Downscaling of Climate Data for Local Governments in Kerala

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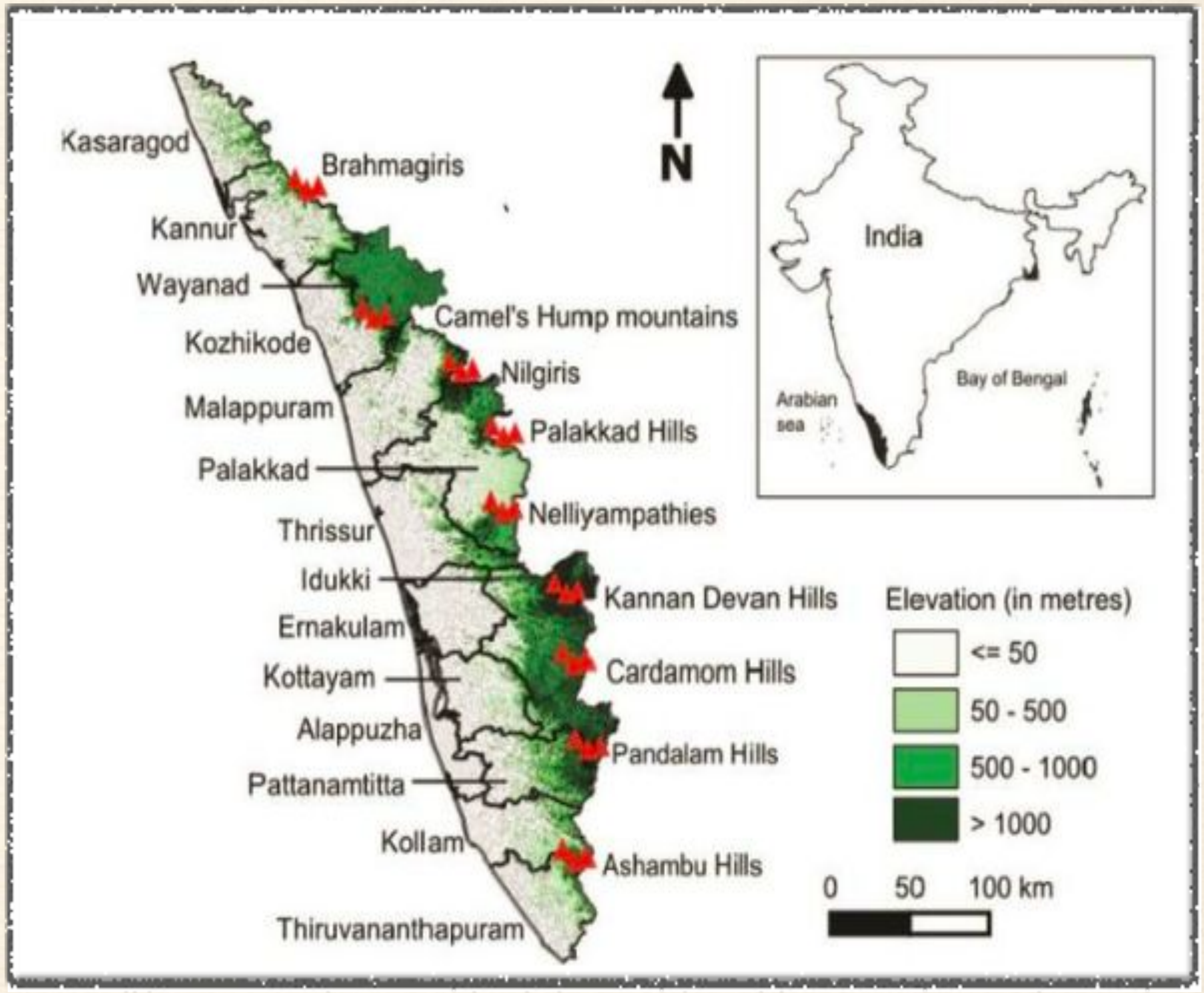
Kerala

- South west coastal State
- Gateway to Monsoon
- Multi-hazard prone state
- 1.18% of Indian landmass
- Area : 38863 km^2
- Coastal line : 592. 9 km
- Width : 30 km to 120 km
- Population density: 860/km^2
- Districts: 14
- Local Self Government: 1034



Kerala's Vulnerabilities

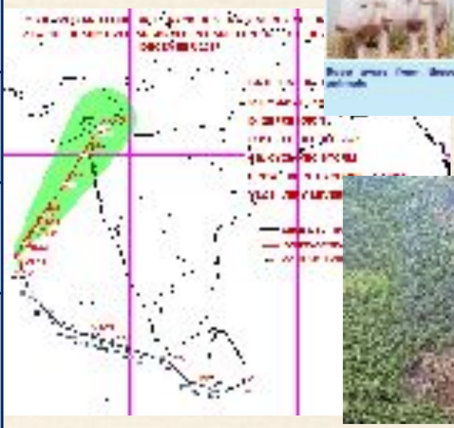
1	Natural Hazards	Flood (Riverine, Urban and Flash Floods)
2		Landslides (includes debris flows, rock fall, rock avalanche, rock slide, landslips and mud slips)
3		Drought
4		Coastal hazards (High waves, Storm surges, Kallakadal, Tsunami, Salt Water Intrusion, Coastal erosion)
5		Wind (Cyclone, Gustnados, Gusty winds)
6		Lightning
7		Earthquakes
8		Human epidemics
9		Plant disease epidemics and pest attack on crops
10		Avian epidemics
11		Animal epidemics
12		Pest attack of human habitations
13		Forest Fire
14		Meteorite/asteroid impacts
15		Soil Piping
16		Heat wave/sunburn/sunstroke
17		Natural background radiation

