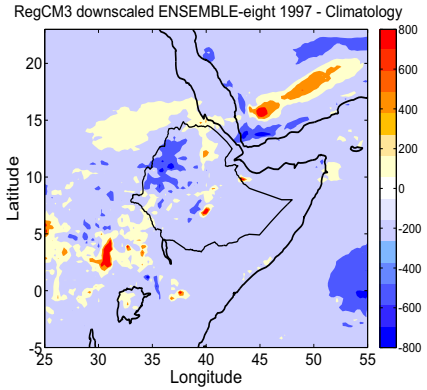






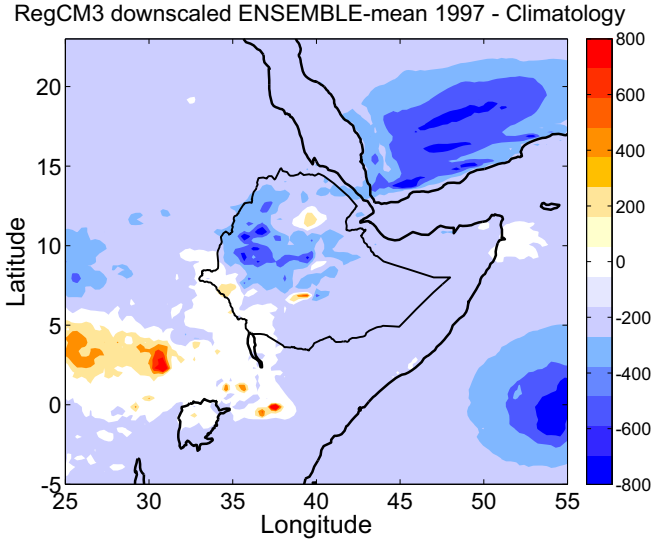


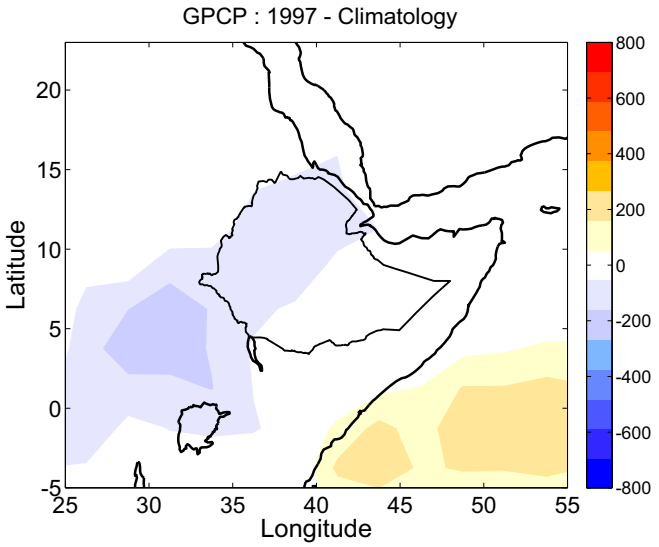




Individual ensemble members

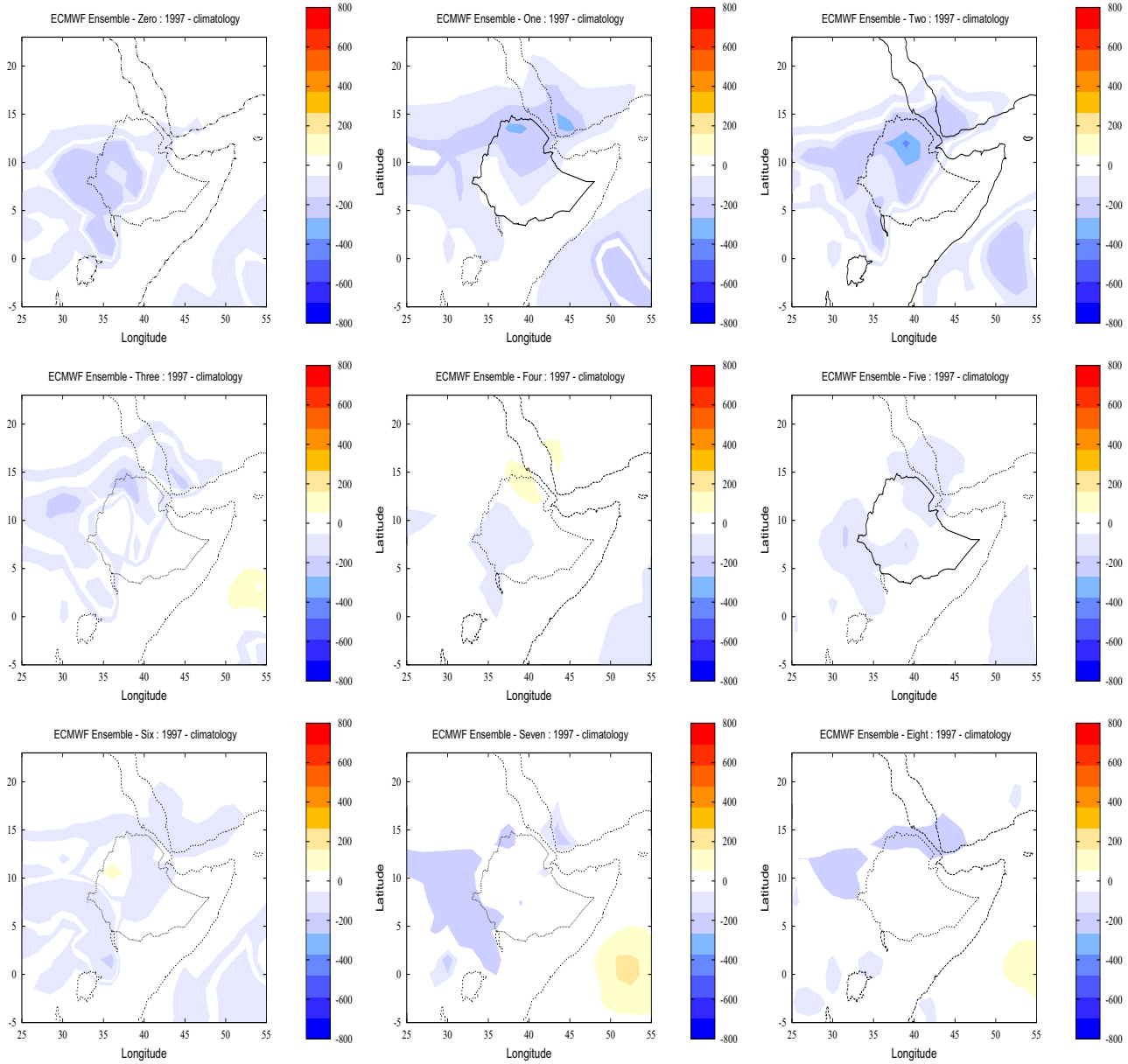
ensemble mean





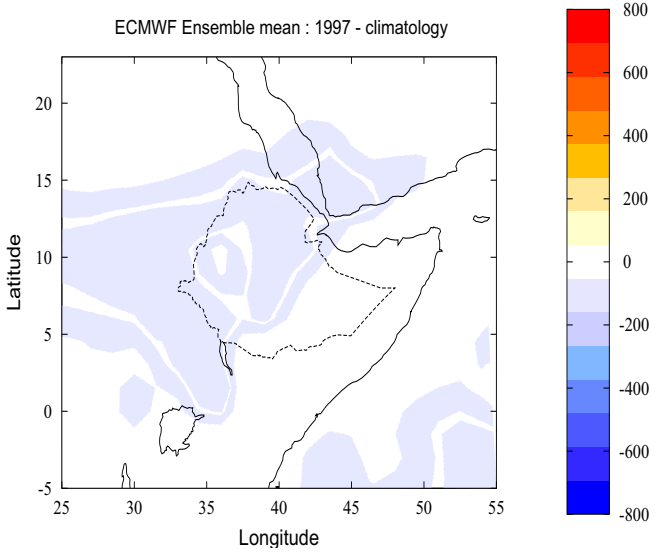
