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# Climate, Water and Vulnerabilities

Climatic trend & variability in South Asia and their potential implications for peri-urban water security

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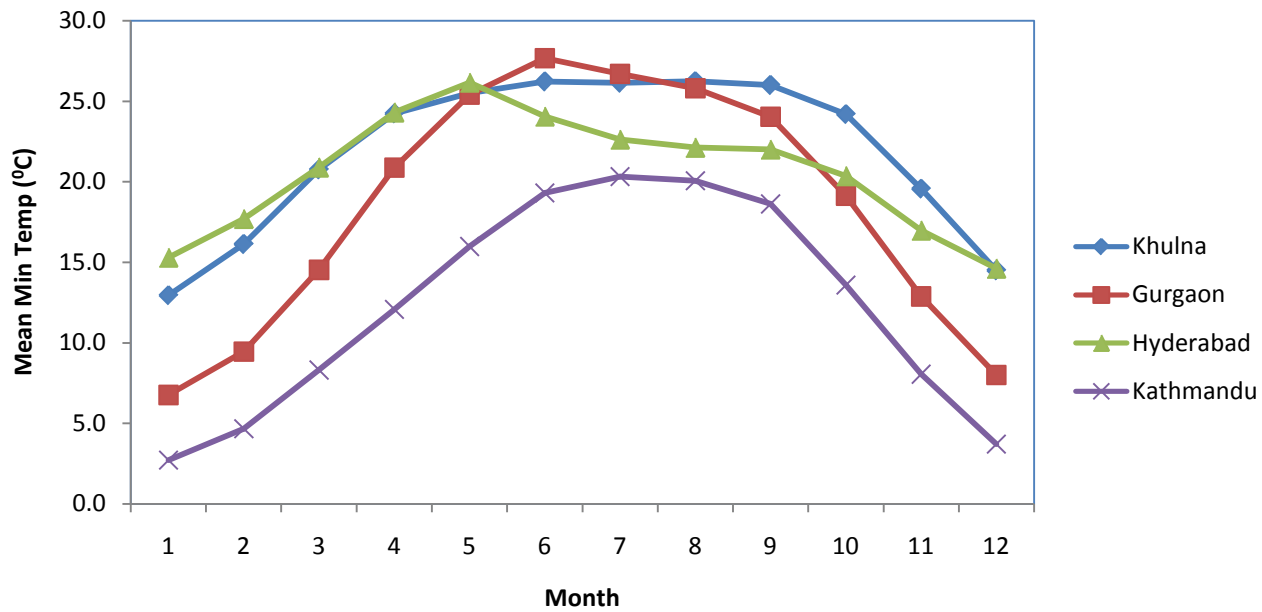
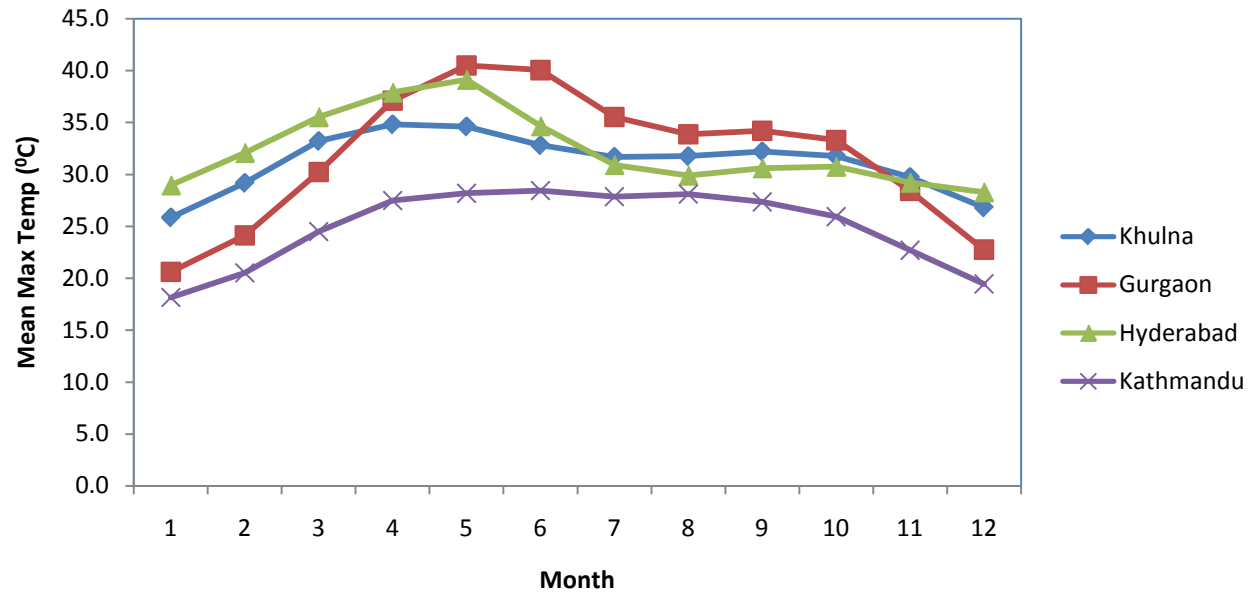
*18 June, 2013, Kathmandu*

