Climate Change Impact Assessment on Indian Water Resources

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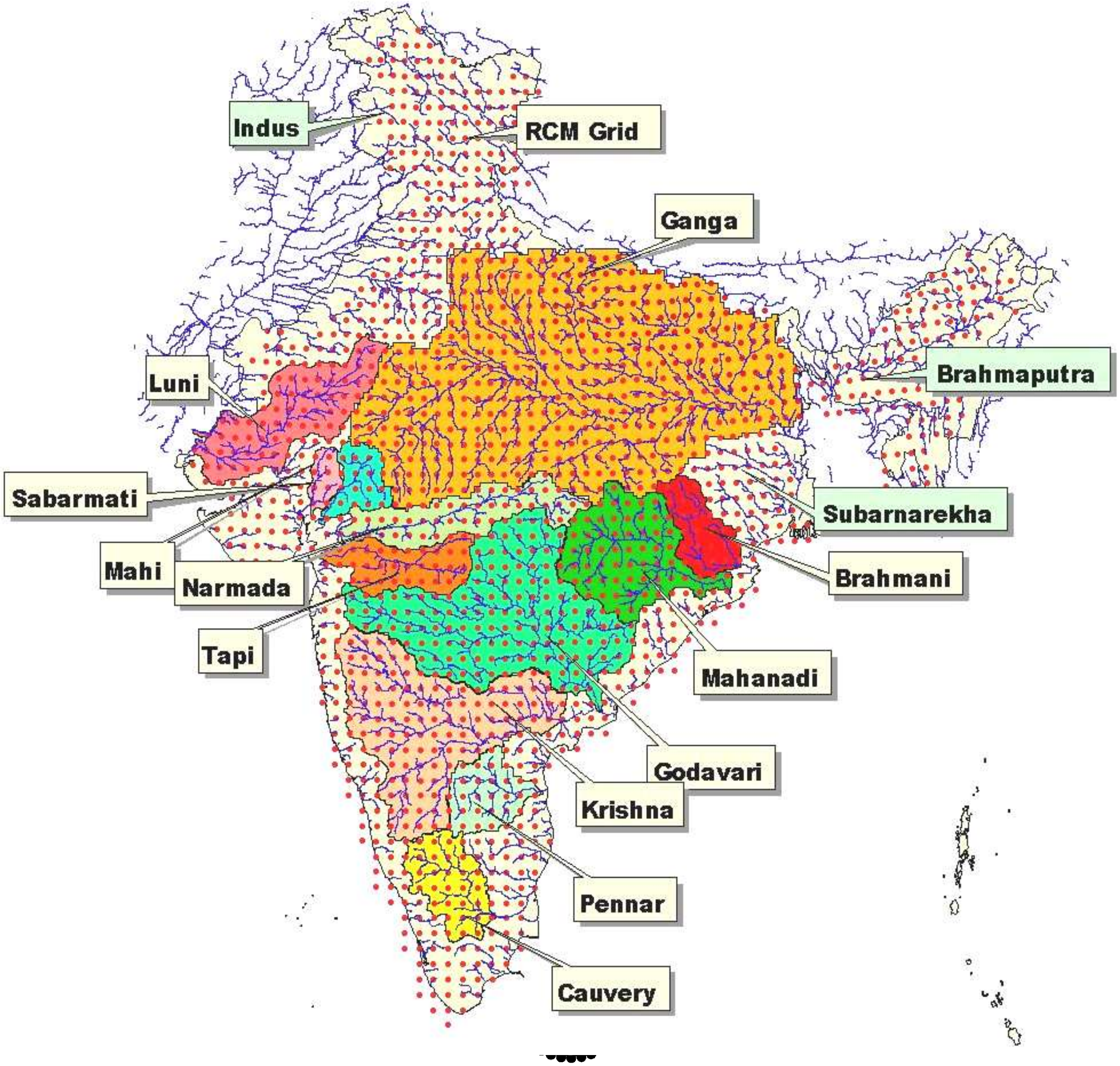
Objectives of the Study

- To quantify the impact of the climate change on the water resources of the country
- Identify Hotspots
- Identify Adaptation & Coping strategies

Data Used for Modeling

- DEM: 1km grid, generated using contours from 1:250000 topographic data
- Land use: 1:2M USGS
- Soil: 1:5M FAO
- Weather: Data generated by the "Hadley Centre for Climate Prediction" U.K. at a resolution of 0.44° X 0.44° latitude by longitude (HadRM2) from IITM, Pune

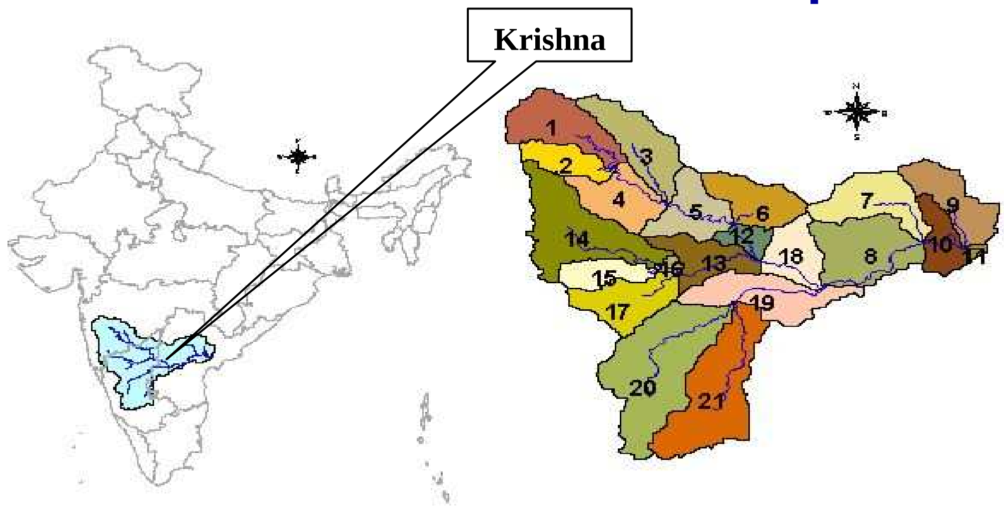
River Basins Modeled

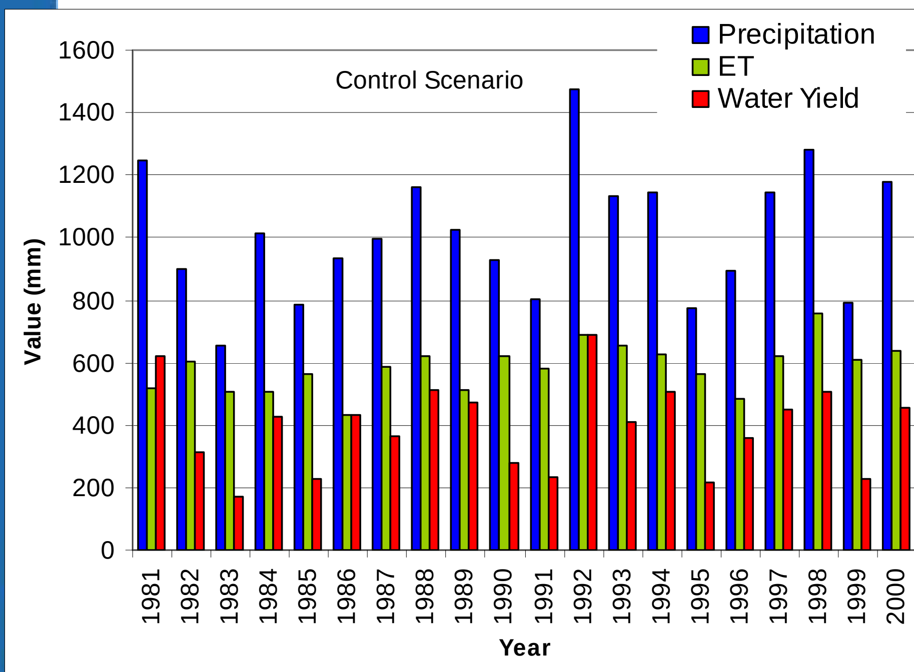


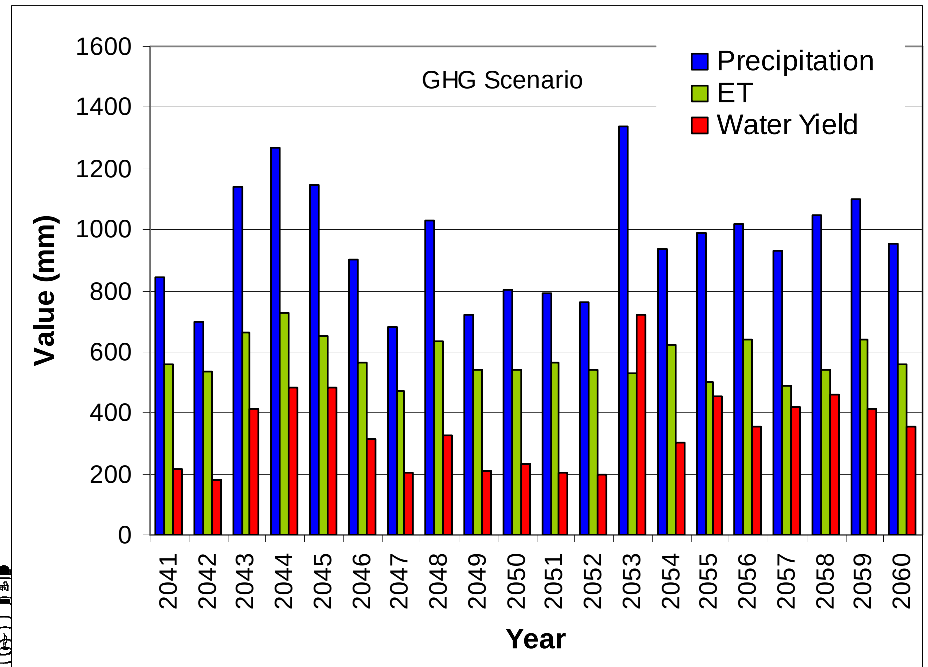
Assumptions

- The land use has been assumed to remain same
- Water bodies including reservoirs could not be incorporated at this stage due to lack of data - capacities and the operation rules

