Project CLIMATRANS: Climate Change Mitigation and Adaptation

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Motivation

- Transport systems are vulnerable to the increasing impacts of extreme weather.
- Adaptation in the transport sector is necessary for its role in economic and social development.
- Despite rising interest in climate adaptation, relatively little comprehensive work has been done, mostly focusing on transport sub-sectors.
- The efforts do not meet the challenges posed by urban transport systems.
- Developing countries are already suffering climate impacts, more than developed counties due to their higher vulnerability.
- Urbanization is taking place at fast pace, more so in rapidly growing economies
- It is critical that ongoing efforts to include a significant adaptation component to complement mitigation efforts in urban area.

Motivation

Further challenges faced by India (and other fast developing economies):

- Cities could generate 70% of net new jobs created in 2030
- Cities produce 70% of GDP, and increase the per capita incomes by fourfold nationally
- Cost of delivering basic services is 30 to 40% lower than rural areas

However lopsided urbanization can result in:

- Unemployment, and income disparities
- Slums & urban sprawl
- Growing congestion
- Inadequate and unreliable urban infrastructure, including transport

Motivation

WHO: air pollution is single biggest environmental health risk

- **The losses from environmental pollution are equivalent to about 4% of GDP**
- **Climate change and air pollution in India has become so severe that yields of crops are being cut by almost half (further pressure on urbanization)**

Among challenges: funding the capital investment in cities in India

Motivation

- Transport systems are inherently subject to significant **Risks and Uncertainties** and **irreversibility (RUI)** with compounding RU concerning technology, markets, political context, socio-demographics and changes in values and preferences.

Climate change amplifies these RU. There is a need to:

- improving risk assessment and risk management
- changing the planning framework to embrace **flexibility** as part of the process.
- To make decisions based on steady flow of new information.

RUI is of great relevance in the context of climate change adaptation and mitigation policies, in particular for the fast developing economies

Climate change in India

Warmer seasons

- Avg. temp rise: 2.0 deg C predicted
- 1.0-4.0 deg C at extreme ranges

Increased annual precipitation

- lower frequency of rainy days; increased intensity

Cyclonic disturbances

- lower frequency; increased intensity
- increased risk of storm surges

Sea-level rise

- 1.3 mm/year on average

Fresh water supply

- High variability predicted in water yields (from 50% increase to 40-50% reduction)
- 10-30% increased risk of floods; increased risks of droughts

Objectives of the CLIMATRANS project

1. 1. To assess climate change and environmental impacts in urban areas in India related to the transport sector
2. 2. To develop mitigation and adaptation strategies under risk, uncertainty and irreversibility (RUI)
3. 3. Recommendations and production of a guide book for similar studies

The study is based on 3 case cities, Delhi, Bangalore and Mumbai

Project plan

Five broad areas of analysis

1. 1. Current situation (Demography, Economy, Land use, Mobility & Motorization, Climate & Environment)
2. 2. Outlining of trends up to 2050
3. 3. Development of alternative scenarios and Scenario analysis
4. Scenario evaluation
5. 4. Identification of barriers and institutional change
6. 5. Recommendations and production of a guide book for similar exercises for other