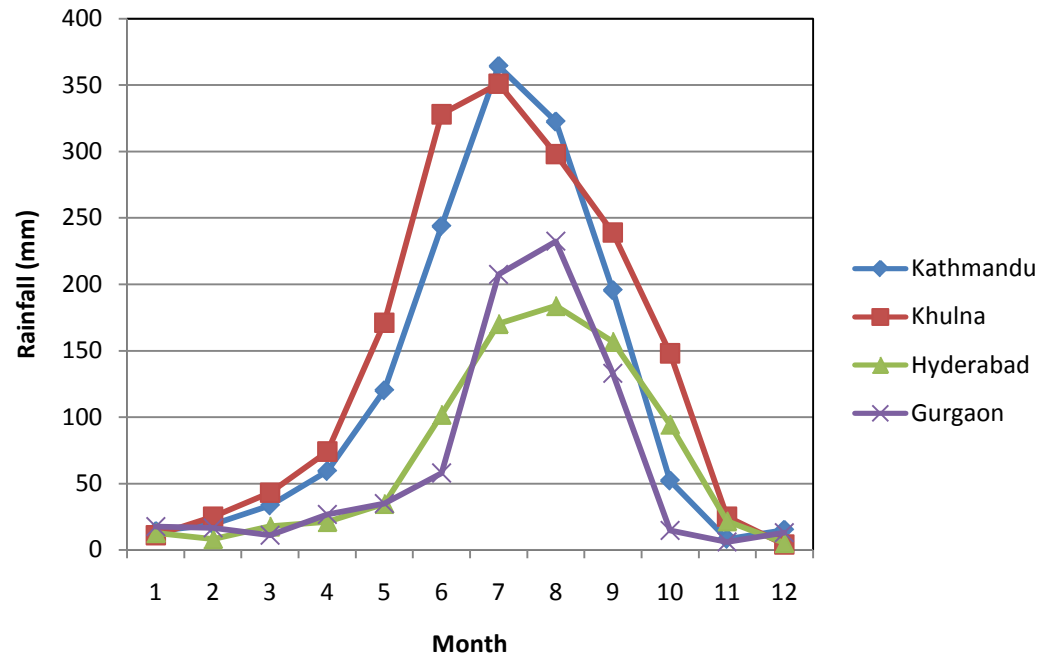
# Background of the problem

- SA is particularly vulnerable to CC because of burgeoning coastal and peri-urban population, poor environmental management, high incidence of poverty and heavy dependency on subsistence agriculture.
- Cyclone, land slide, drought, flood, etc., are the major climatic and hydrologic hazards that often jeopardize its efforts of human and economic development
- Ensuring water security for maintaining basic, livelihood and ecological services in these developing nations is particularly challenging in the event of CC.
- Peri-urban people are especially vulnerable to water insecurity due to institutional lacuna, poor environmental setting, lack of social cohesion, insecure land tenure and vulnerable livelihoods.
- Therefore, it is necessary to assess the risk associated with CC/variability
- Though projection of future climate, particularly temperature and rainfall, is available in IPCC (2007), that projection is not directly usable on spatial, temporal & uncertainty grounds.

