

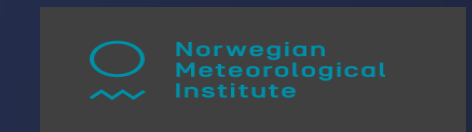
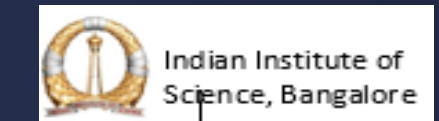
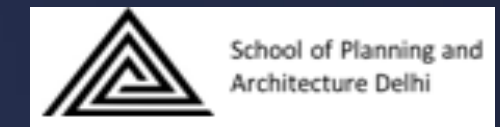
Building scenarios for climate change mitigation and adaptation for urban passenger transport for Delhi, Mumbai and Bangalore

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Partners:



Outline

- Introduction
- Theoretical framework
- Prediction of extreme weather
- Flooding model
- Identification of adaptation policies
- Rapid assessment of emissions of CO₂ and concentration of local pollutants
- Development of transport model systems
- Construction of mitigation and adaptation policy scenarios
- Evaluation
- Highlights of results

Important mega trends in India

- Rapid pace of urbanization
- Rapid economic growth in India and optimistic predictions for coming years
- Increase in occurrences and severities extreme climate events

Consequences for mitigation and adaptation scenarios for urban India

Highlights of major events since the beginning of the study in 2014

- Paris Climate Accord 2015: India an important signatory to the Paris Agreement
- Significant decrease in costs of renewable energy and storage & potentials for electrification of the transport systems in India

A multi-disciplinary and multi-theoretical project

The project focuses on four broad area of analysis:

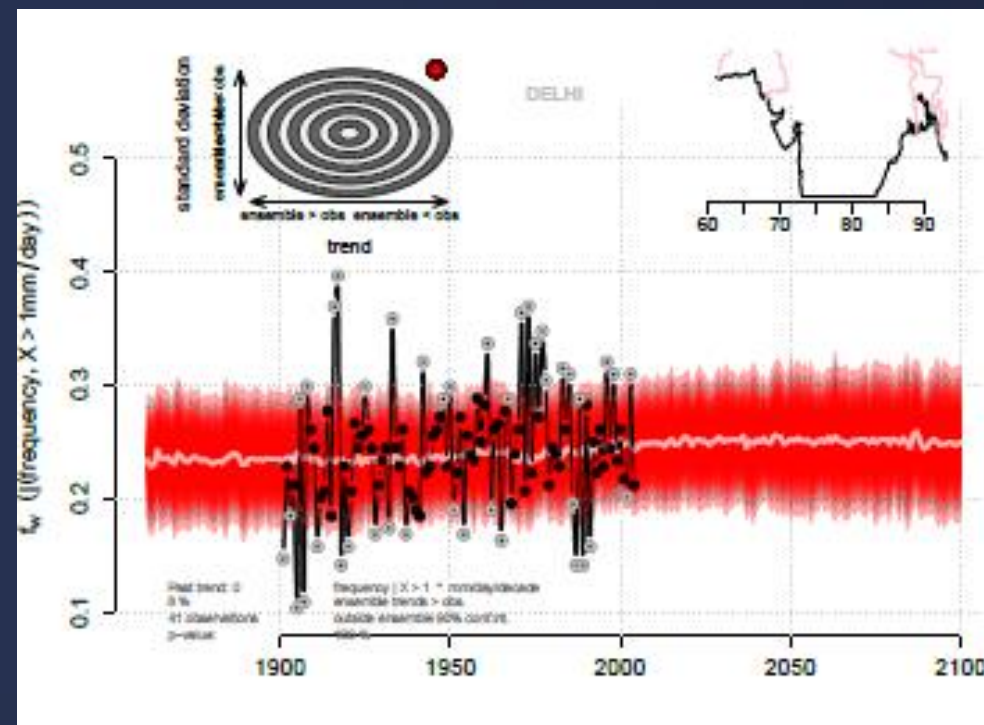
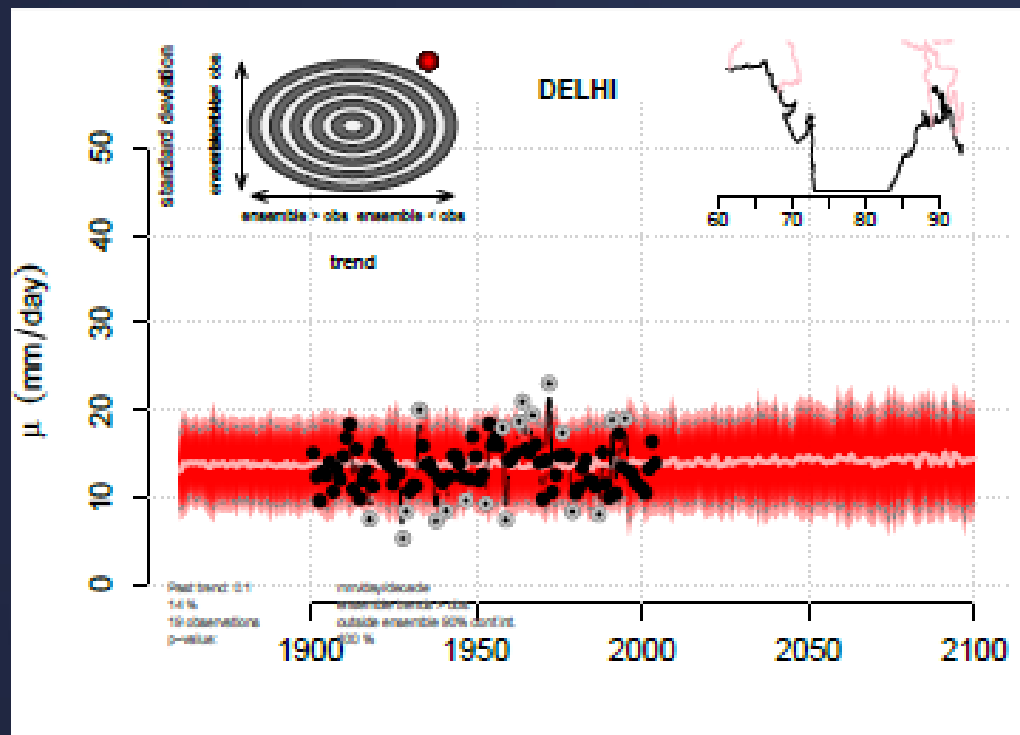
- Current situation & outlining of trends up to 2050
- Scenario construction
- Scenario evaluation
- Identification of institutional and other barriers for implementation