Current situation and outlining the trends

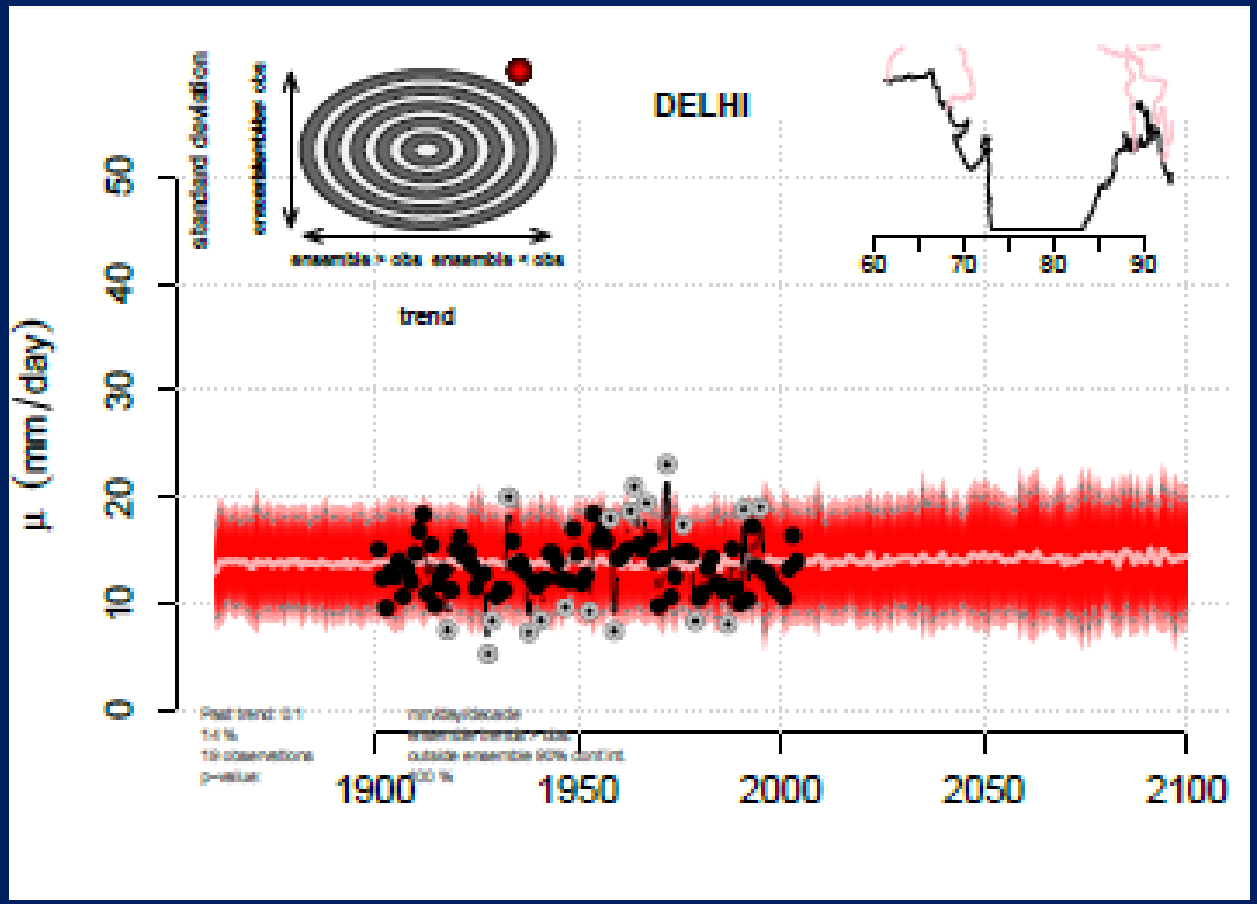
Historical trends (when necessary and available) and present