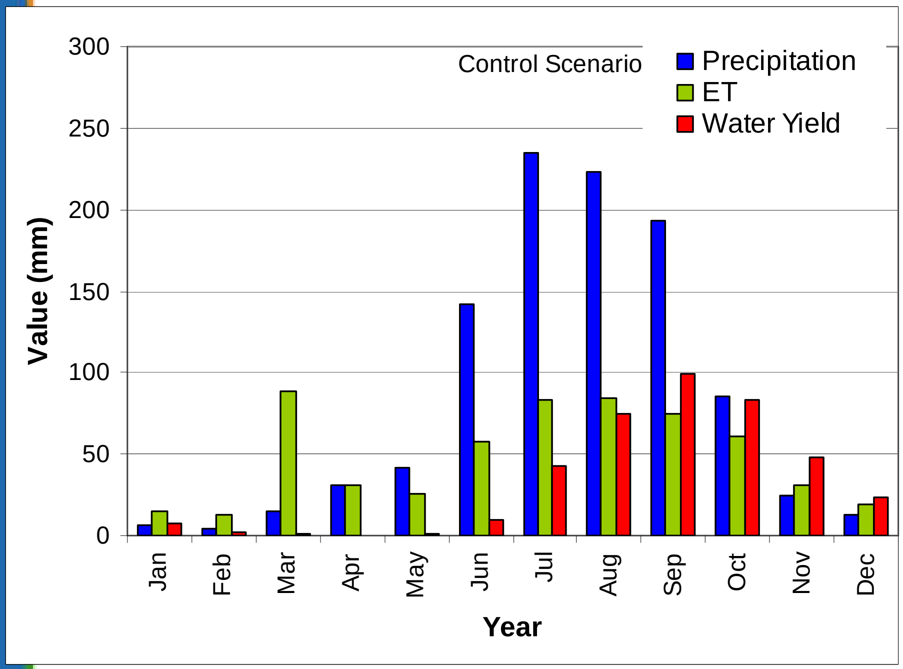
Drought Prone Basin-Krishna River Basin
Annual water balance components