The selected case cities are:

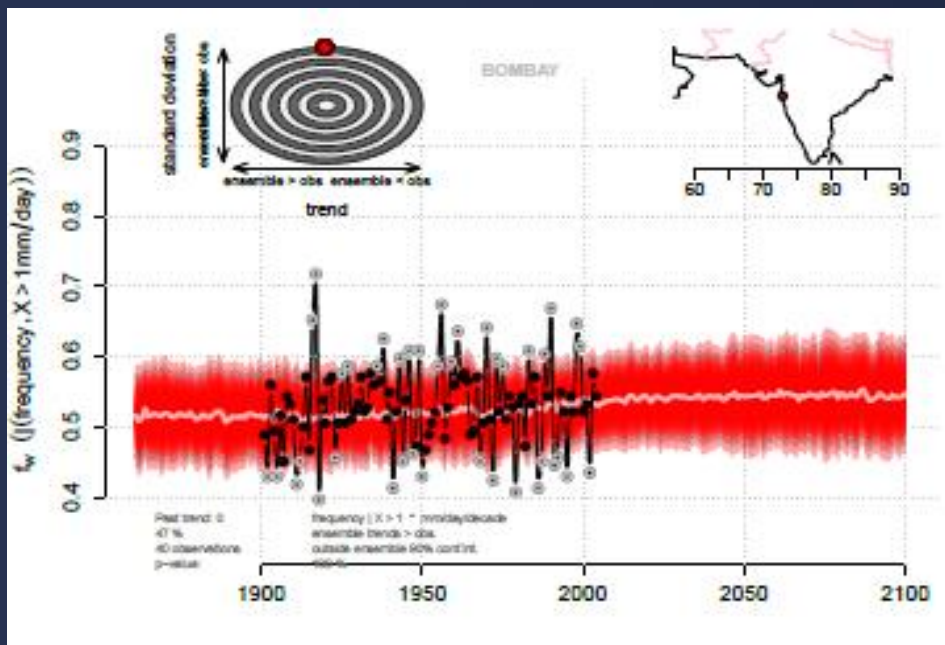
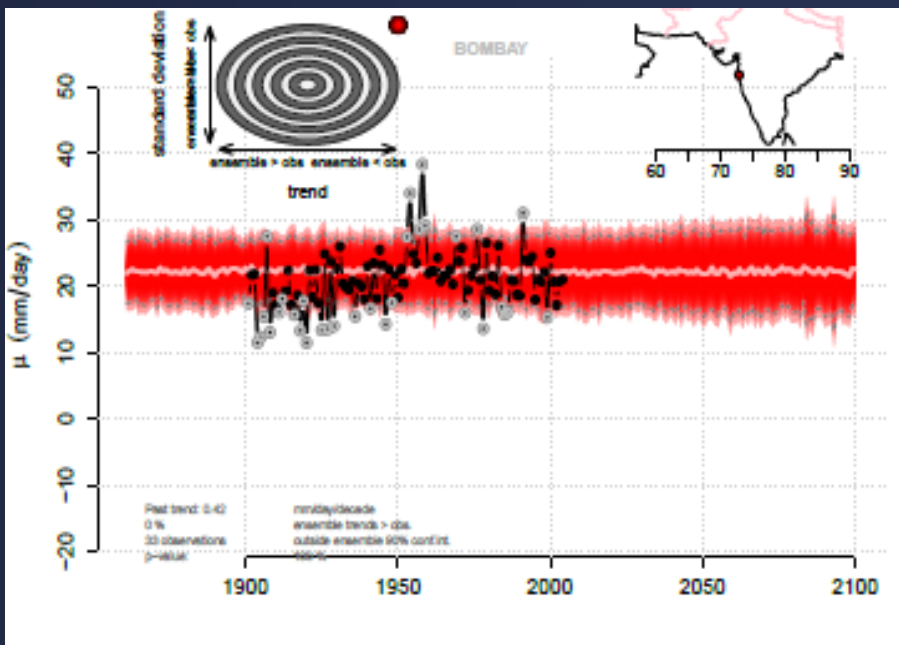
- Delhi
- Mumbai
- Bangalore