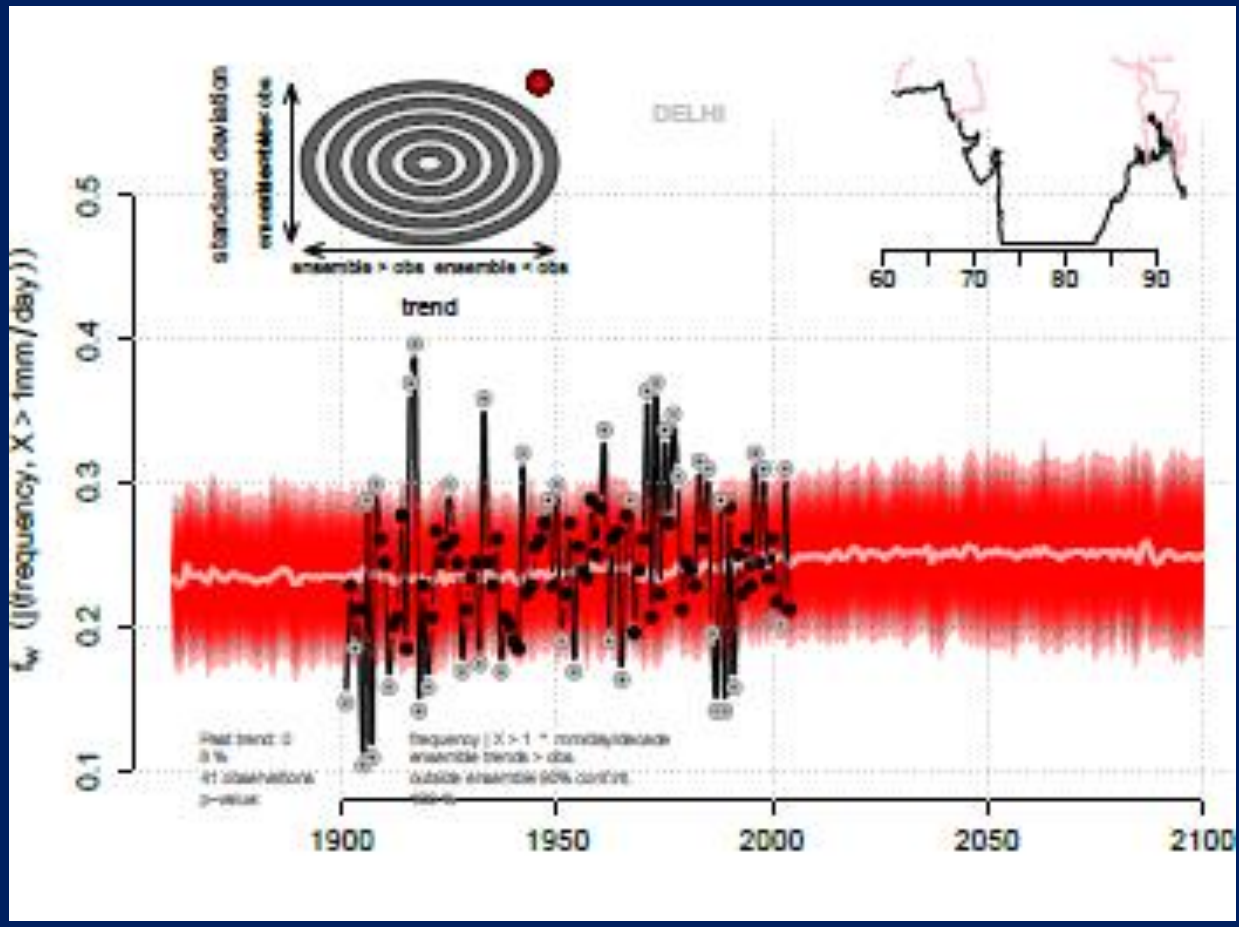
- Demography: Population by segments (age, gender, etc.)
- Economy: Income, income distribution, employment (by sector), etc.
- Land use: Total land coverage, land use by type, periphery developments, transport infrastructure coverage and layouts
- Mobility: Mode shares, travel distance and O-D patterns for different travel purposes
- Motorization: Size of different fleets of vehicles, including private car
- Climate: Downsizing Climate Scenario RCP 8.5
- Analysis of flooding
- Environment: Conversion of emissions, including the emissions from the urban transport sector, to the concentrations of different pollutants

Scenario analyses: BAU scenarios(s)