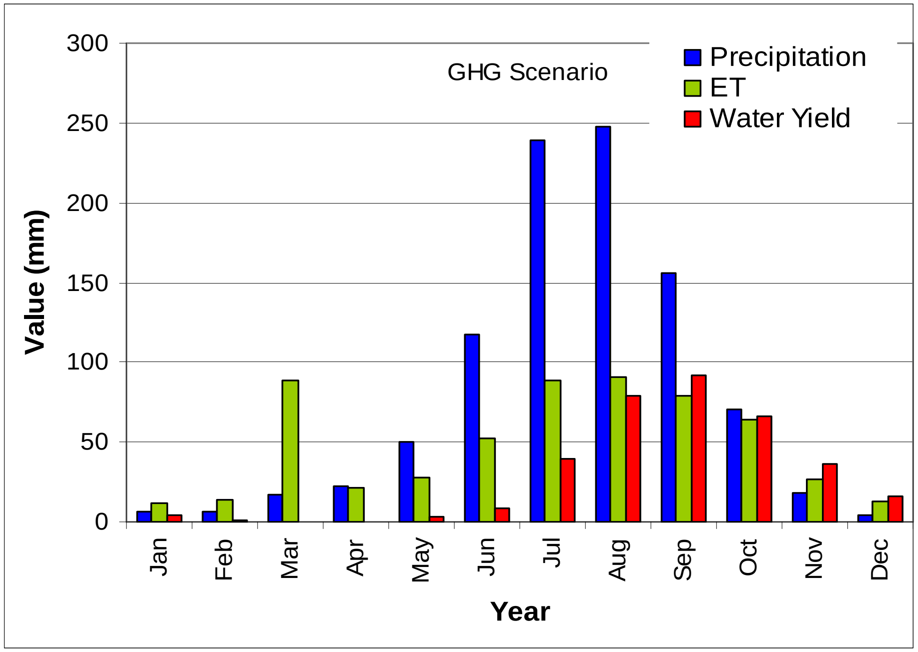






Monthly water balance components for Krishna river basin





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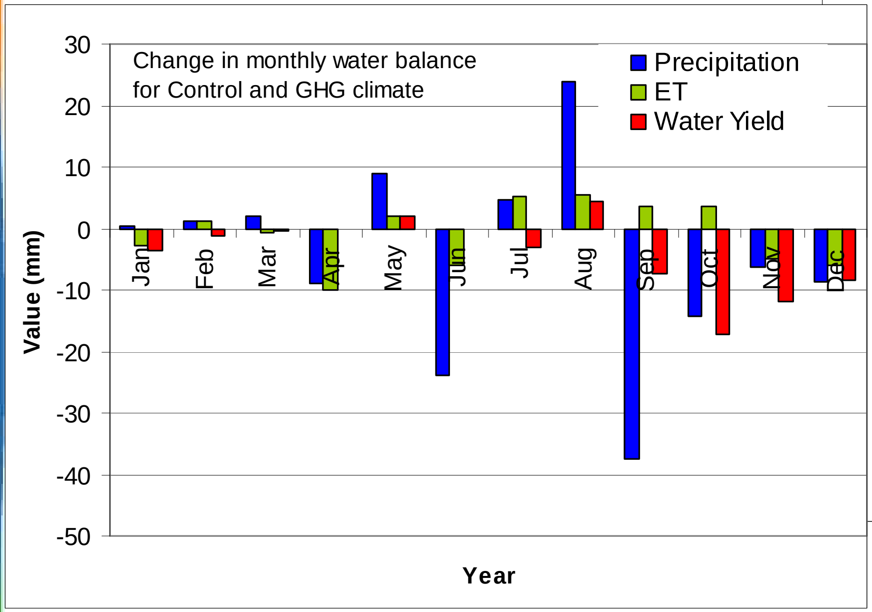
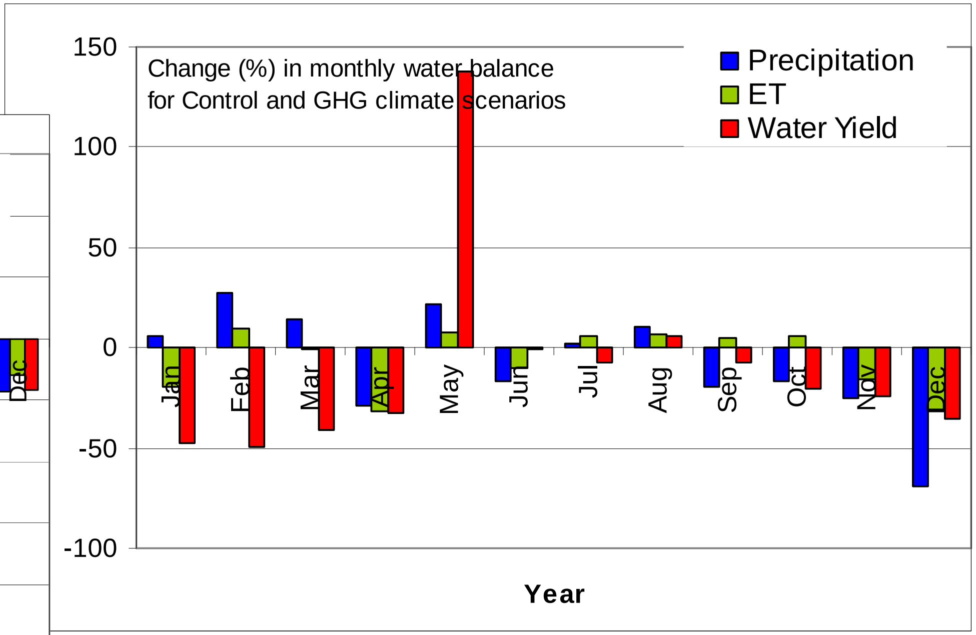
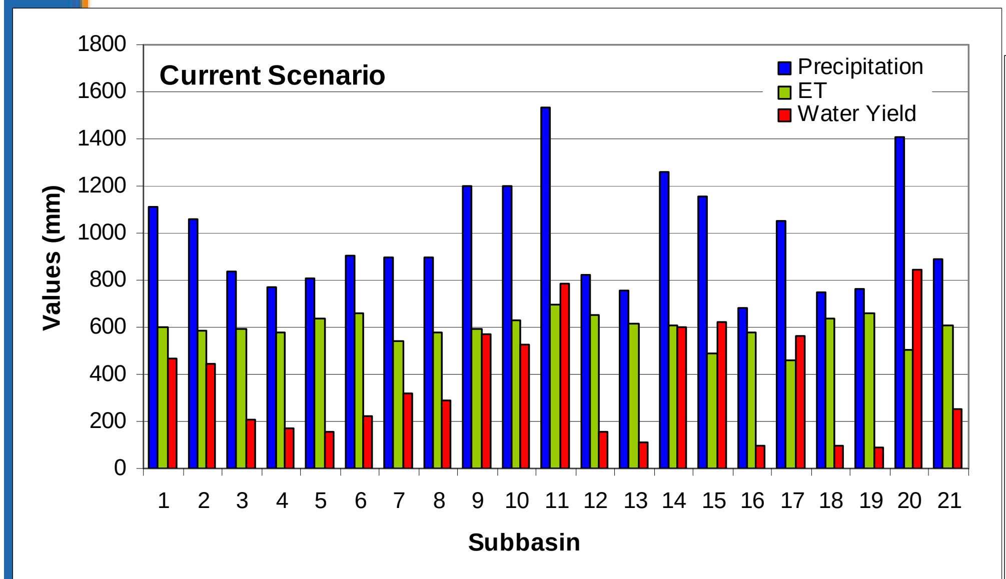
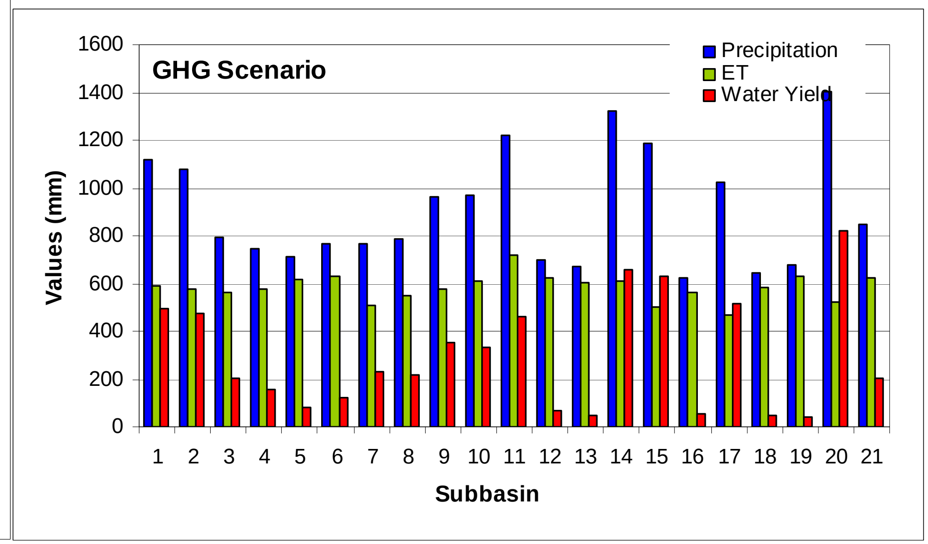
Change in Monthly water balance components for Krishna river basin





Sub-basin Water Balance components for Krishna Basin





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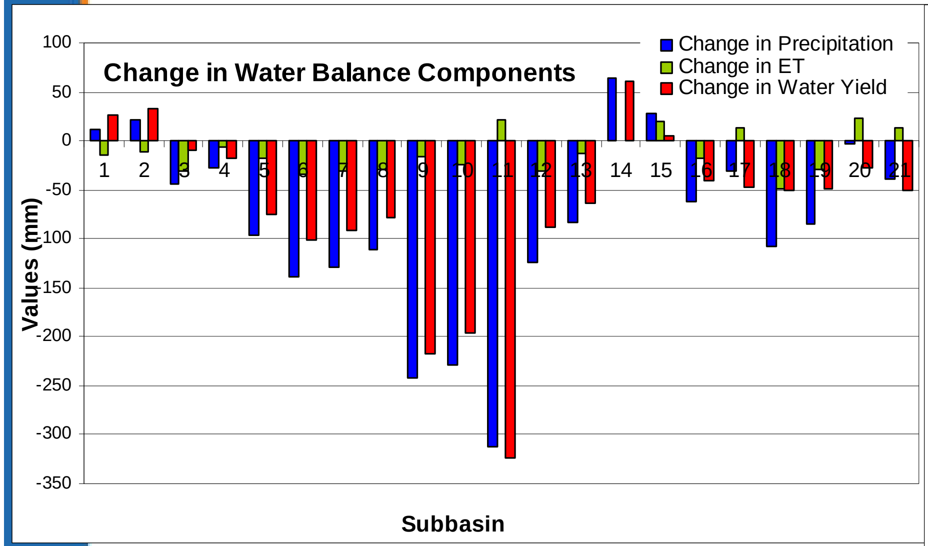
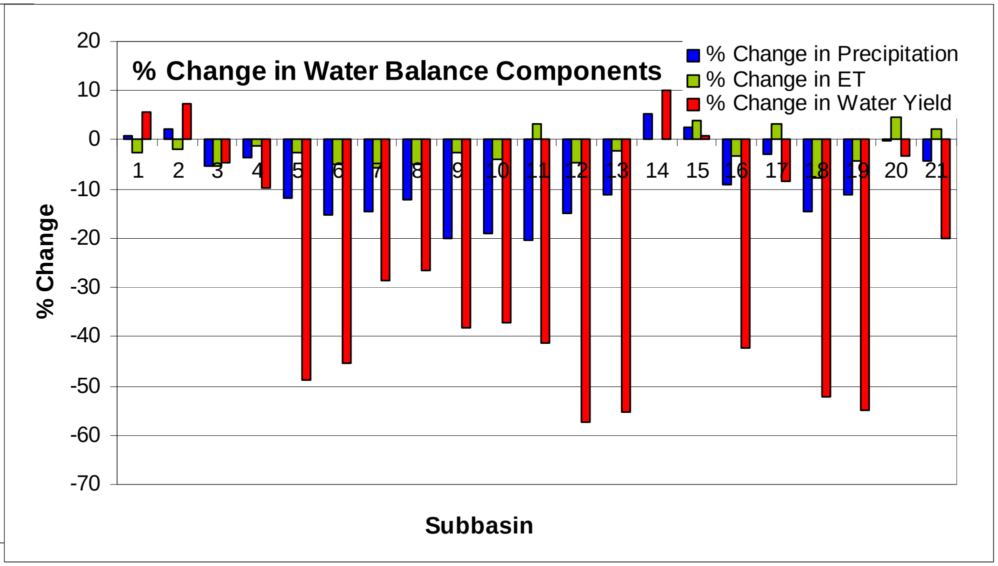
Change in Sub-basin Water Balance components for Krishna