GPCP

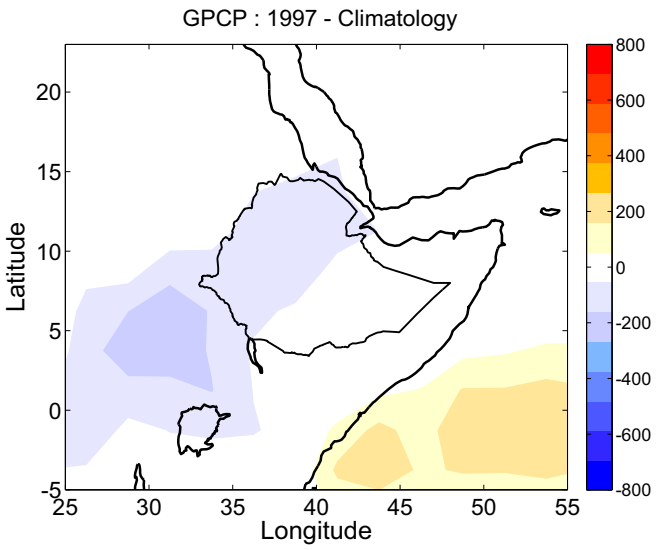
ECMWF Elnino year- 1997



Individual ensemble members

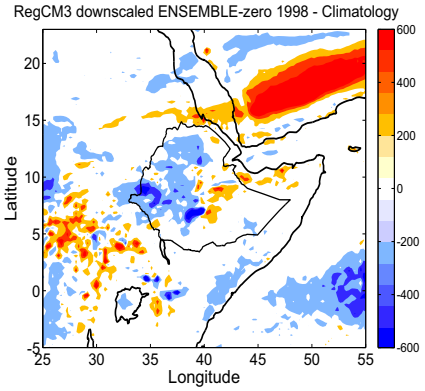
ensemble mean

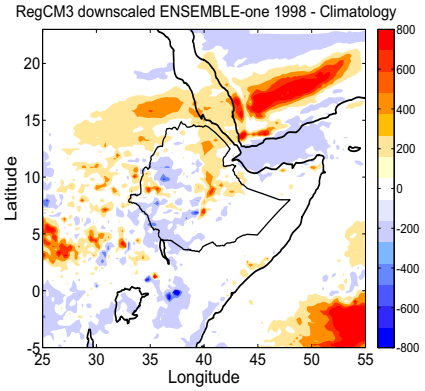


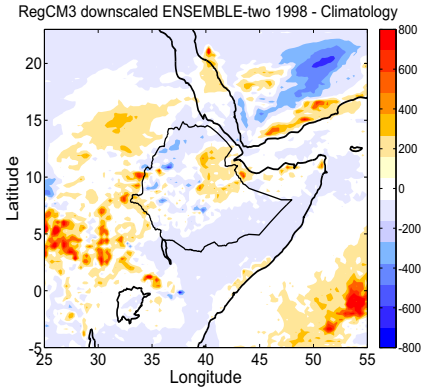