# Peri-urban sites

Peri-urban site	Altitude (m)	Location	Climatic Zone	Climate
Khulna	1.5	Delta	Tropical	Tropical monsoon
Hyderabad	542	Plateau	Tropical	Tropical wet & dry
Kathmandu	1300	Mountain	Temperate	Subtropical mild humid/cool temperate
Gurgaon	216	Mountain edge	Temperate	Humid subtropical



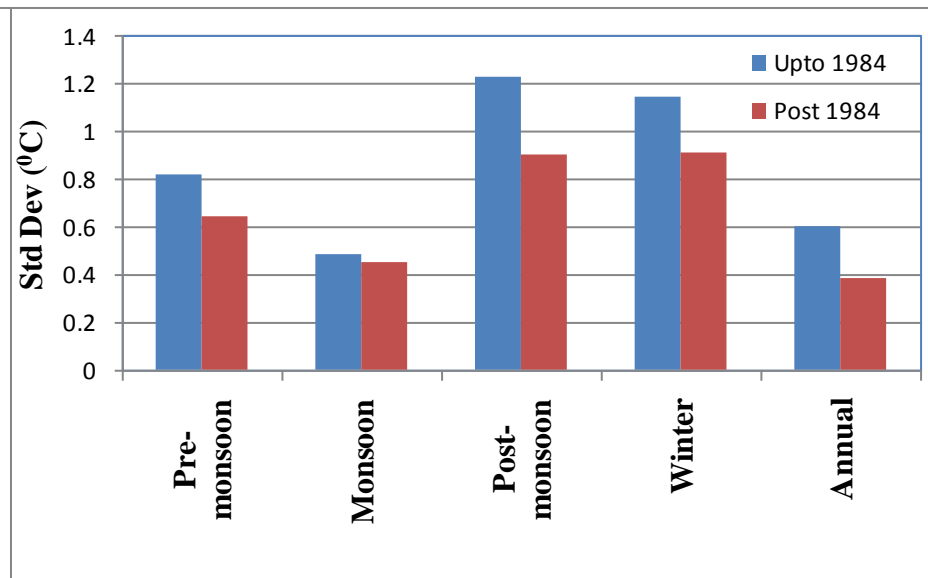
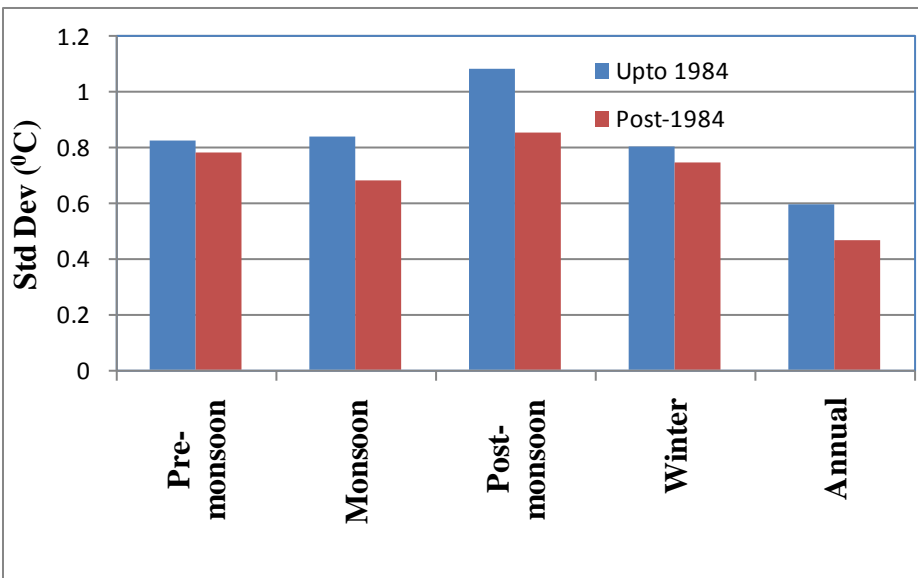
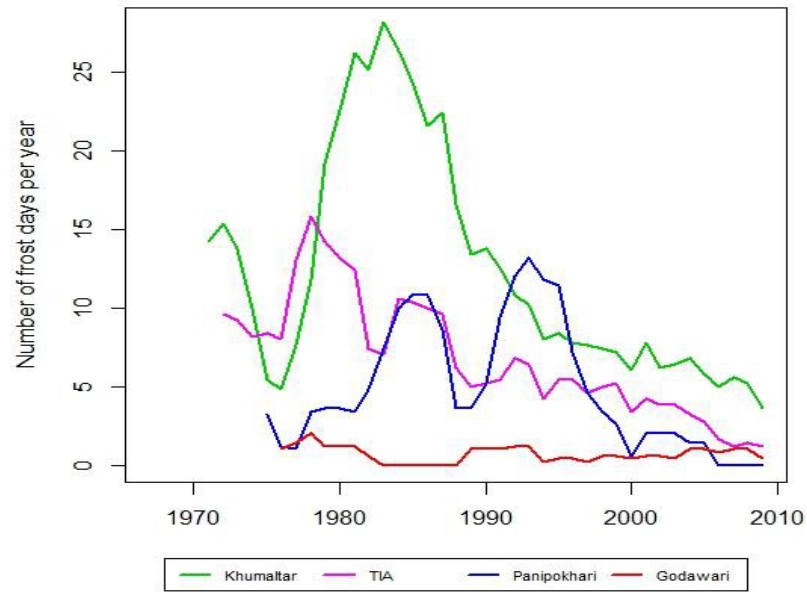
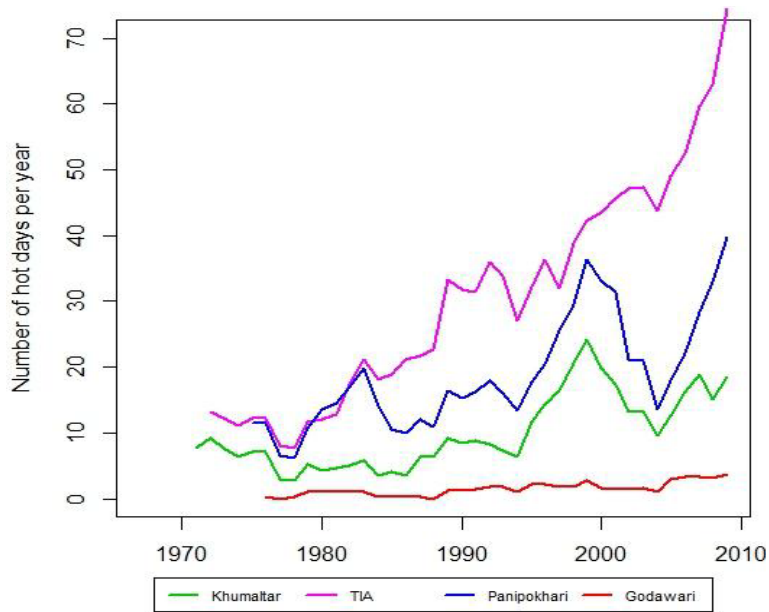


Khulna:	6 months	1717	89% (71%)	Jul
Kathmandu:	5 months	1447	86% (78%)	Jul
Hyderabad:	5 months	828	85% (74%)	Aug
Gurgaon:	3 months	773	74% (82%)	Aug