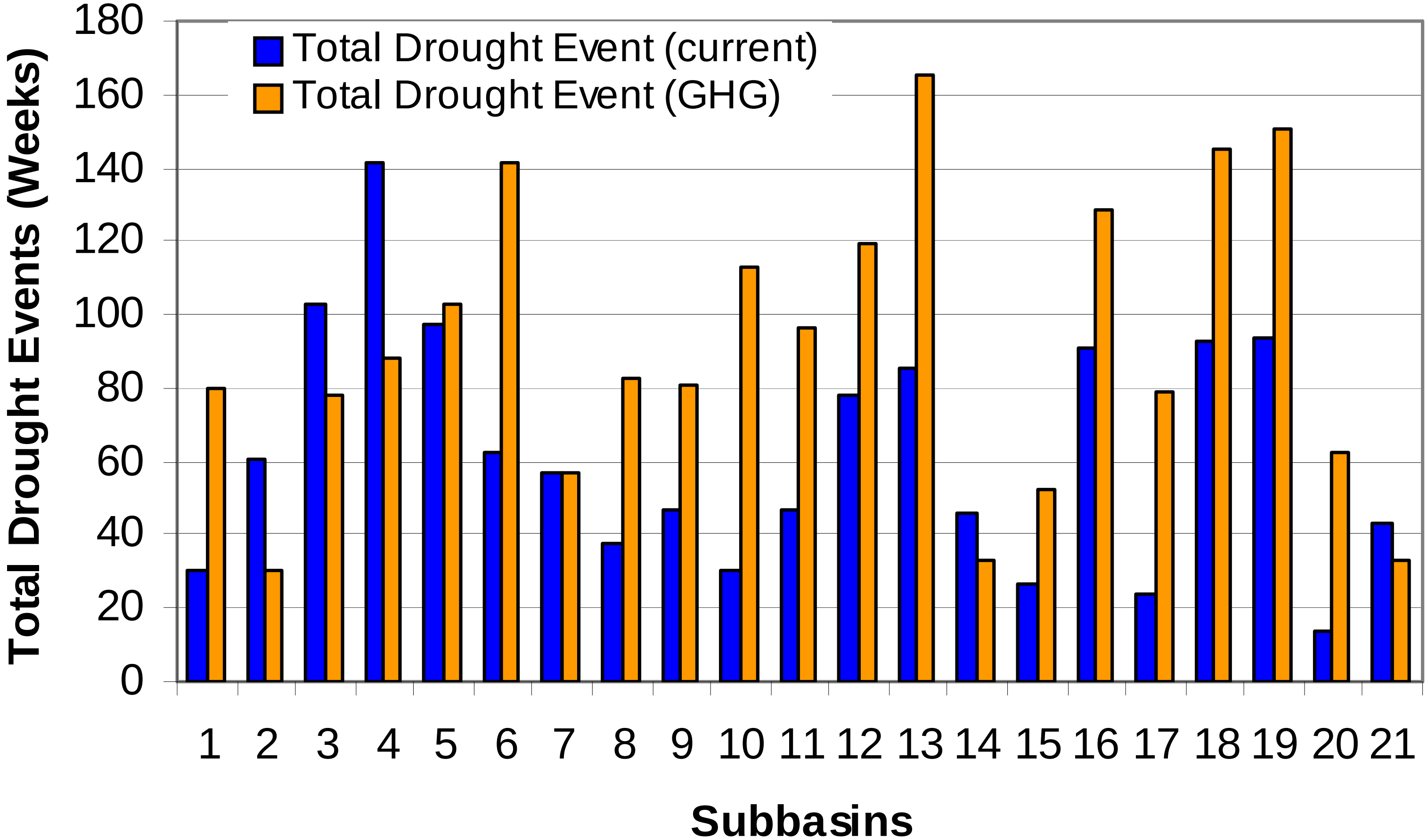
Current to GHG - Krishna Sub-basins

- Reduction in precipitation by about 20% of the current value
- Corresponding decrease in water yield over the sub-basins is varying between 30% to 50%
- Actual evapotranspiration reduced by about 5% over most of the sub-basins

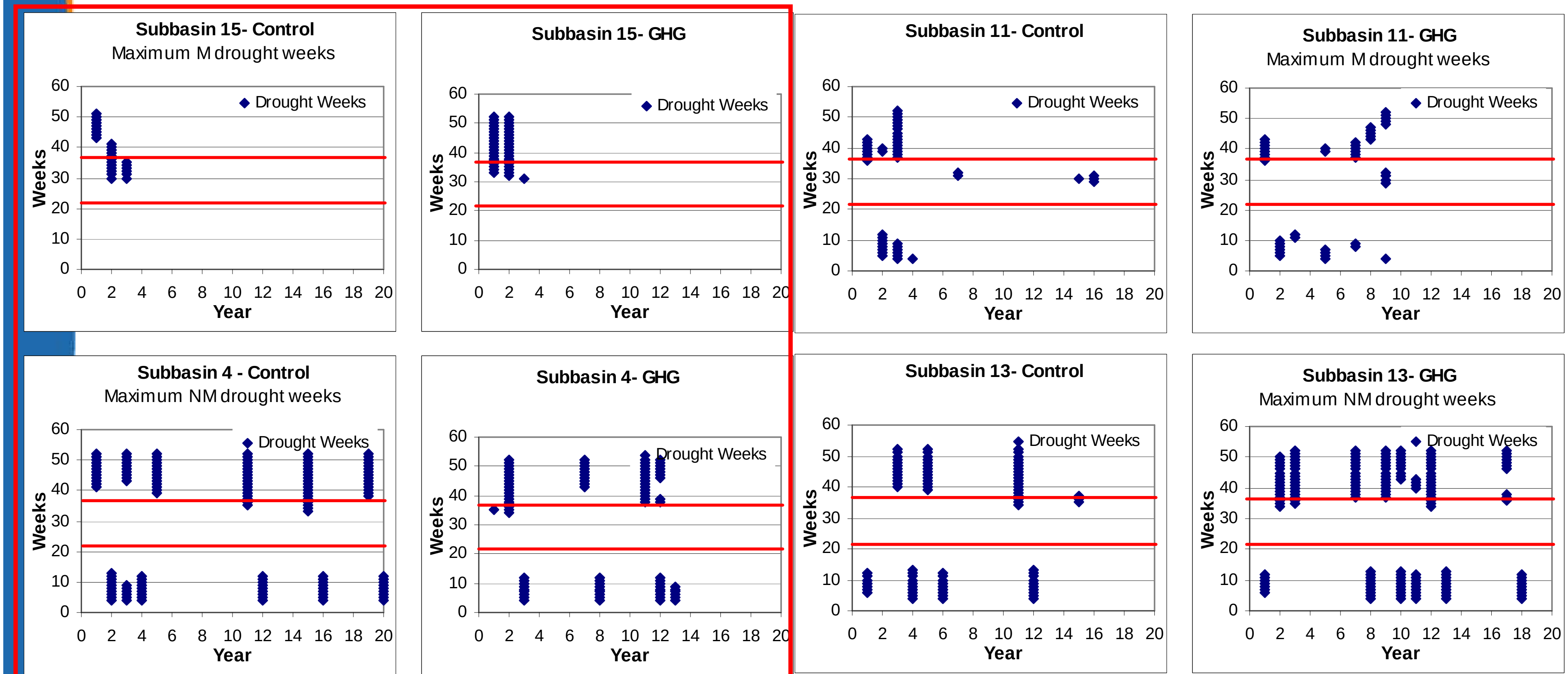
Vulnerability Assessment Procedure

- Palmer Drought Severity Index (PDSI) widely used index
  - incorporates information on rainfall, land-use, and soil properties in a lumped manner
- PDSI value
  - below 0.0 indicates the beginning of drought situation
  - A value below -3.0 as sever drought condition
- Soil Moisture Index to monitor drought severity
  - Narasiman, B., and Srinivasan, R., 2002

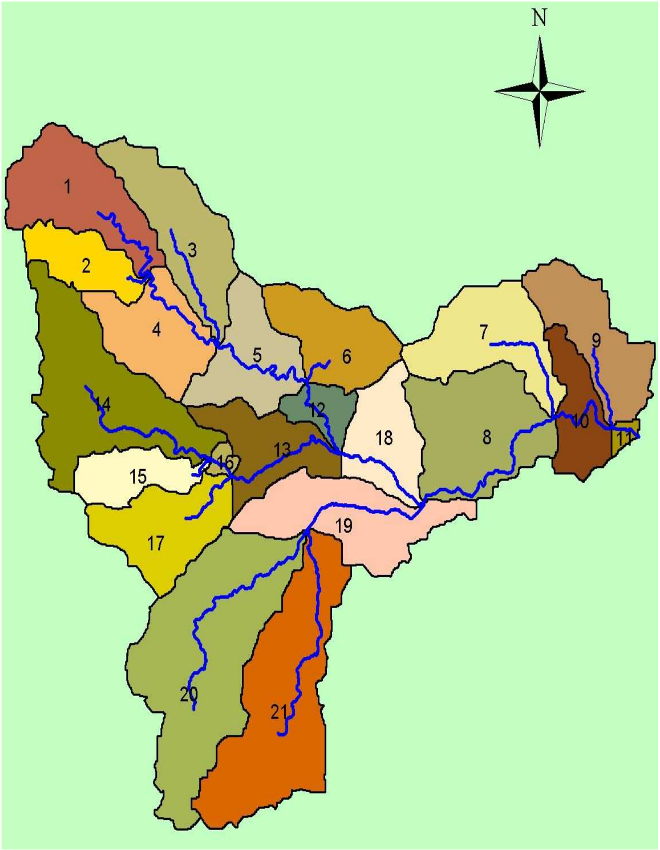
Number of drought weeks in Sub-basins of Krishna for Current to GHG scenarios