Prediction of intensity & occurrences of extreme rainfall under Climate Scenario RCP 8.5 and historical data

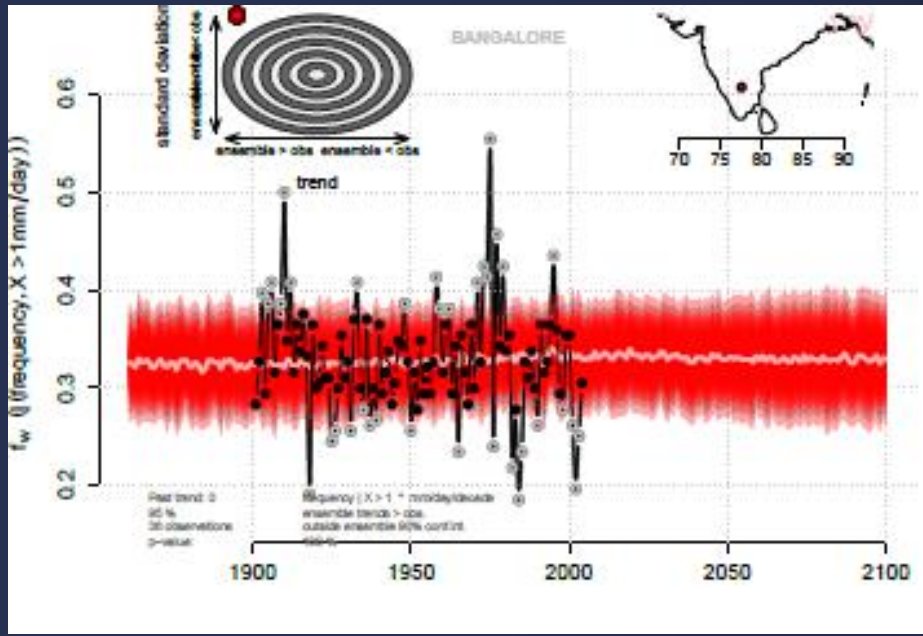
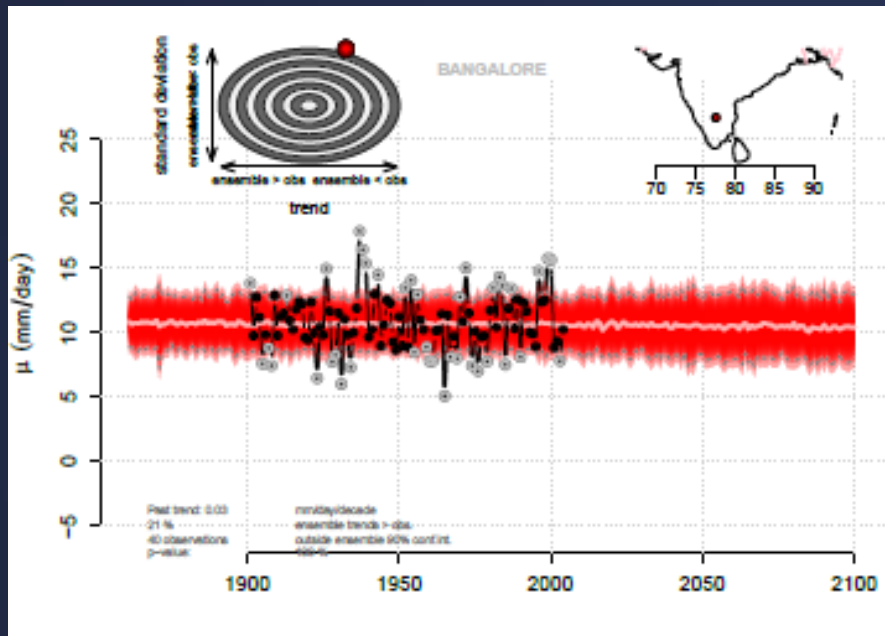
Delhi