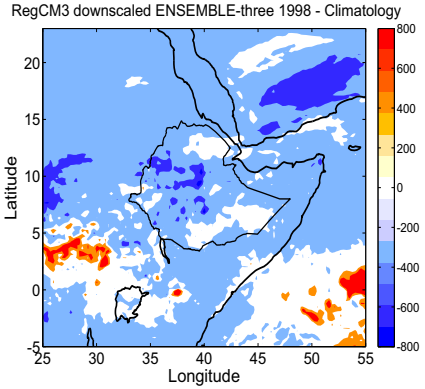
GPCP

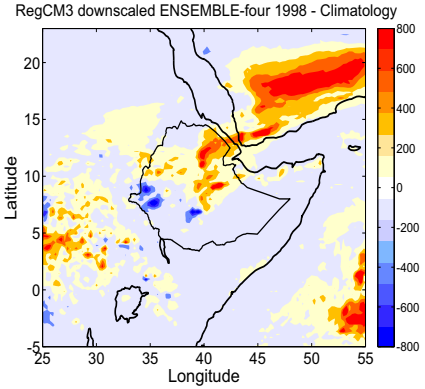
RegCM La Nina year- 1998

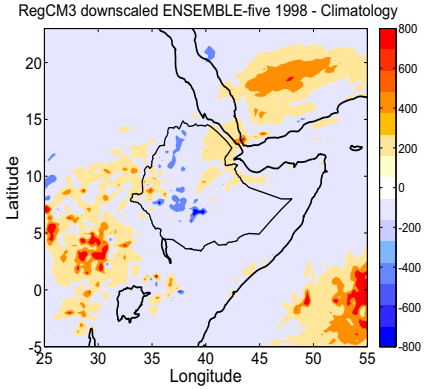


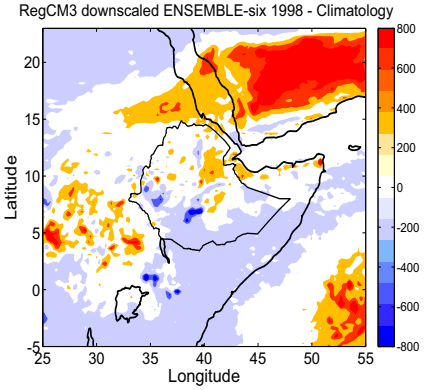


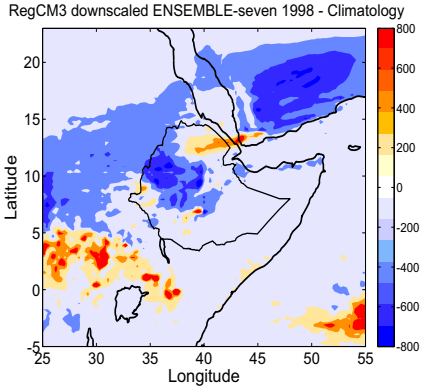