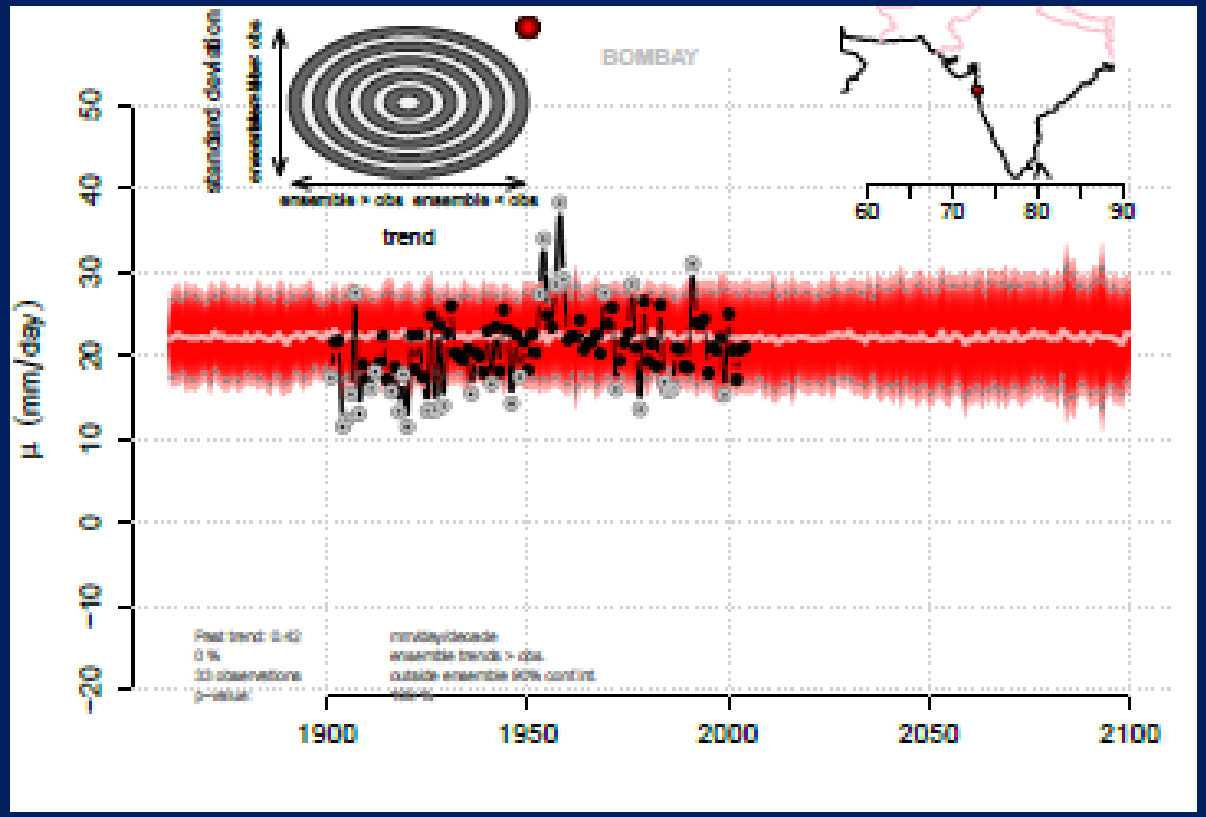
- Development transport model systems for the calculations of BAU (and policy scenarios)
- Climate: Downsizing Climate Scenario RCP 8.5 up to 2050
- Analysis of flooding for the base scenario
- Environment: Conversion of emissions to the concentrations of different pollutants for the base scenario(s)
- Calculation of the health effects
- Calculation of other indicators