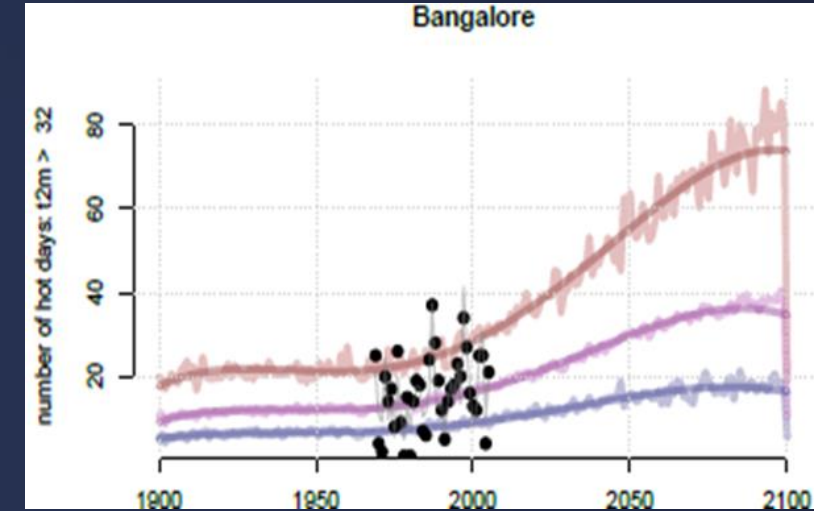
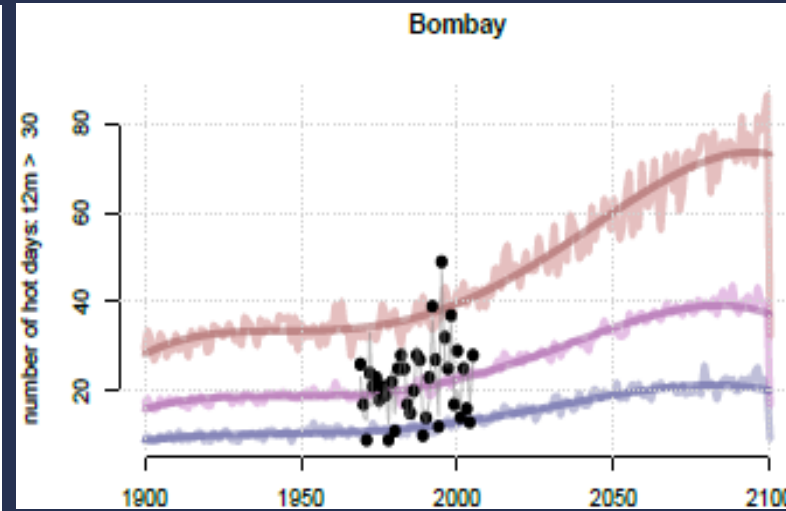
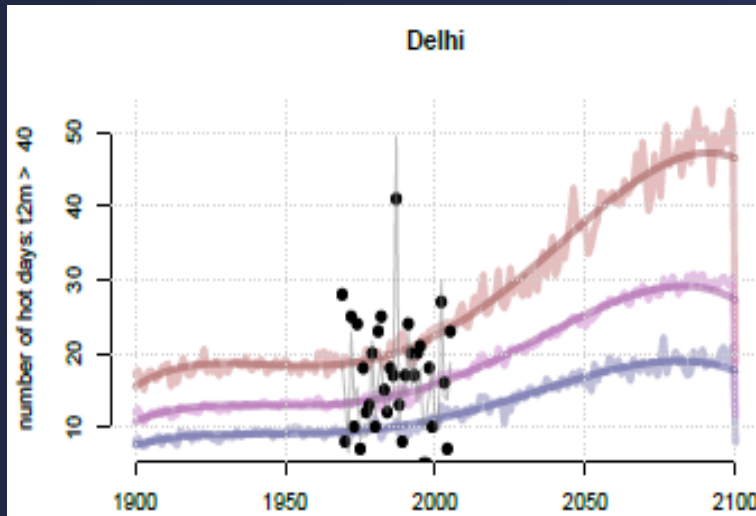
Mumbai