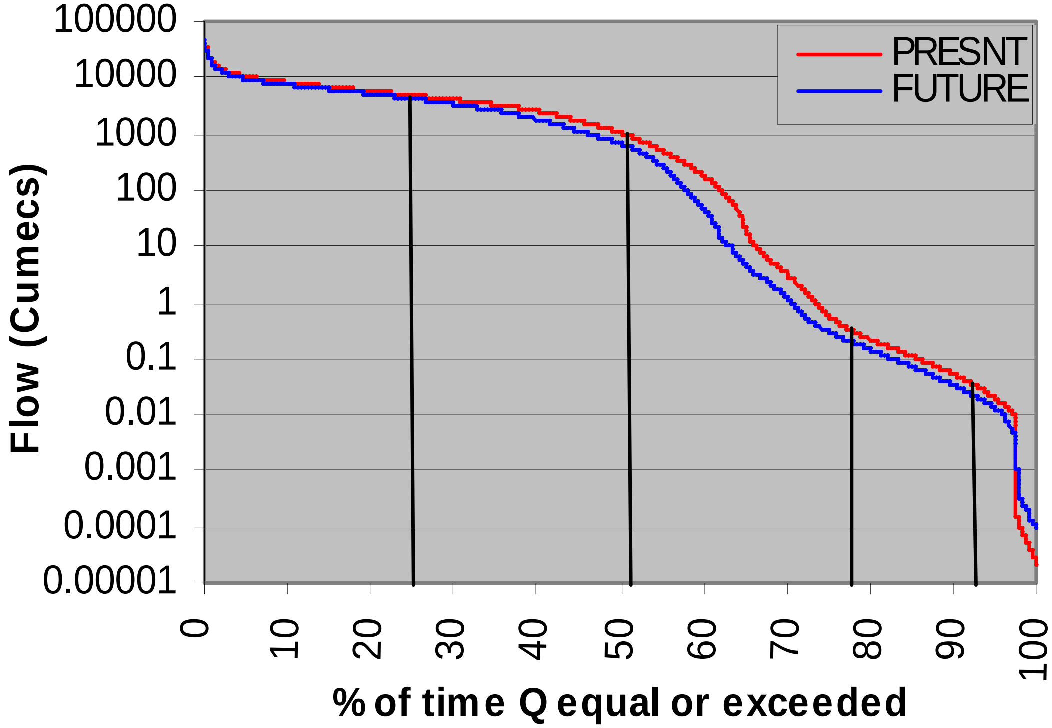


Krishna Sub-basins with maximum Monsoon & Non monsoon events



Krishna River - Flow Duration Curve





Dependable Flow (cumecs)	25%	50%	75%	90%
PRESENT	4867	1046	0.5784	0.05251
FUTURE	4261	664.8	0.2969	0.03422

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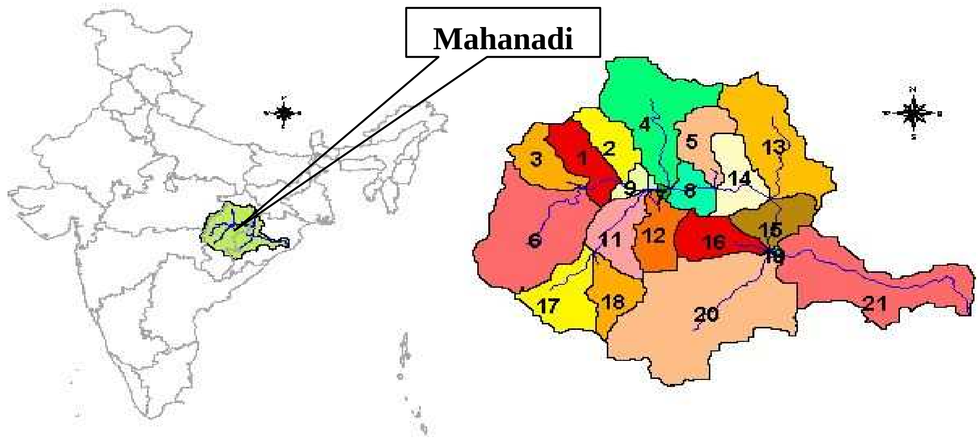
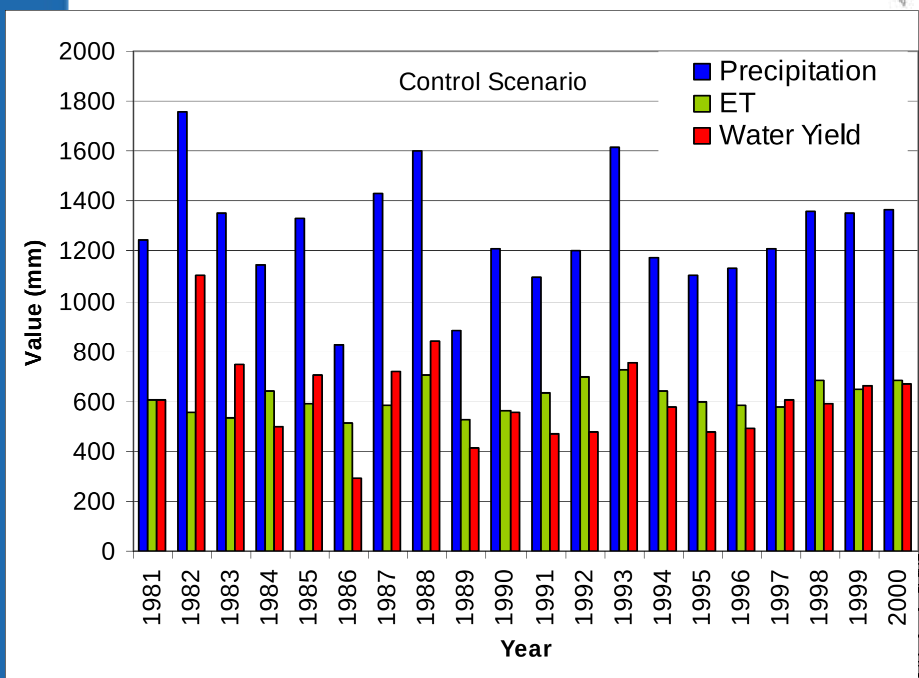
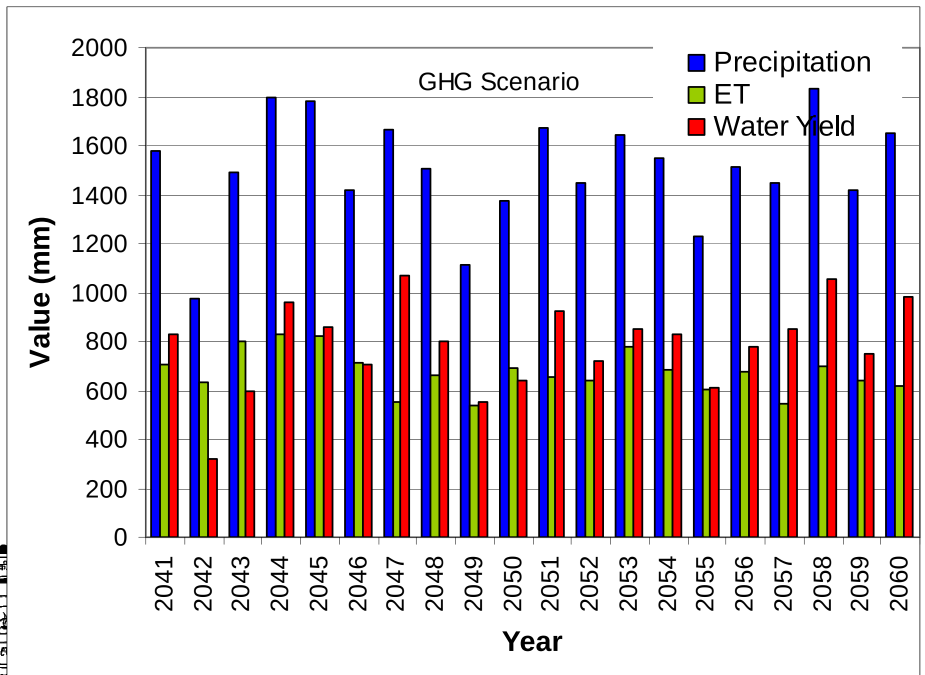
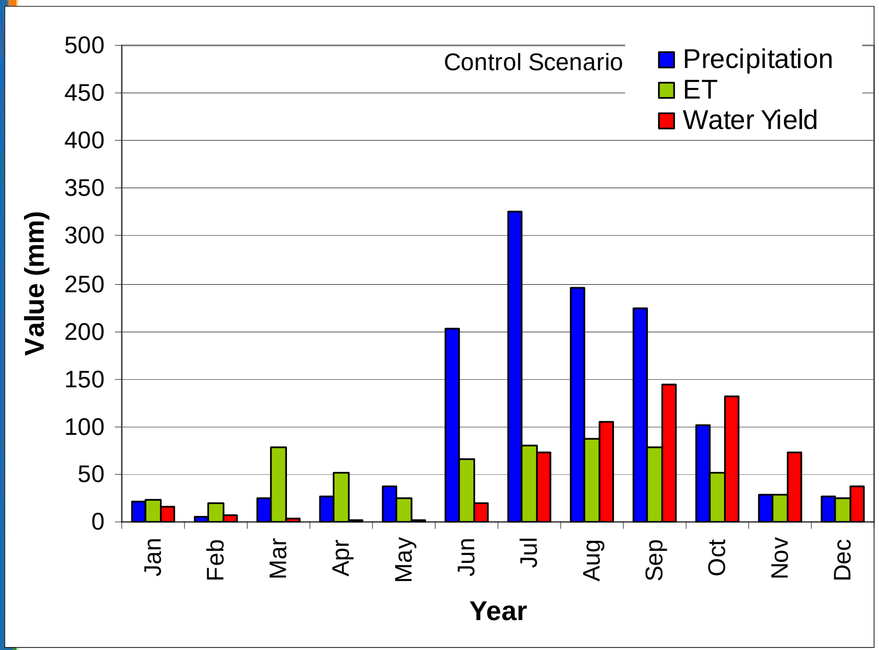
Flood Prone Basin - Mahanadi River Basin Annual water balance components