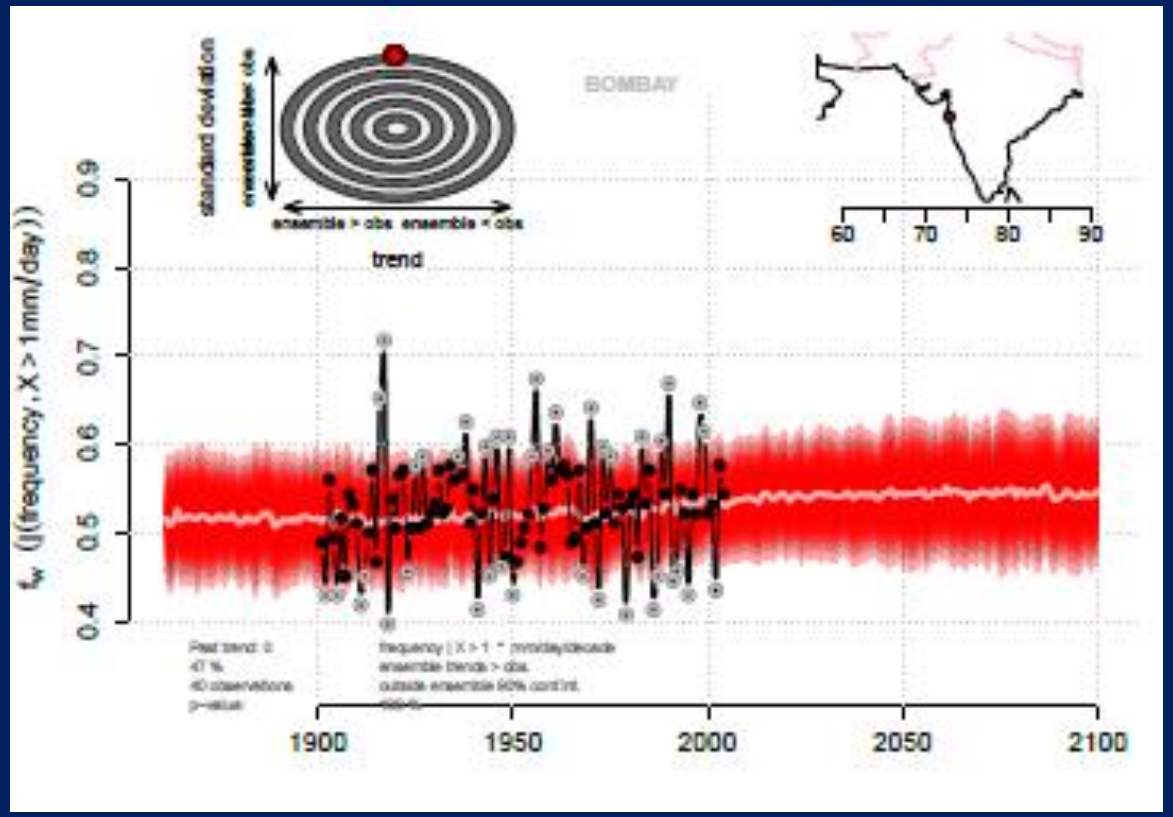
Extreme precipitation (Climate Scenario RCP 8.5)**: Delhi**