Kerala’s Vulnerabilities

1	Anthropogenic Hazards	Stampedes
2		Fire cracker accidents
3		Petro-chemical transportation accidents
4		Industrial accidents
5		Dam break
6		Dam spillway operation related floods & accidents
7		Oil spill
8		Road accidents involving civilian transport vehicles
9		Human induced forest fire
10		Human-animal conflicts
11		Fire accidents in buildings and market places
12		Boat capsizing
13		Accidental drowning
14		Building collapse
15		Hooch accident
16		Air accidents
17		Rail accidents
18		Terrorism, riots and Naxalite attacks
19		Nuclear and radiological accidents
20		Space debris impacts
21		Biological accidents
22		Occupational hazards
23		Accidents in Armed Forces premises

Recent disaster events in Kerala

Event	Year	Damage/Fatality
Drought	2012-13	₹23.78 billion
Drought	2016	₹9.93 billion
Cyclone Ockhi	2017	142 fatalities
Nipha Virus	2018	17 fatalities
Floods & Landslides	2018	451 fatalities
Floods & Landslides	2019	125 fatalities
Covid19	2020…	64,466 fatalities
Landslides	2020	69 fatalities
Air Crash	2020	18 fatalities
Landslides	2021	27 fatalities
Nipha Virus	2023	2 fatalities



Relevance

- In order to mitigate the increasing number of climate change-driven disasters in Kerala, adaptation initiatives must be undertaken at the grassroots level.

- It is essential to consider disaster risks and potential climate change scenarios in long term and short term development plans.

- To achieve this, local government entities must have access to information about climate change.

Data

Observational data

Varaibles	Source	Spatial resolution	Temporal resolution
Precipitation	IMD	0.25° × 0.25°	Daily
Maximum temperature	IMD	1° × 1°	Daily
Minimum temperature	IMD	1° × 1°	Daily

Downscaled model data

Varaibles	Source	Spatial resolution	Temporal resolution
Precipitation	CORDEX	0.5° × 0.5°	Monthly
Maximum temperature	CORDEX	0.5° × 0.5°	Monthly
Minimum temperature	CORDEX	0.5° × 0.5°	Monthly

Period

Historical : 1976-2005

Future: Near term (2021-2040)

Medium term (2041-2060)

Long term (2061-2099)

Seasons

JF

MAM

JJAS

OND

Annual

Climate Scenarios

RCP 4.5

RCP 8.5

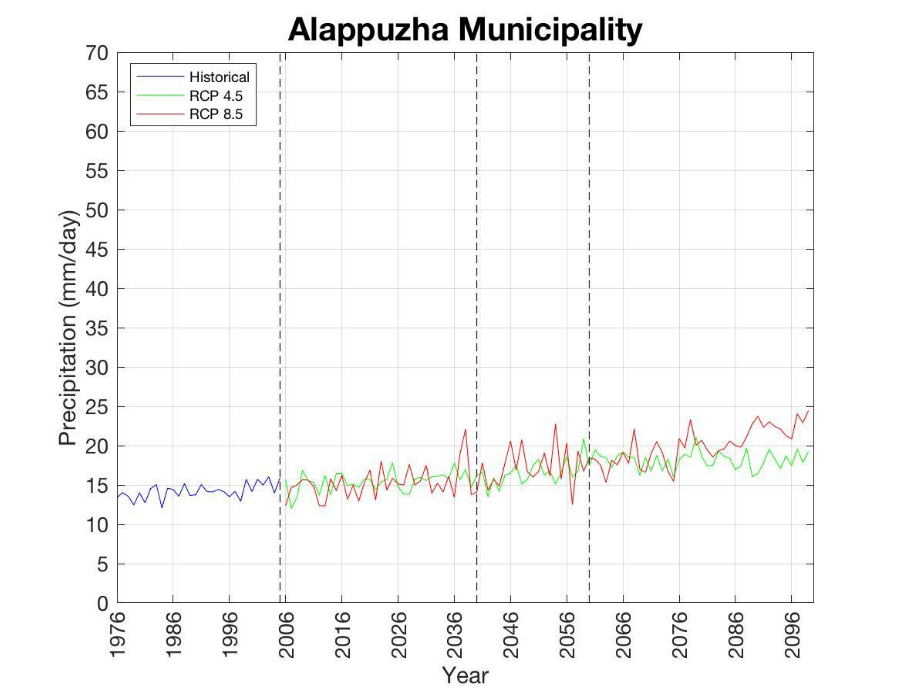
CORDEX Simulation	Regional Climate Model	Variables
CNRM-CERFACS-CNRM-CM5	SMHI-RCA4	Precipitation
NOAA-GFDL-GFDL-ESM2M	SMHI-RCA4	Precipitation Max Temperature Min temperature
IPSL-CM5A-MR	SMHI-RCA4	Precipitation Max Temperature Min temperature
NCC-NorESM1-M	SMHI-RCA4	Precipitation Max Temperature Min temperature
CCma-CanESM2	SMHI-RCA4	Max Temperature Min temperature
MIROC-MIROC5	SMHI-RCA4	Max Temperature Min temperature
CNRM-CERFACS-CNRM-CM5	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
IPSL-IPSL-CM5A-LR	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
CCma-CanESM2	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
CSIRO-QCCCE-CSIRO-MK3-6-0	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
NOAA-GFDL/GFDL-ESM2M	IITM-RegCM4-4	Precipitation Max Temperature Min temperature
MPI-M-MPI-ESM-MR	IITM-RegCM4-4	Precipitation Max Temperature Min temperature