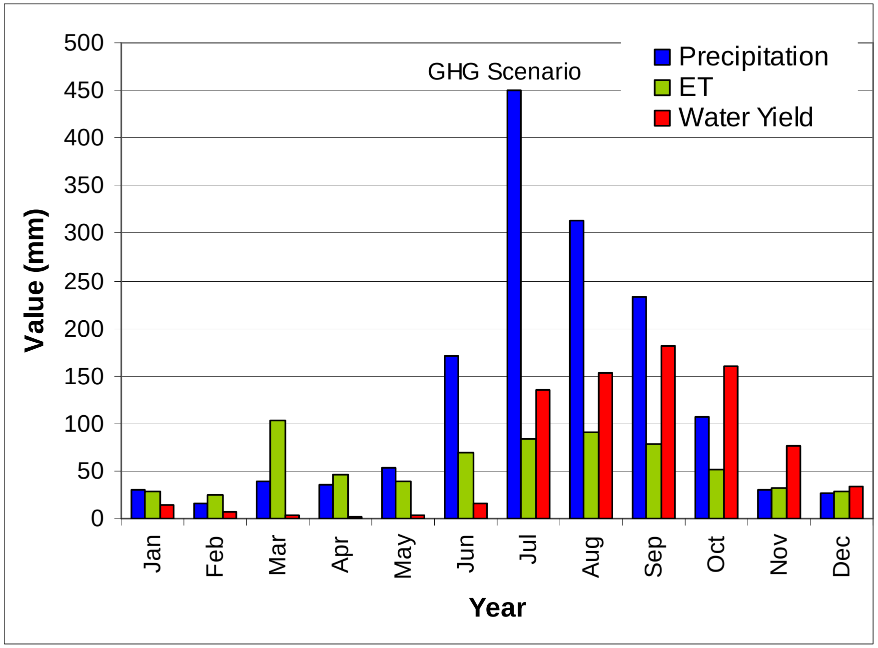




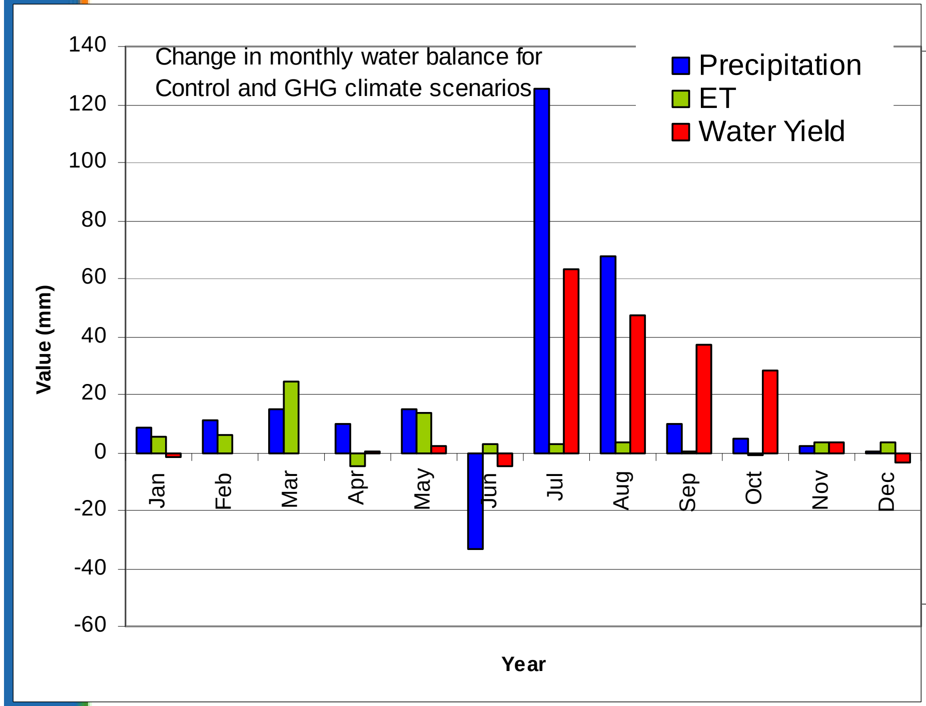


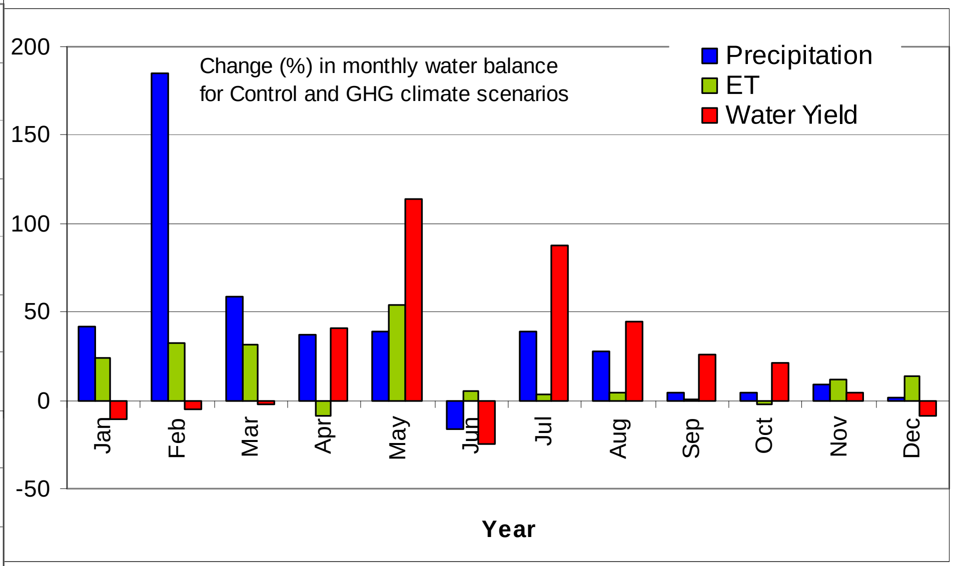
Monthly water balance components for Mahanadi river basin





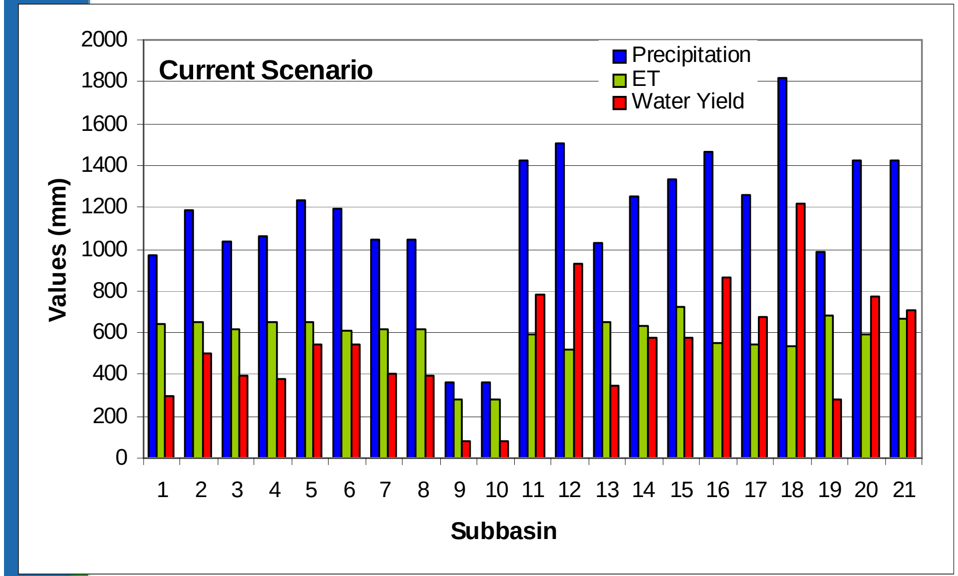
Change in Monthly water balance components for Mahanadi river basin