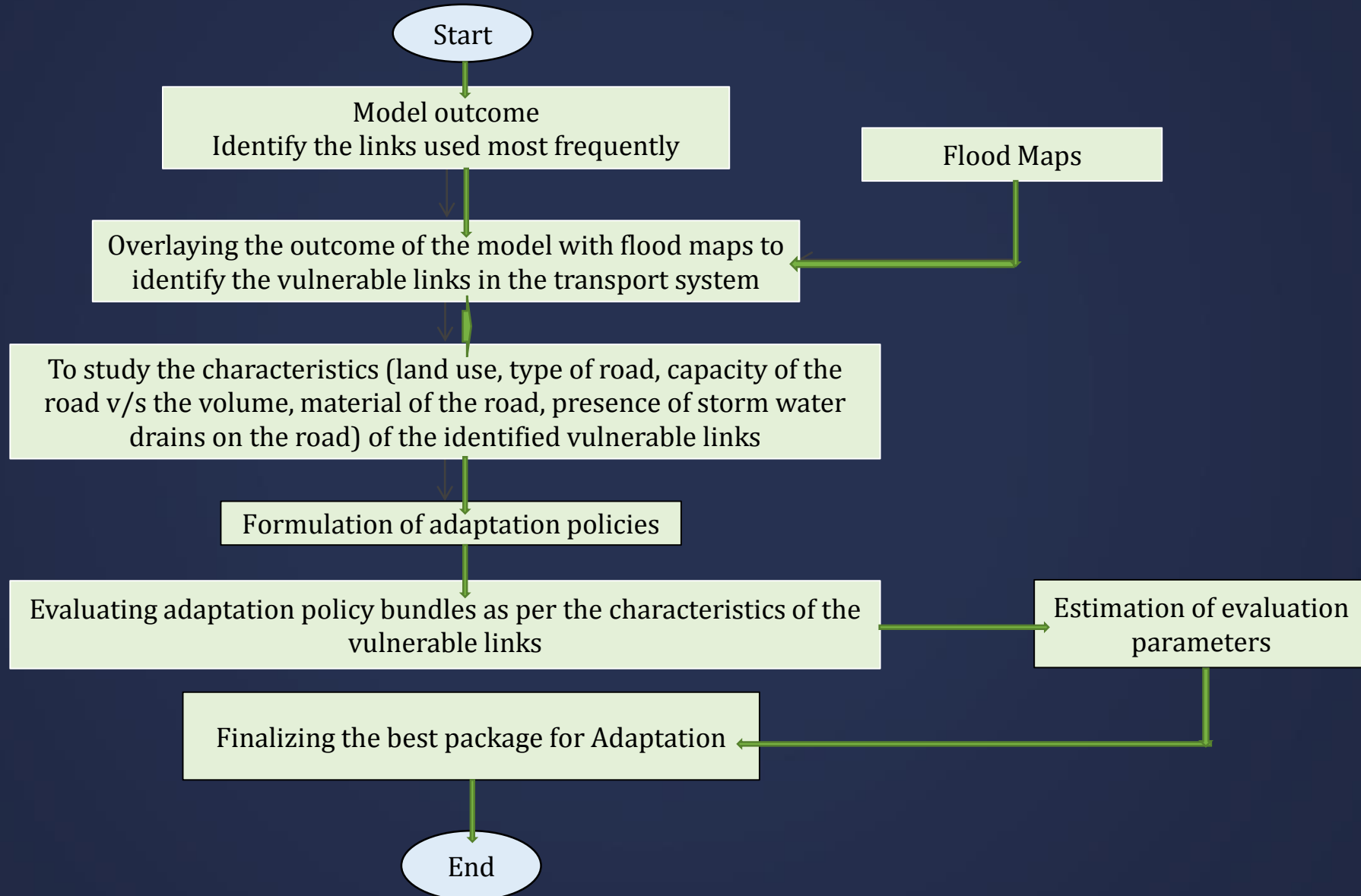
Bangalore



Prediction of occurrences of extreme temperature ($+40^{\circ}\text{C}$) under Climate Scenario RCP 8.5 and historical data – Delhi, Mumbai and Bangalore