Source: https://esgf-node.ipsl.upmc.fr/search/cordex-ipsl/

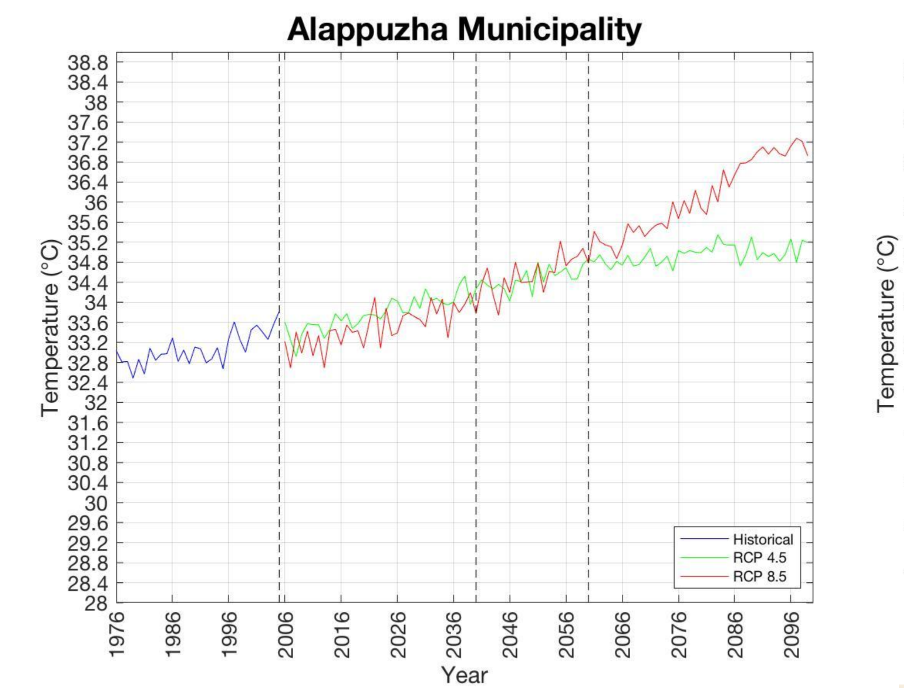
Methodology

Time Series of precipitation, maximum temperature and minimum temperature

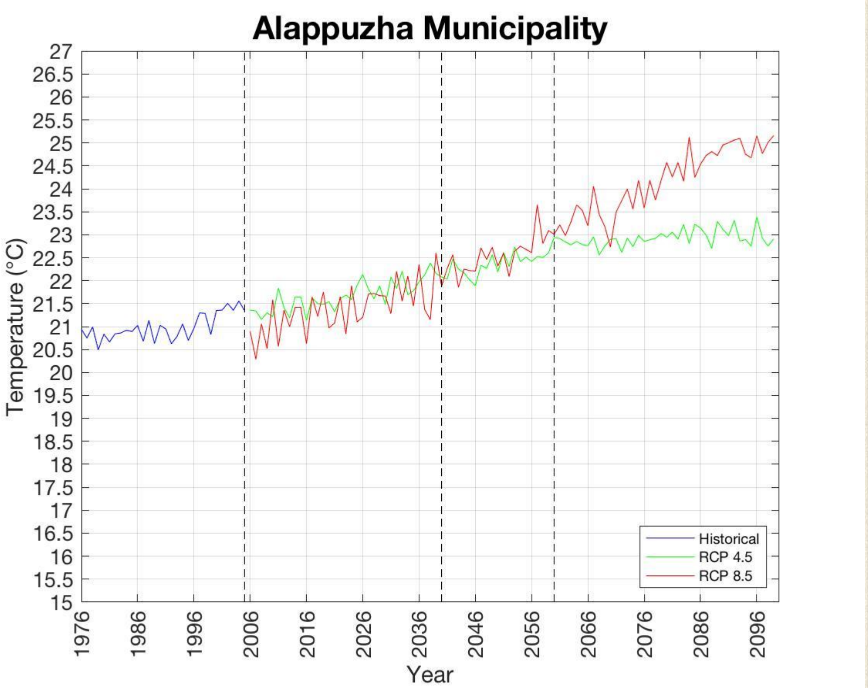
Precipitation (JJAS)



Max Temperature (MAM)



Min Temperature (JF)