# Temperature trend & variability

Gurgaon	Hyderabad	Khulna	Kathmandu
<ul style="list-style-type: none"> <li>•Night temp</li> <li>•Both night &amp; day temp in <b>pre-monsoon</b></li> <li>•Recent trend in night temp in pre-monsoon &amp; monsoon (8<sup>0</sup>C)</li> </ul>	<ul style="list-style-type: none"> <li>•Day &amp; night temp</li> <li>•Recent trend in day temp in <b>winter</b> (6.5<sup>0</sup>C in Dec)</li> </ul>	<ul style="list-style-type: none"> <li>•Day &amp; <b>night</b> temp</li> <li>•Recent trend in night temp in <b>dry season</b> (6.7<sup>0</sup>C in Feb)</li> <li>•Heat stress (May-Oct) (+)</li> <li>•Extreme cold nights (-)</li> <li>•DTR (-)</li> </ul>	<ul style="list-style-type: none"> <li>•Day &amp; <b>night</b> temp</li> <li>•<b>Fall &amp; winter</b> seasons</li> <li>•Extreme hot days (+) &amp; cold nights (-)</li> <li>•Urban heat island</li> </ul>

**Kathmandu** has the highest trend among the four sites. Trends in mean & intra-year variability have **opposite directions**. Inter-year **variability (-)**.



# Rainfall trend & variability

Gurgaon	Hyderabad	Khulna	Kathmandu
Clearly decreasing	Increasing	Clearly increasing <ul style="list-style-type: none"> <li>•No. of rainy days, maximum no. of consecutive rainy days (+)</li> <li>•Maximum rainfalls in 1, 3 &amp; 7 days (+)</li> <li>•Extreme rainy days (+)</li> </ul>	No clear signal <ul style="list-style-type: none"> <li>•Extreme rainy days (+)</li> </ul>

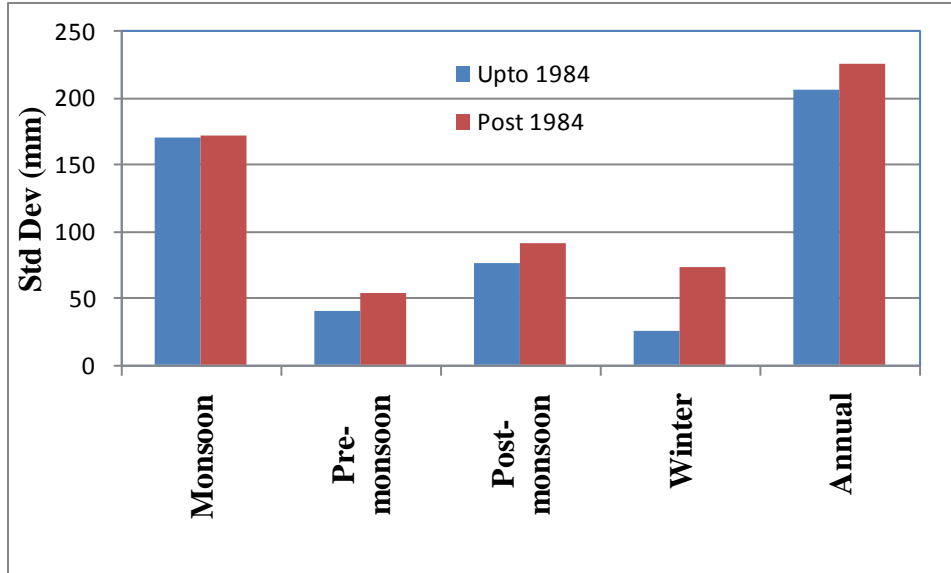
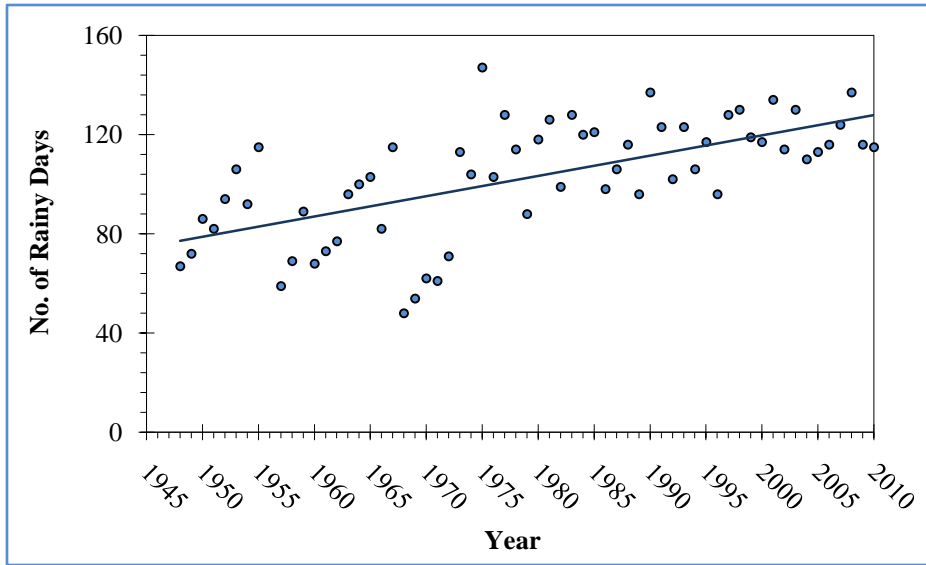
The site with highest rainfall shows highest increasing tendency and lowest rainfall highest decreasing tendency.