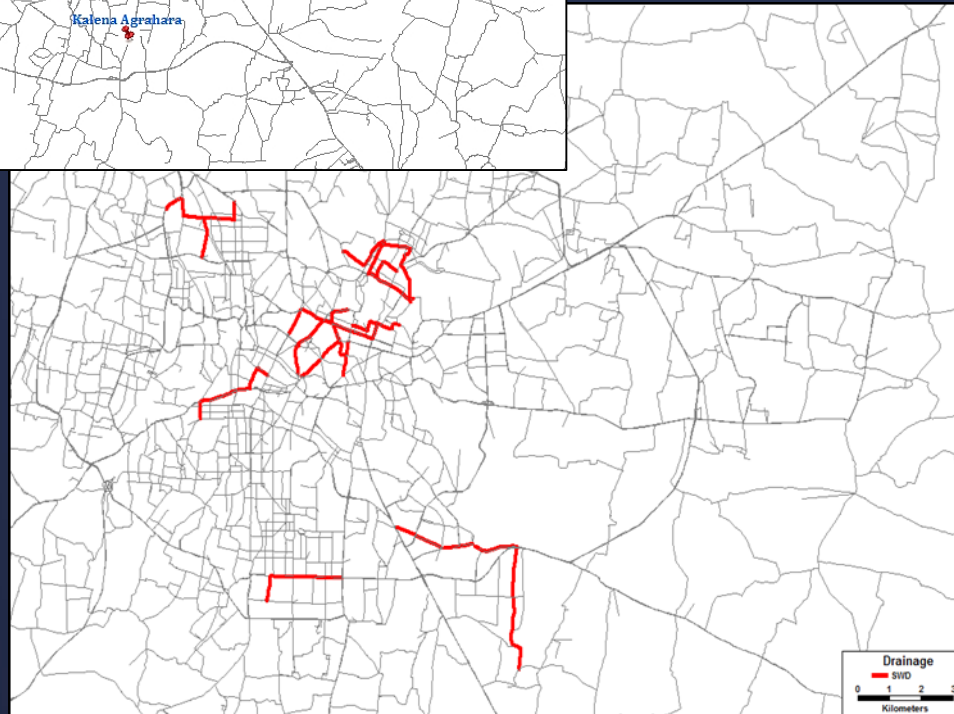
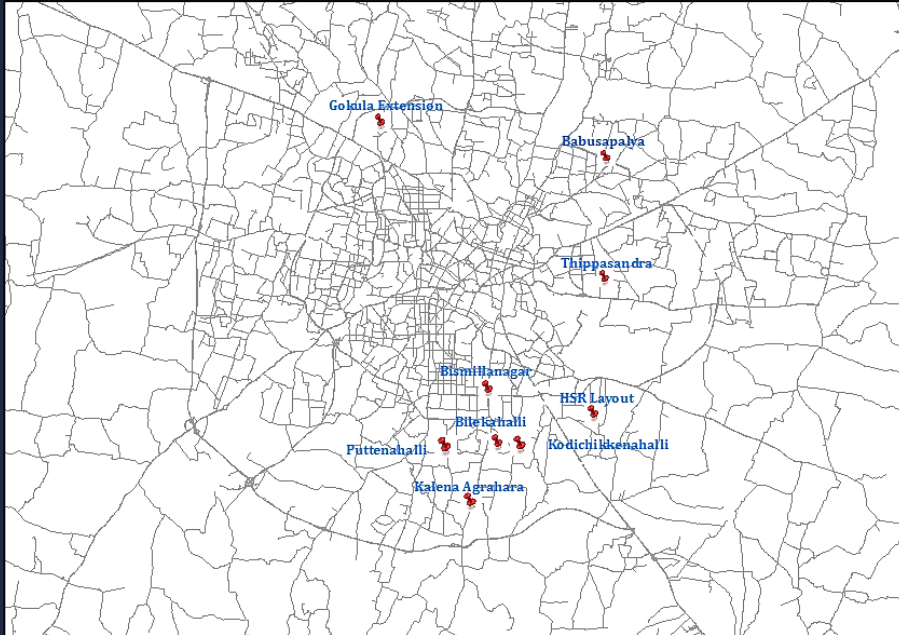