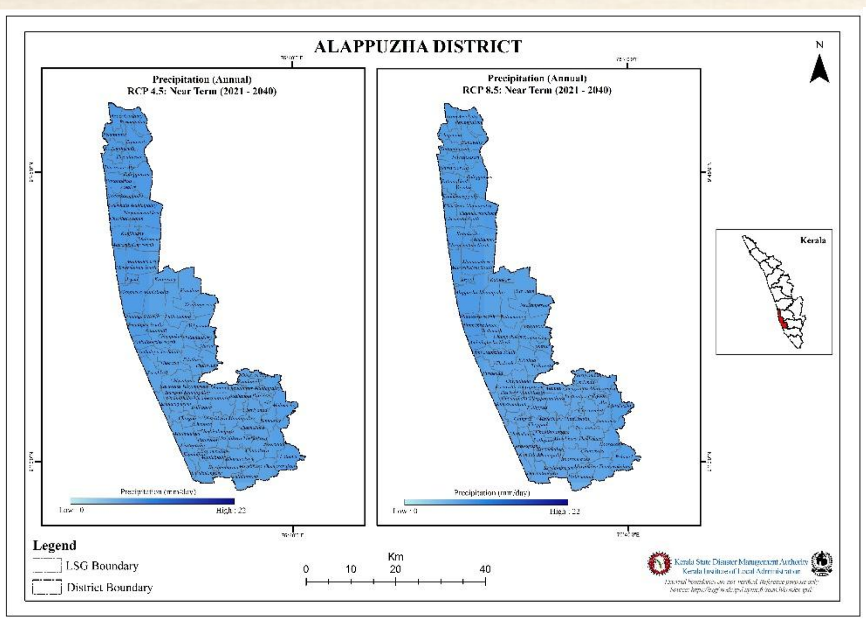


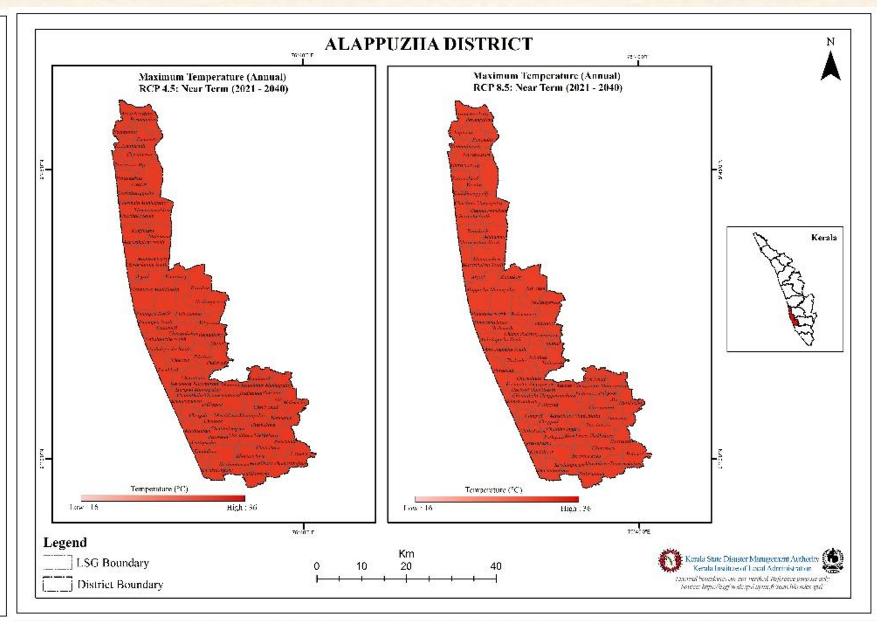
Methodology

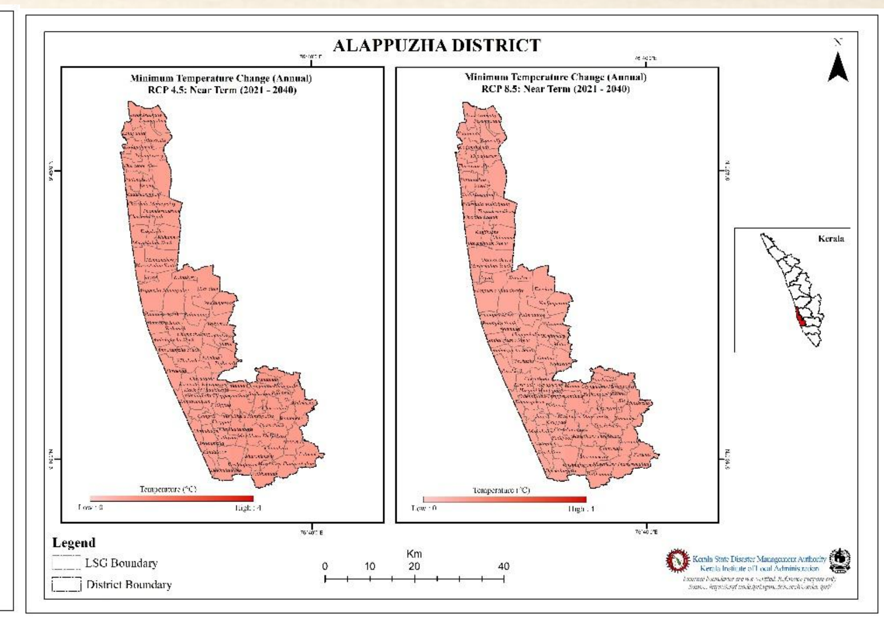
- Mean value of maximum temperature/ minimum temperature/ precipitation for each season -1034 LSGs

- Change in maximum temperature/ minimum temperature/ precipitation in near term/medium term/long term from historic period

- Available at KSDMA website: [Climate Change Information for Local Governments – Kerala State Disaster Management Authority]