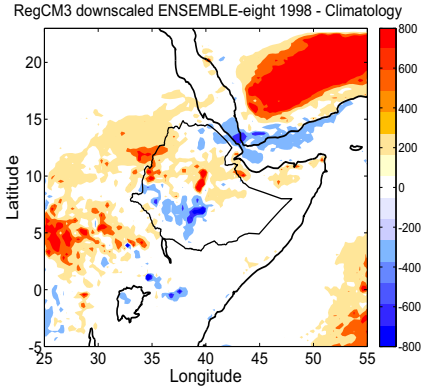






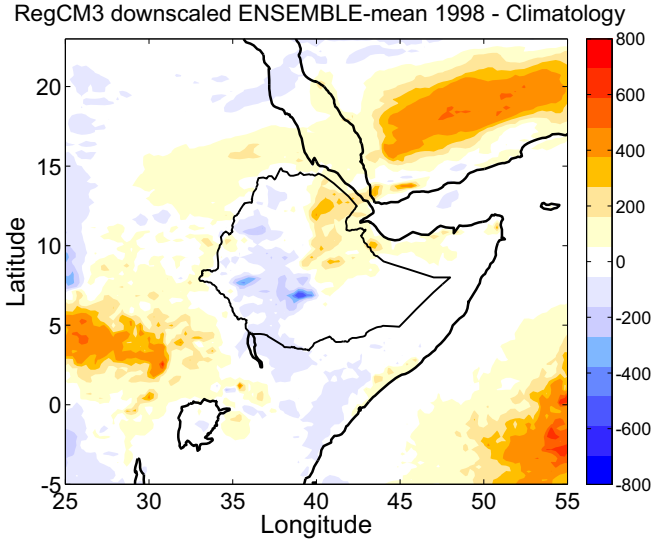


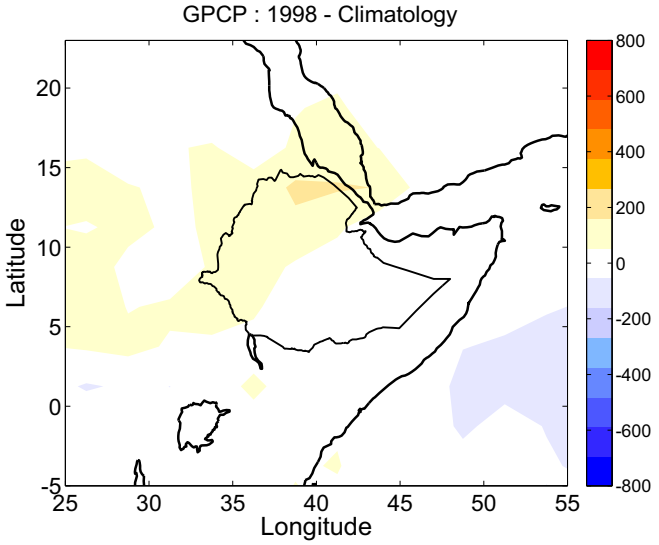




Individual ensemble members

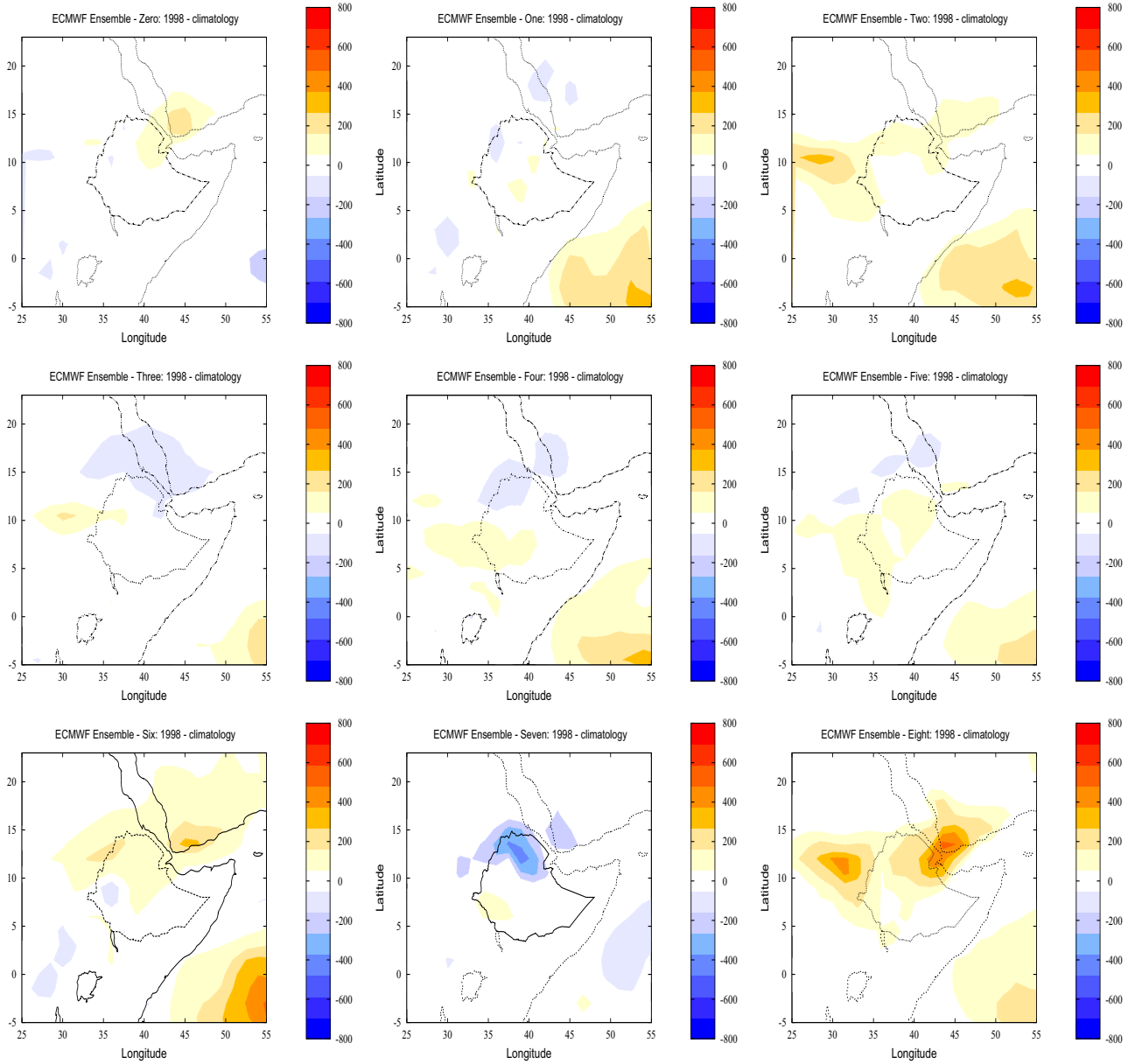
ensemble mean