Development of flooding models – example Bangalore

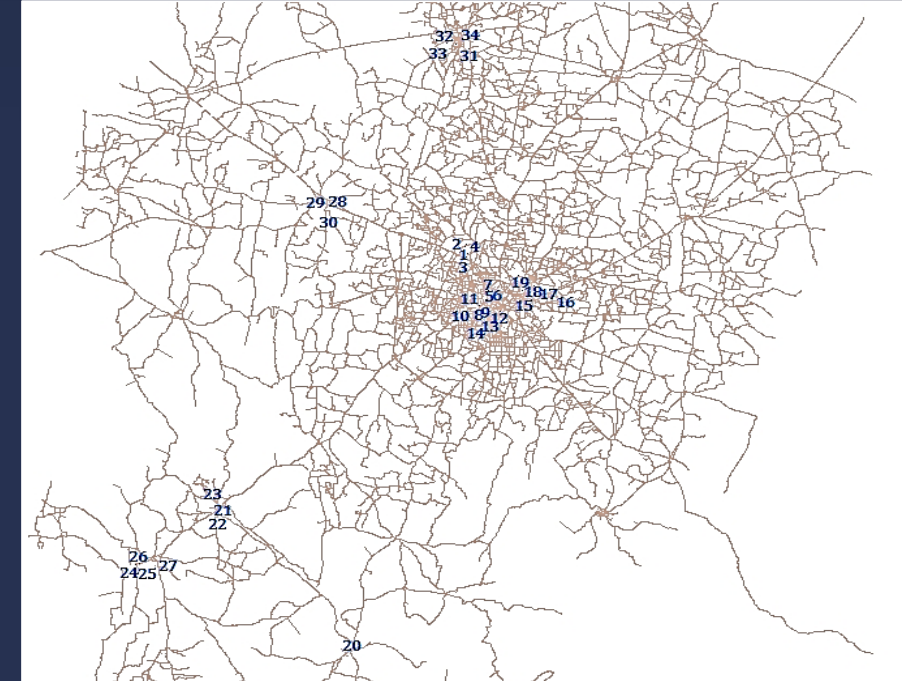


Identification of adaptation policies – example Bangalore

Restricting development in low lying or vulnerable areas



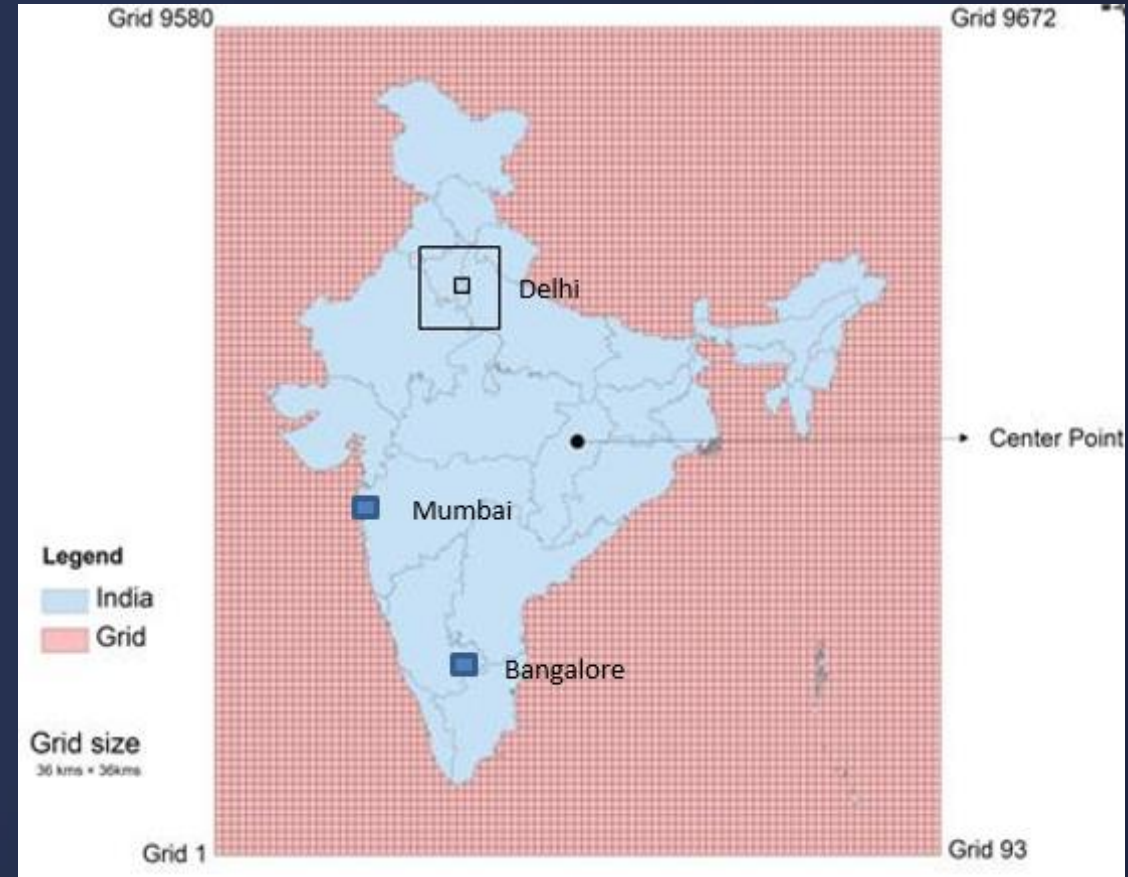
Slum relocation and rehabilitation



Require proper drainage facilities at vulnerable areas:

Rapid assessment of emissions of CO₂ and concentration of local pollutants for BAU scenarios up to 2050 under Climate Scenario RCP 8.5

1. Using available prediction of total emissions from all sectors for a 36x36 grid
2. Identifications of the grids corresponding with the case cities
3. Adjustment of the emissions with rapid assessment of emissions from the transport sector for BAU
4. Conversions of emissions to ambient concentrations of pollutants for the calculation of health impacts



Development of transport model systems for the case cities – Example Bangalore

Projections:

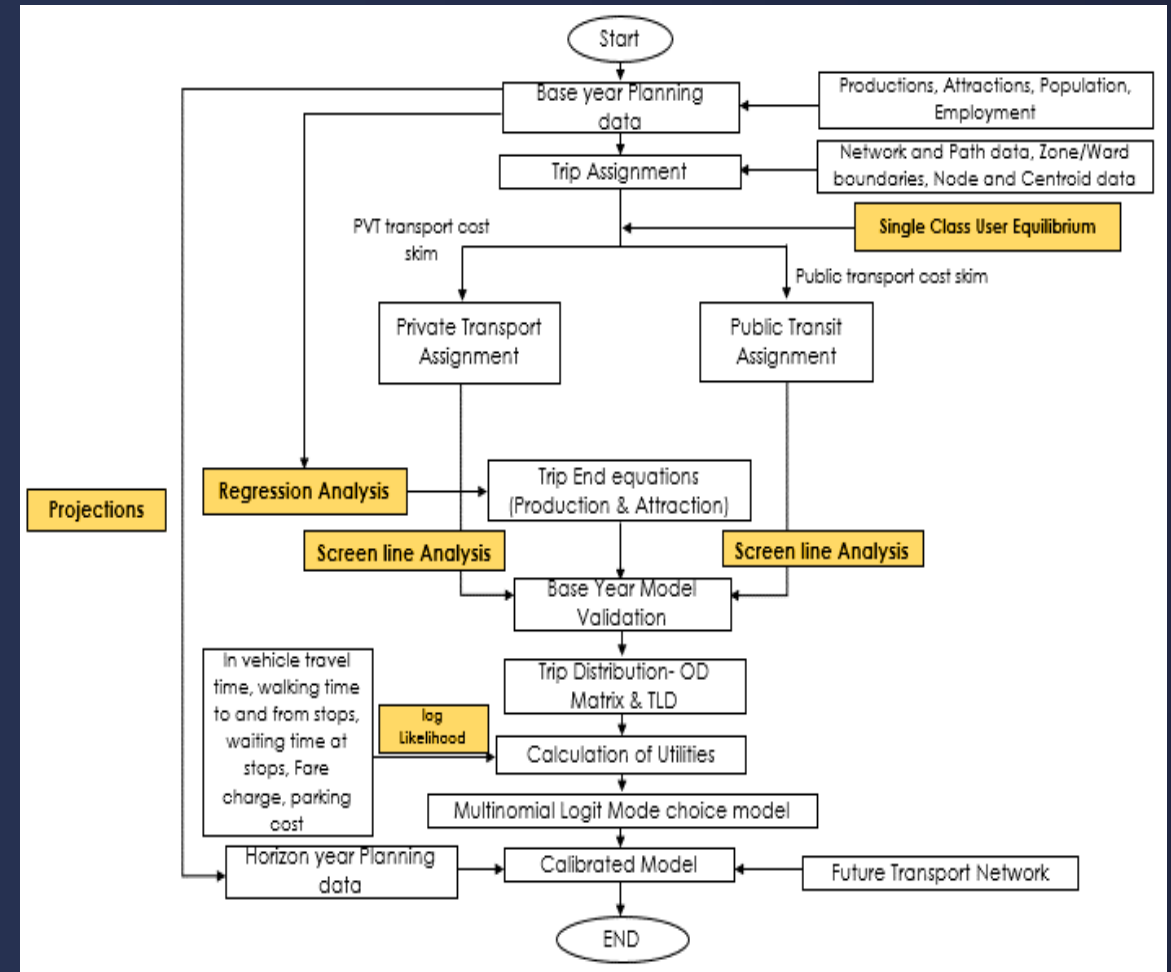
- Population
- Area
- Economy
- Land use
- Transport networks and infrastructure
- Registered vehicles and motorization

Travel demand forecast:

- Travel demand by mode
- Vehicle distance by mode

Using emission prediction of factors:

- Emission of CO₂
- Emission of local pollutants



Identification of 3 – 4 policy scenarios for mitigation and adaptation for each case city.

The policy scenarios compromise plausible policy packages identifies based on:

- Using an expert DELPHI study
- Consultation with national and case city stakeholders
- Case city context
- Transport Mater Plan for the case city

Additional scenarios for electric mobility based on 4 different “energy mix”

- Renewable (100%)
- Non-renewable energy source and renewable (50% - 50%)
- IEA, 2015: Non-renewable energy source and renewable (74% - 26%)
- Non-renewable source (100%)

Calculation of BAU and policy scenarios for the case cities

Multi-criteria approach

1. Emission of CO₂ in tones
2. Emissions of local pollutants in tones
3. Health effects of PM_{2.5} in terms of mortalities
4. User's benefits and costs in \$

Uncertainties

- Different predictions, specially with sparse data
- Unit values such as emission factors, value of travel time savings, etc.

Presentations tomorrow

- Evaluation of scenarios based on emissions of CO₂ & PM_{2.5}
- Barriers to implementation

India has committed to reduce the emission intensity of its GDP by 33-35 by 2030 from the 2005 level

- All policy scenarios meet India's national climate goal.
- In fact, with an “optimistic” prediction of emission factors, BAU scenarios for the case cities will meet the national goal
- Land use and integrated land use transport policies emerge as an essential part of a policy package for climate change mitigation and adaptation
- The assumption about energy mix has important implication for CO₂ emissions. Non-renewable production of electricity results in an increased CO₂ emissions.
- The benefits for local air quality will be significant and the same under different energy mix, given that the production of electricity is far from a case city

Thank you