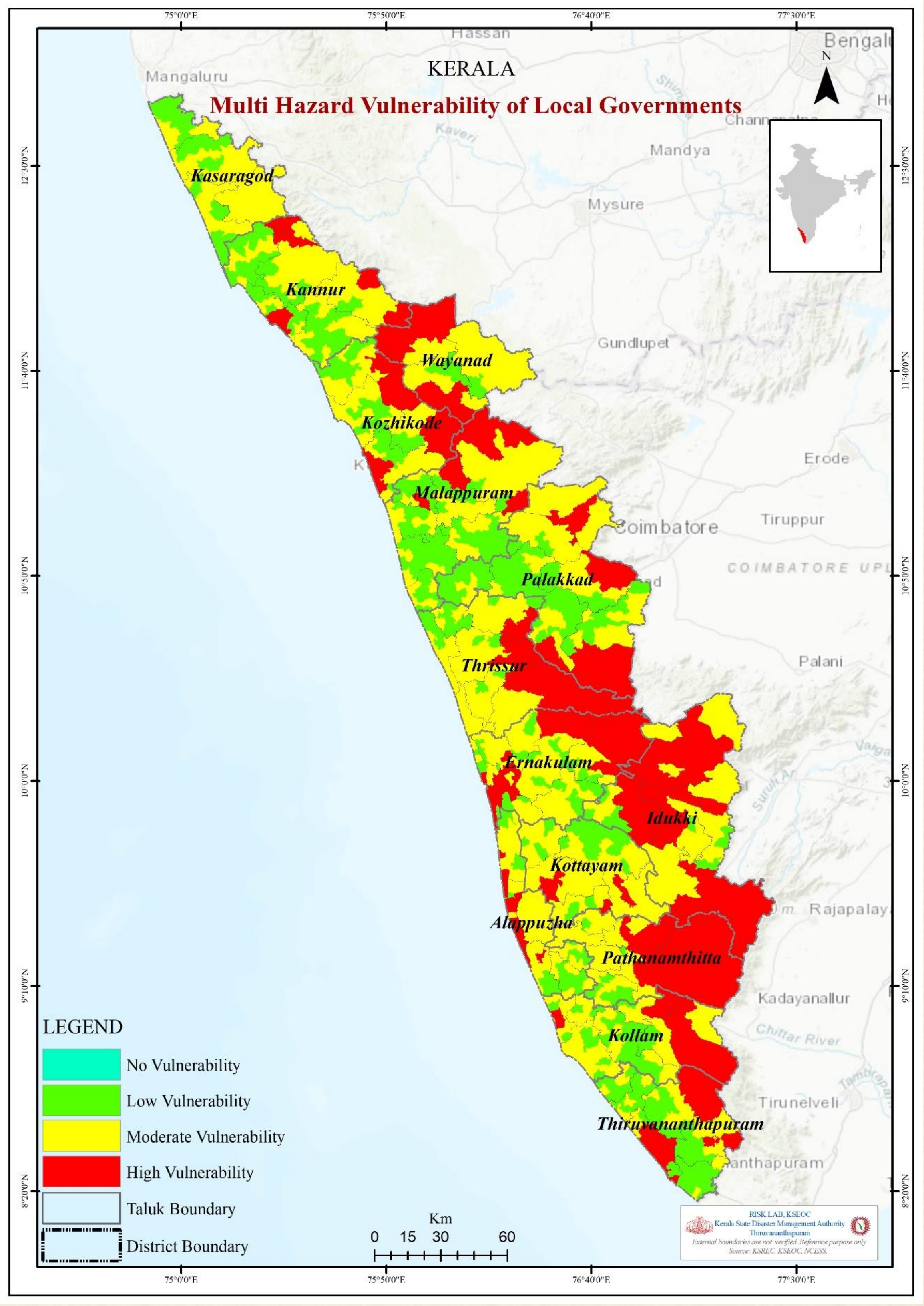


Methodology

- Prioritize the LSGs based on

1. Multi hazard Vulnerability index

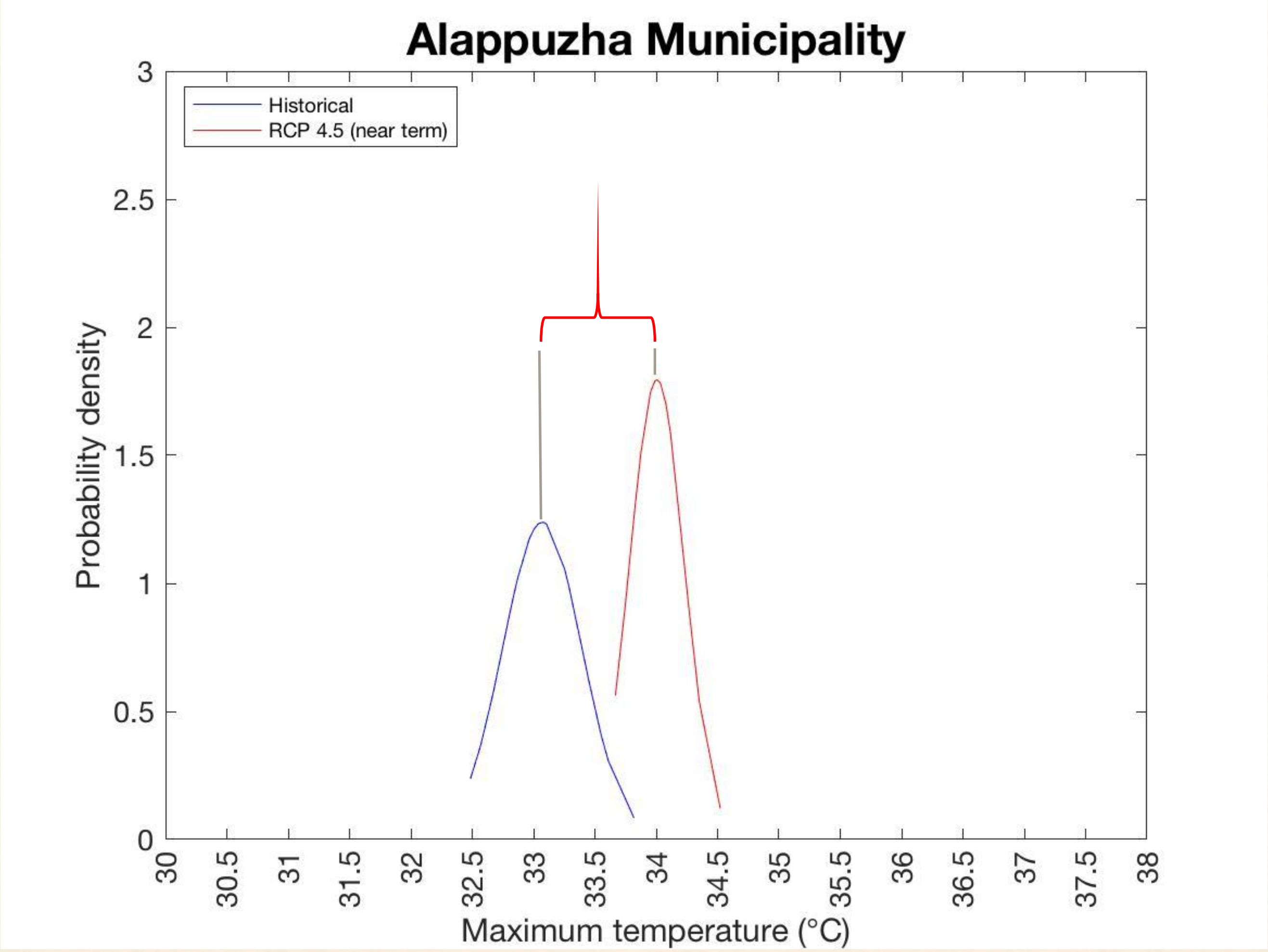
   - High – 95 LSGs
   - Moderate – 560 LSGs
   - Low – 379 LSGs