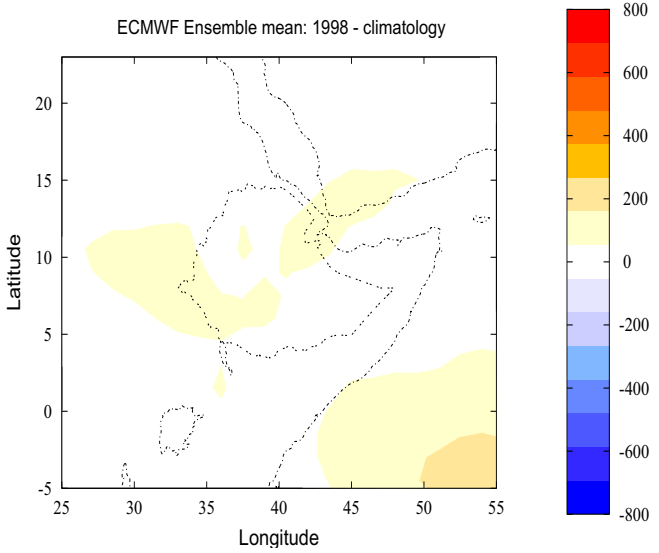
GPCP

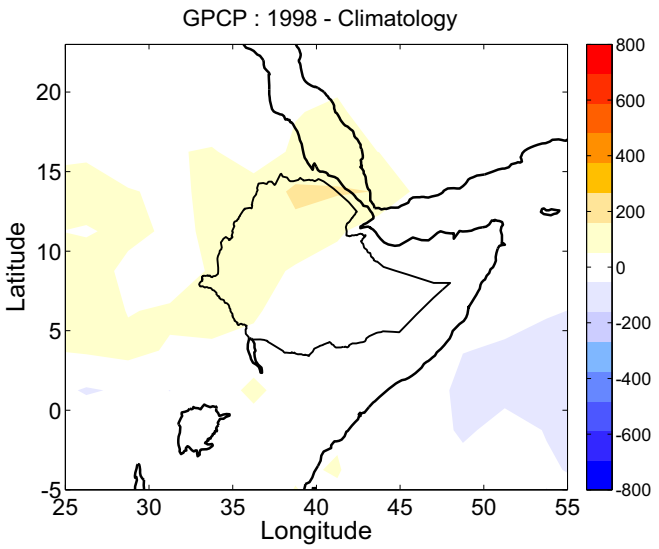
ECMWF Lanina year- 1998



Individual ensemble members

ensemble mean





GPCP

Summary and future work

- Spatial variability is reasonably reproduced
- RegCM better captured the interannual variability when the whole season considered
- the skill is less for the onset but better for the cessation
- need high resolution validation dataset
- probabilistic verification: ROCS/RPSS
- Intraseasonal variability

Thanks