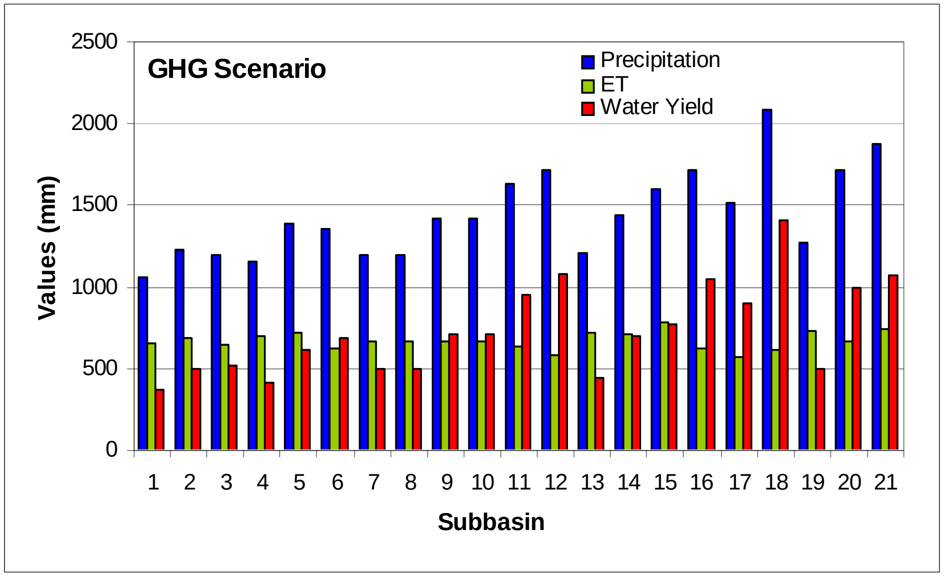




Sub-basin Water Balance components for Mahanadi River Basin

- an increase in precipitation, water yield and evapotranspiration has been predicted in all the sub-basins of Mahanadi





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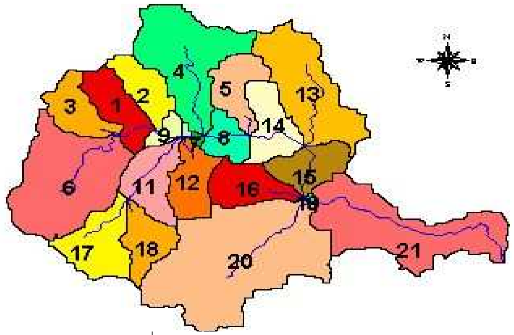
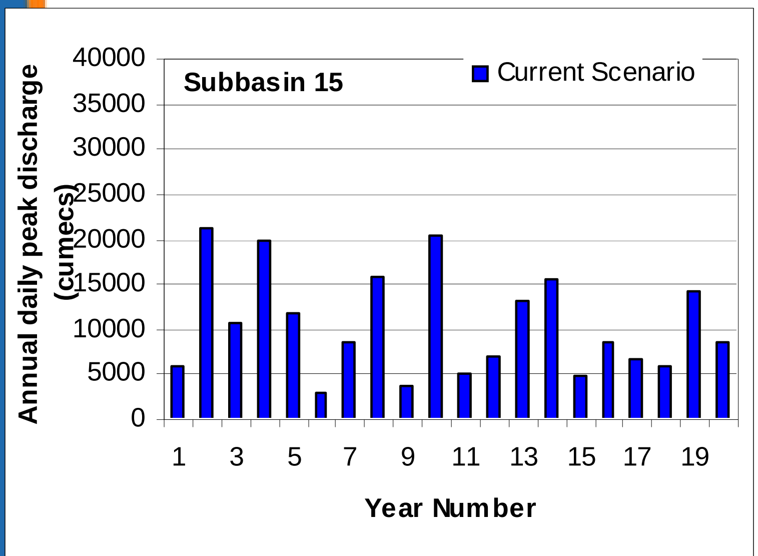
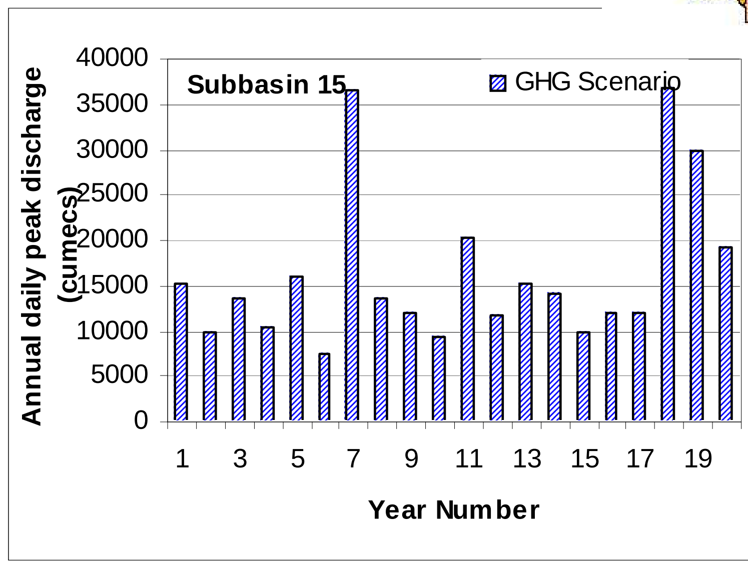
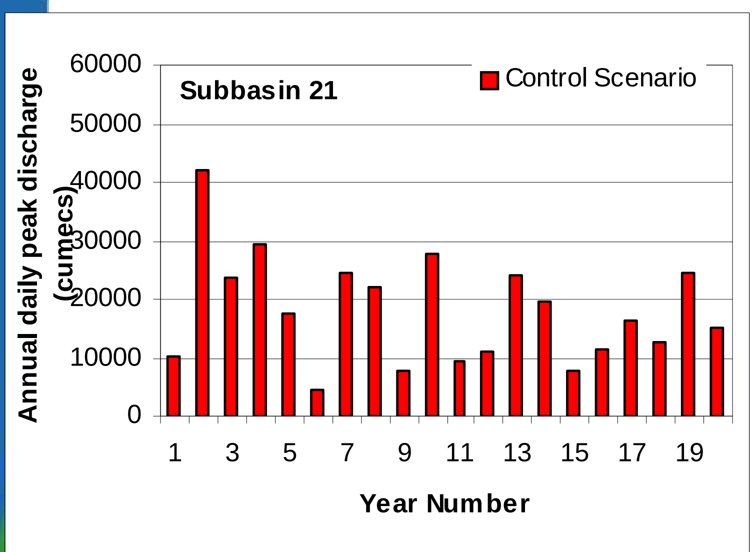
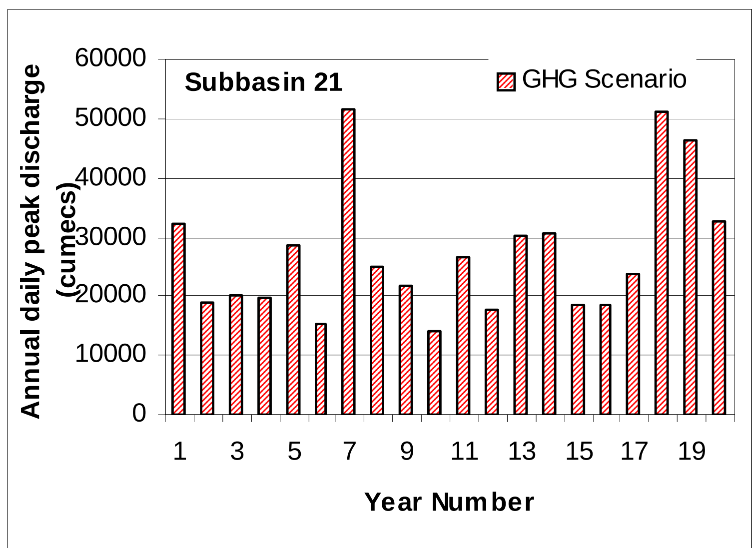
Flood Analysis - Mahanadi Basin











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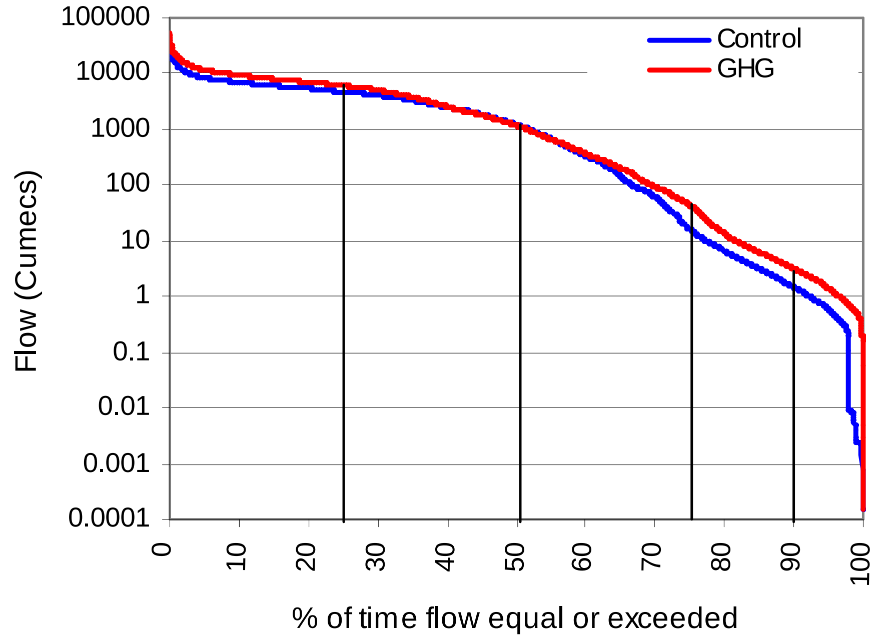
Events exceeding arbitrary thresholds in Mahanadi River Basin