Methodology

- Prioritize the LSGs based on

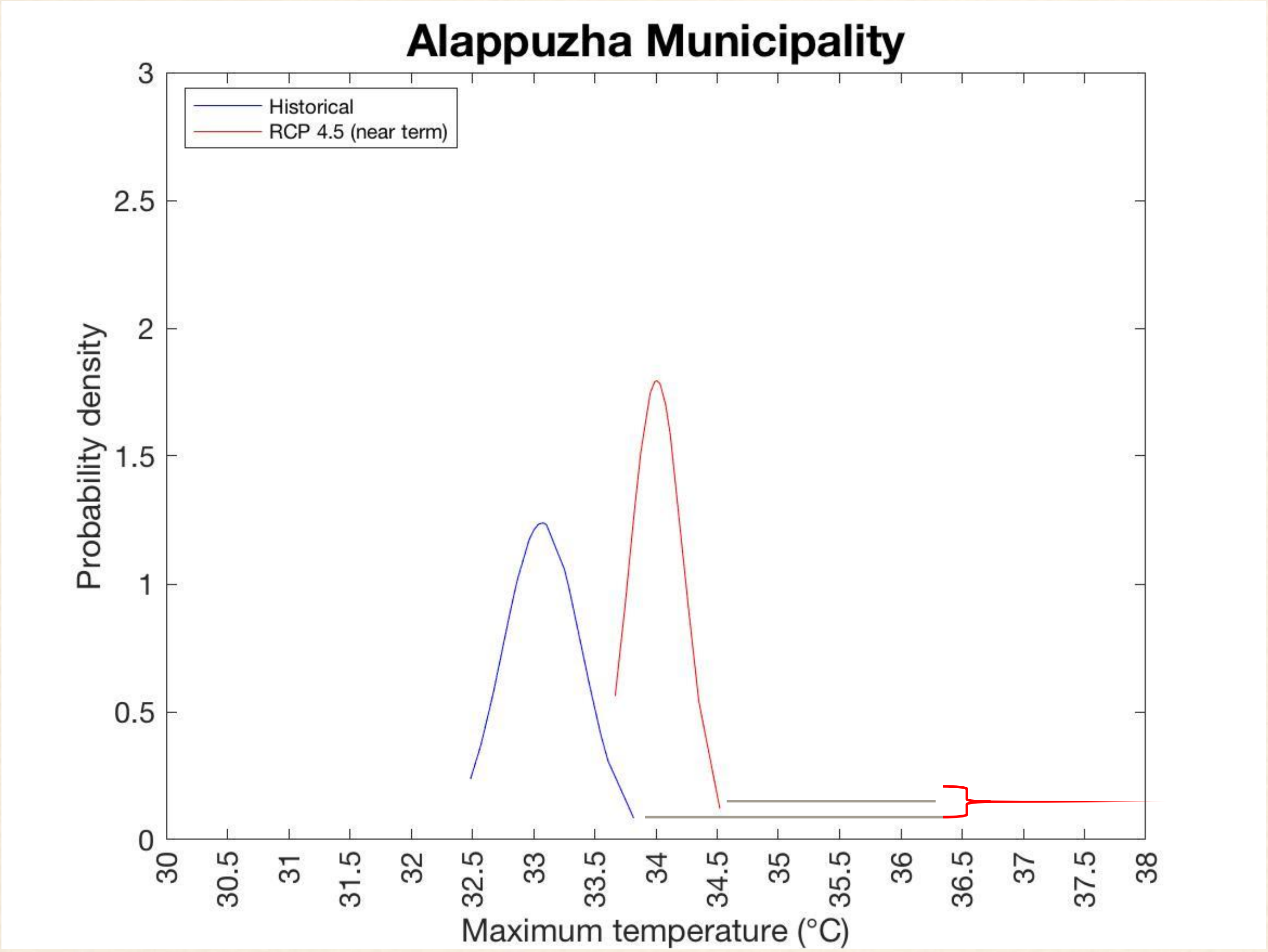
2. Difference between the value (temperature/precipitation) with maximum probability to occur in the near term (2021-2040) and historic period.