Khulna & Kathmandu rains give an indication of weakening of the monsoon at its beginning.

There is no evidence so far from any site for a decrease in the dry/winter season rainfall.

Inter-year **variability (+)**; Intra-year variability (+) except at Gurgaon.





## Trends in other variables

Gurgaon	Khulna
<ul style="list-style-type: none"><li>• RH (-)</li><li>• E (+)</li></ul>	<ul style="list-style-type: none"><li>• <b>SSH</b> (-) <b>RH</b> (+) particularly in winter &amp; post-monsoon</li><li>• <b>E</b> (-) <b>ET<sub>0</sub></b> (-)</li><li>• <b>HTL</b> (+) 7-18 mm/year</li></ul>

# Potential implications for peri-urban water security

Gurgaon	Hyderabad	Khulna	Kathmandu
<ul style="list-style-type: none"> <li>• ET &amp; water demand (+)</li> <li>• Water availability (-)</li> <li>• GWT (-)</li> <li>• Input cost (+)</li> <li>• Wheat yield (-)</li> <li>• Pest attacks (+)</li> <li>• Conflicts on scarce water resources (+)</li> <li>• Human comfort and health</li> </ul>	<ul style="list-style-type: none"> <li>• ET &amp; water demand (+)</li> <li>• Water availability (-)</li> <li>• Cropping practices &amp; productivity</li> <li>• Change in occupation</li> <li>• Prices (+)</li> <li>• Flood (+)</li> <li>• Heat stress for young children &amp; adult migratory laborers</li> </ul>	<ul style="list-style-type: none"> <li>• Domestic water demand (+)</li> <li>• GW recharge (-)</li> <li>• Stress of women (+)</li> <li>• Cyclonic disasters (+)</li> <li>• Water logging &amp; flooding (+)</li> <li>• Damp weather may increase pests</li> <li>• Discomfort &amp; diseases (+)</li> </ul>	<ul style="list-style-type: none"> <li>• Natural spring sources adversely affected due to rainfall variability</li> <li>• GWT (-)</li> <li>• GW recharge (-)</li> <li>• Pest attacks (+)</li> </ul>

## Local perception in context

- Consistent with secondary data
- Some people reported a decreasing trend in rainfall
  - Distance of peri-urban locations
  - Increase in water insecurity
- The perception of a changing climate is more among the poorer social groups.
- There is a variation in the perception between male & female, and with the rate of urbanization.