Discharge (cumecs)	Control	GHG	Control	GHG
Mahanadi Subbasins	Sub15	Sub15	Sub21	Sub21
Discharge>20000	2	4	9	13
Discharge>30000	0	0	1	7

Flow Duration Curve for Mahanadi River for Control and GHG scenarios

- The flow for all the dependable levels has increased for the GHG scenario over the corresponding Current flow magnitude
- For the 50% level of dependability, the flow has marginally reduced



Dependable Flow (cumecs)	25%	50%	75%	90%
PRESENT	4716	1206	15.9	1.468
FUTURE	6103	1168	43.39	3.182

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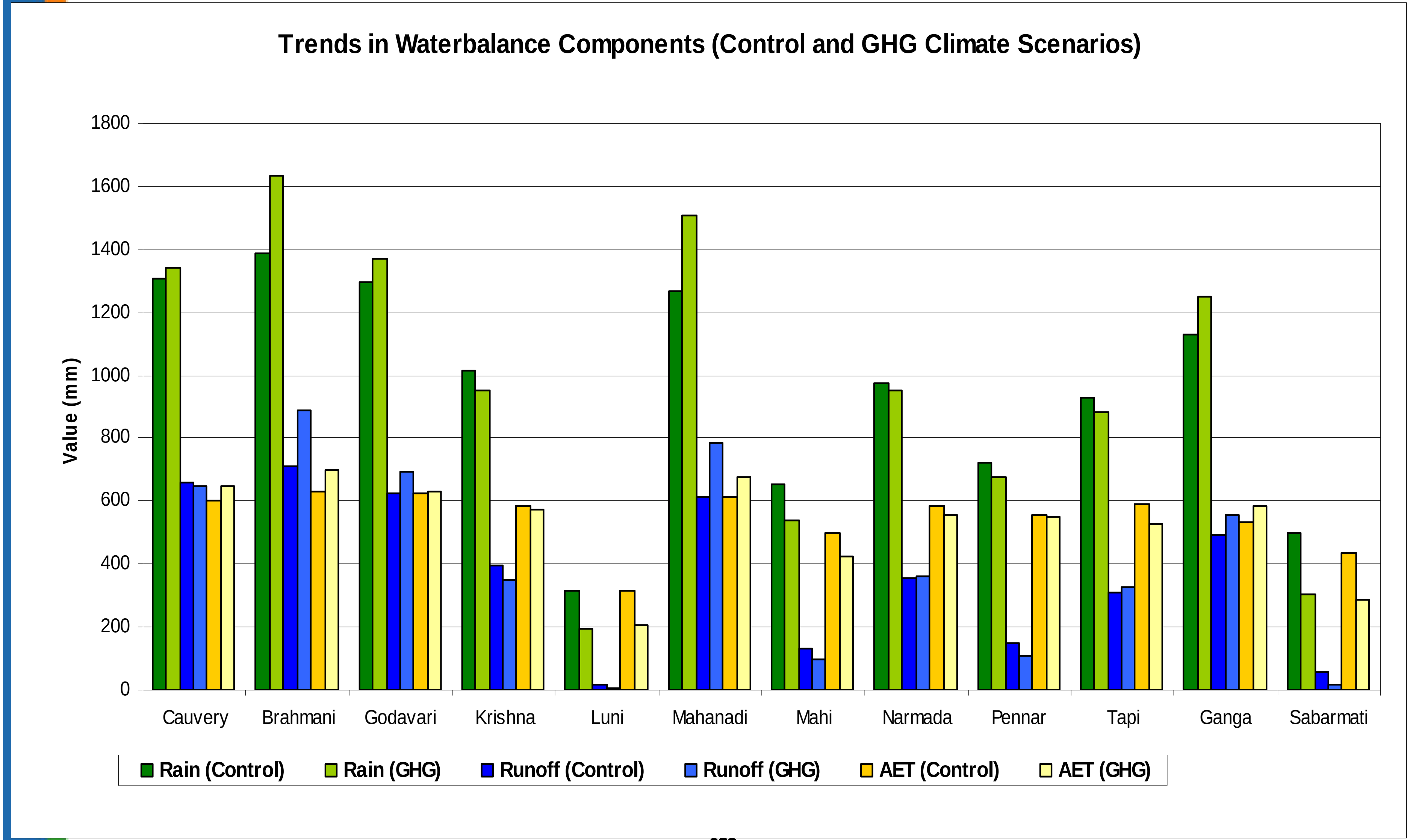
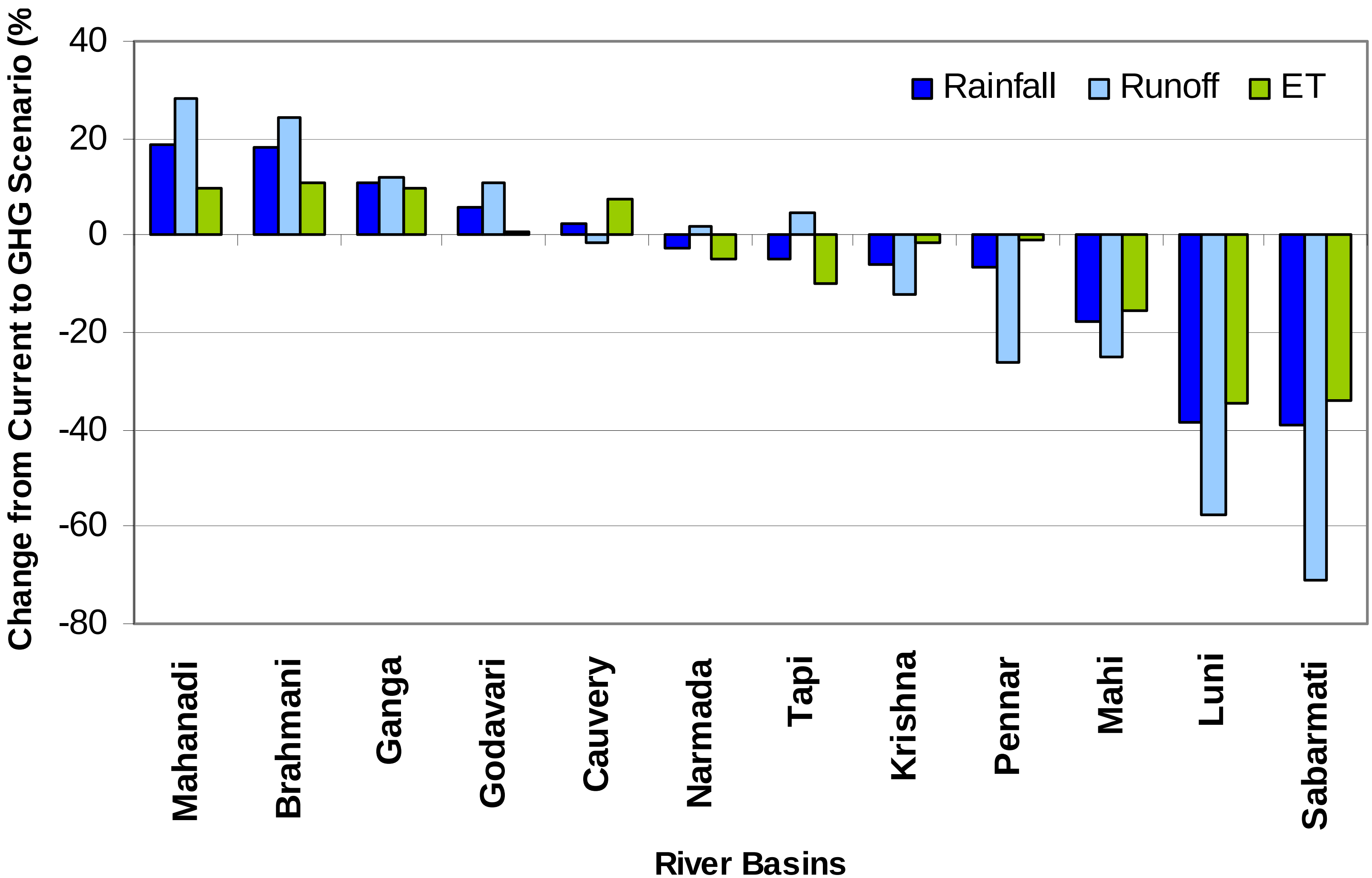
Annual mean water balance for Control and GHG climate scenarios in different river basins



Percent change in mean annual water balance for Control and GHG climate scenarios



Conclusions

- The study is the first step towards getting the realistic estimates of the possible climate change impacts across the country
- It has provided a framework to be used for integrated river basin planning and management which was missing so far
- There is lot of improvement that is desirable and is under process

Thank you