Methodology

- Prioritize the LSGs based on

3. Difference between the probability of occurrence of extreme events in the near term (2021-2040) and historic period

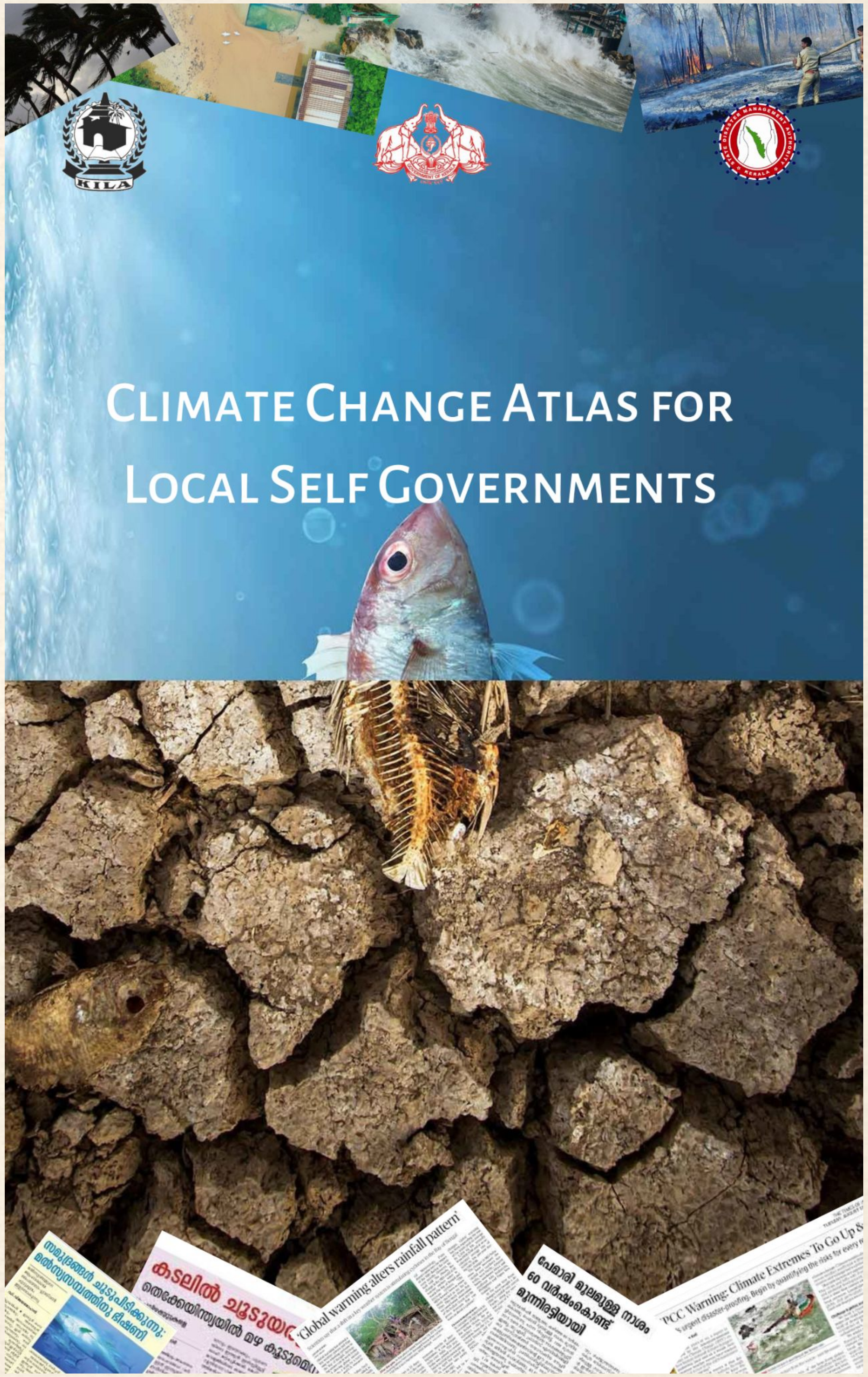


Change in the frequency of occurrence of extreme events

Inference

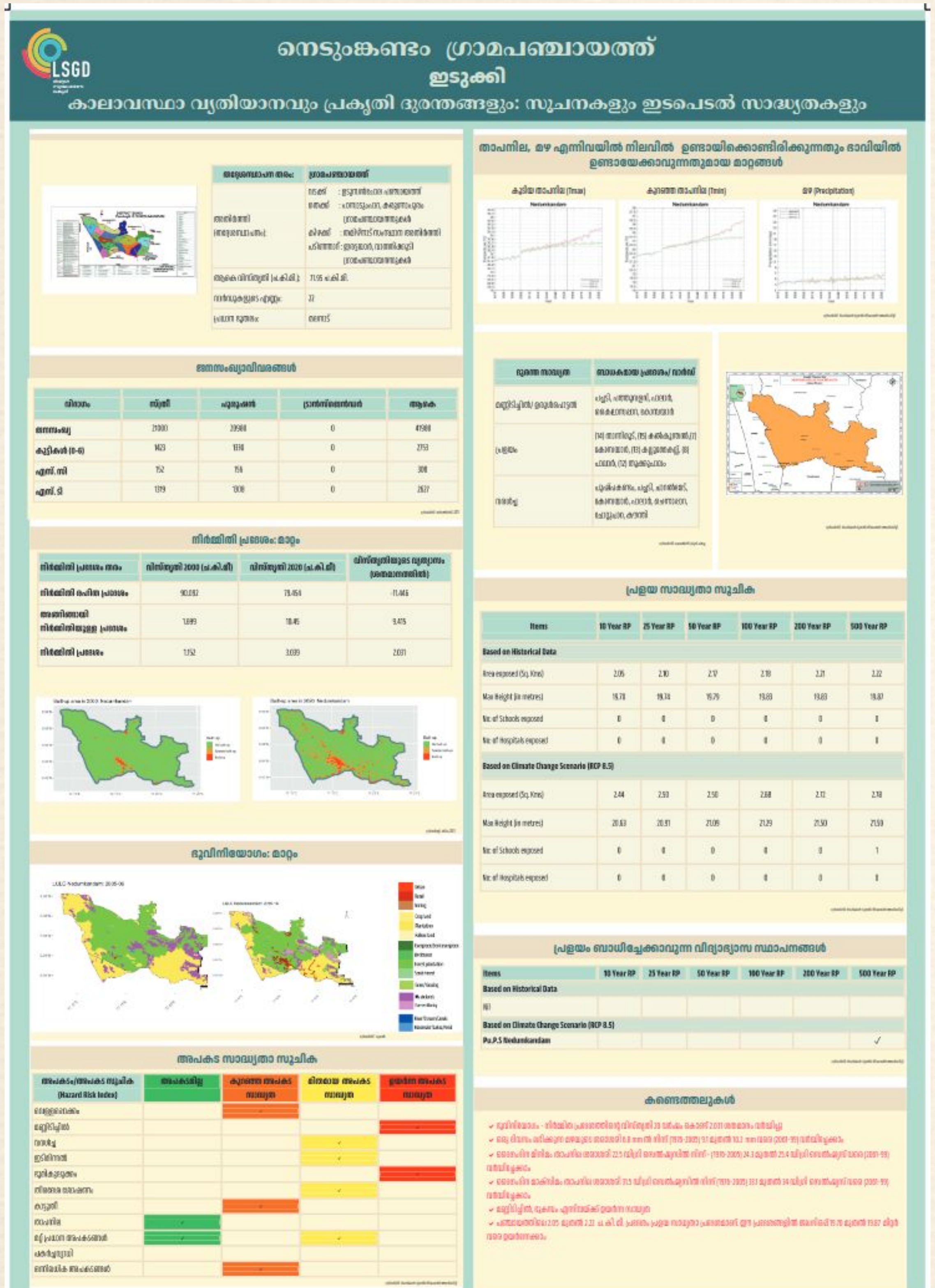
- Both the maximum temperature and minimum temperature is rising in all the seasons
- Increasing probability of occurrence of extreme temperature events
- Rainfall (mm/day) is decreasing in winter and pre-monsoon season
- Increasing rainfall (mm/day) in monsoon season and probability of occurrence of extreme rainfall events are increasing in some LSGs (Thakazhy, Kanjoor...) and decreasing in some other LSGs (Pallipad, Pattanakkad...)
- Rainfall (mm/day) is increasing in some LSGs and decreasing in some other LSGs in post monsoon season

Climate Change Atlas for Local Self Governments



Contains the climate change details and maps of each LSGs

Local Action Plan on Climate Change



Source: Kerala Institute of Local Administration (KILA)

Local Action Plan on Climate Change

- Prepared by KILA in native language
- Contains
  - General information about LSG
  - Climate change and our LSG
  - Impact of climate change on local environment
  - Climate change impacts on livelihoods in the LSG
  - Climate change impacts on local biodiversity
  - Climate change and disasters
  - Intervention possibilities in the LSG
- Prepared for all LSGs of Alappuzha, Pathanamthitta, Idukki and Kottayam districts

Local intervention possibilities

- Carbon Neutral LSGs
- Filament free LSGs
- Green Protocol
- Green building
- Cool roofing
- Solid waste management techniques
- Energy efficient equipments
- Creation of energy self sufficient villages and towns using renewable sources
- Paperless office governance

Local intervention possibilities

- Climate Smart Agriculture
- Climate resilient seed/Local seed varieties/ conservation of local cattle breed
- Paddy fields, wet land conservation
- Rainwater harvesting, Well recharging, conservation of ponds
- Soil and water conservation
- Issue soil health card to farmers based on soil constituents
- Water testing facility
- More Crop insurance schemes

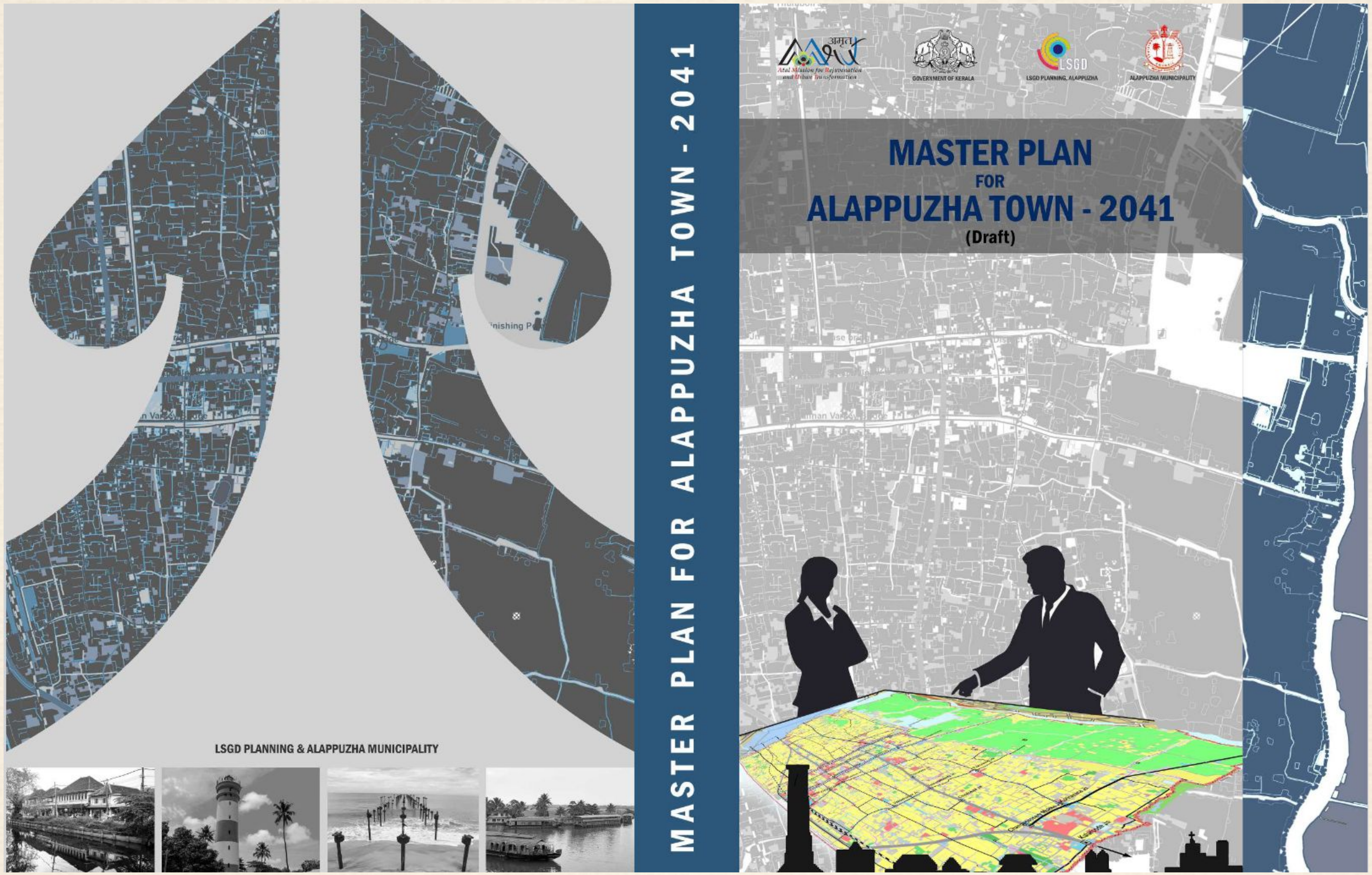
Local intervention possibilities

- Investing in resilient tourism infrastructure
- Implementation of pollution control measures
- Carbon neutral tourism destination
- Relocation of vulnerable population from the coast.
- Rejuvenation of rivers
- Revival of polluted lakes and ponds
- Establish Water data bank
- Climate resilient Urban Infrastructure Development

Disaster Risk management & Climate Action Tracker (DCAT) tool

- Tool developed by KILA to assess and incentivise LSGs that achieve the co-benefits of climate proofing in their development planning
- To empower LSGs to build resilience through climate and disaster risk informed project planning and implementation at the local level
- To evaluate local disaster management and climate resilient activities and provide financial incentives to LSGs based on their performance

Risk Informed Master Plan



Source: https://alappuzhamunicipality.lsgkerala.gov.in/?q=master_plan
Prepared by: LSGD Planning Department

Limitations

- The coarse resolution of the data limits the ability to pinpoint the specific hotspots within each LSGs, which may hinder targeted interventions
- Uncertainties in the analyses, which can impact the reliability of the results and the decisions based on them.
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Thank you