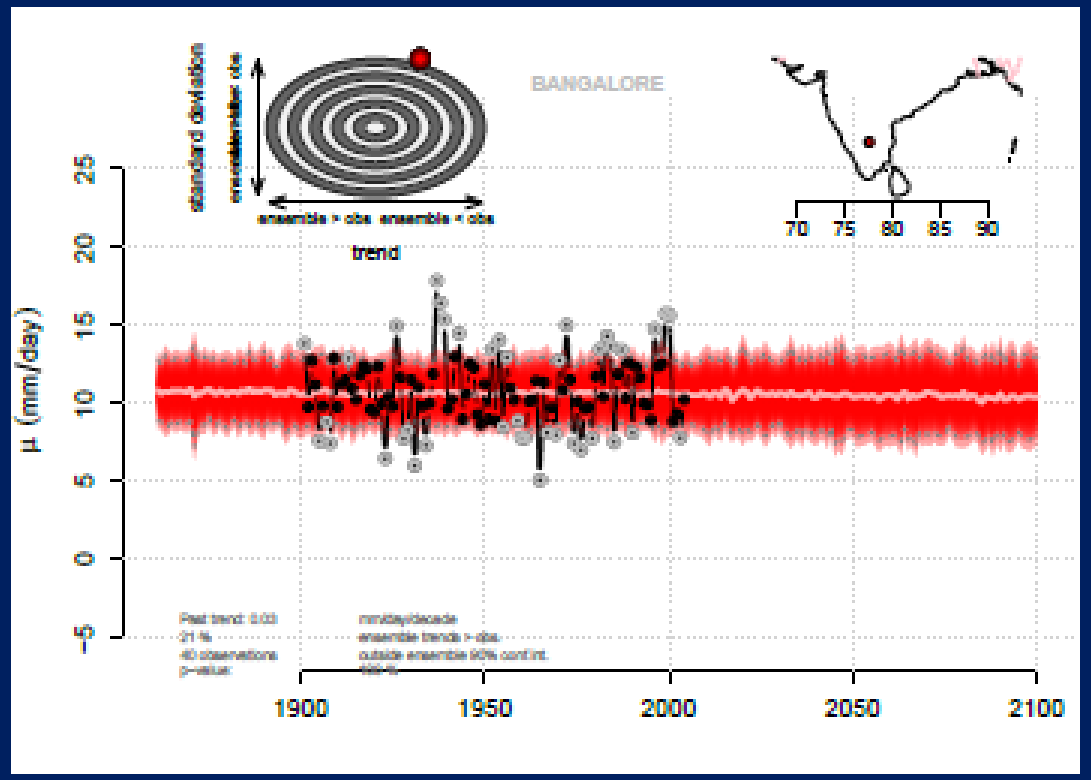


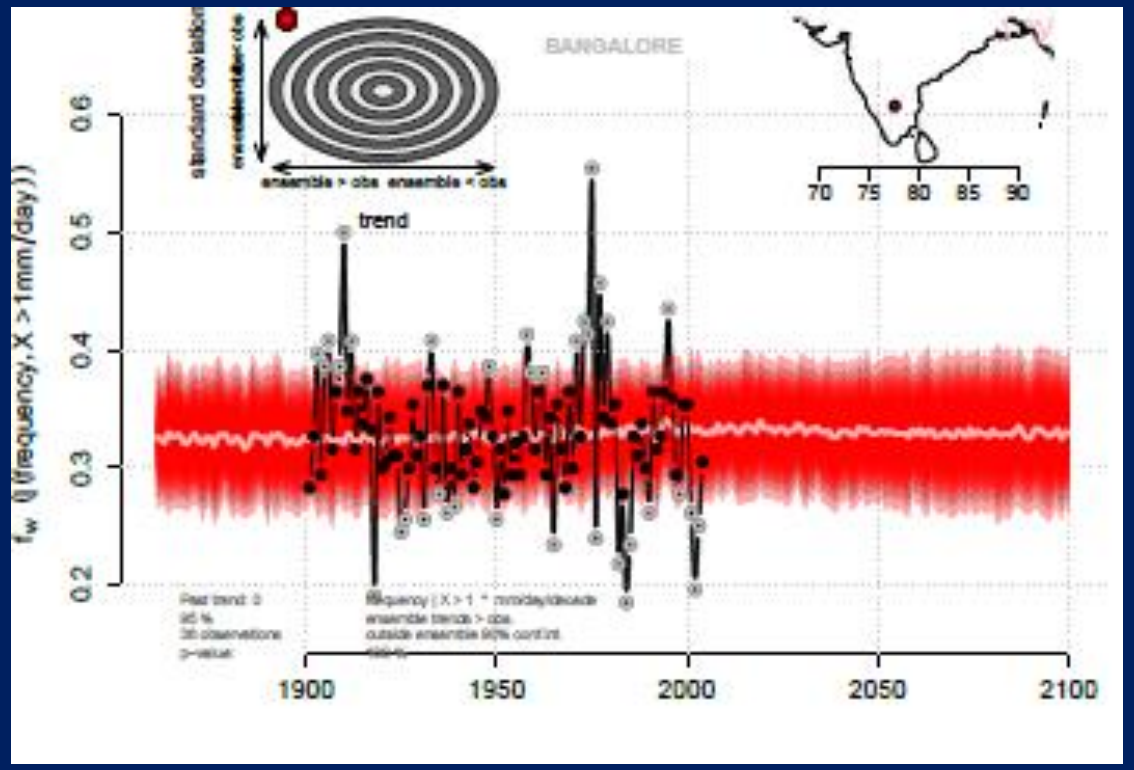
Extreme precipitation (Climate Scenario RCP 8.5)**: Mumbai**



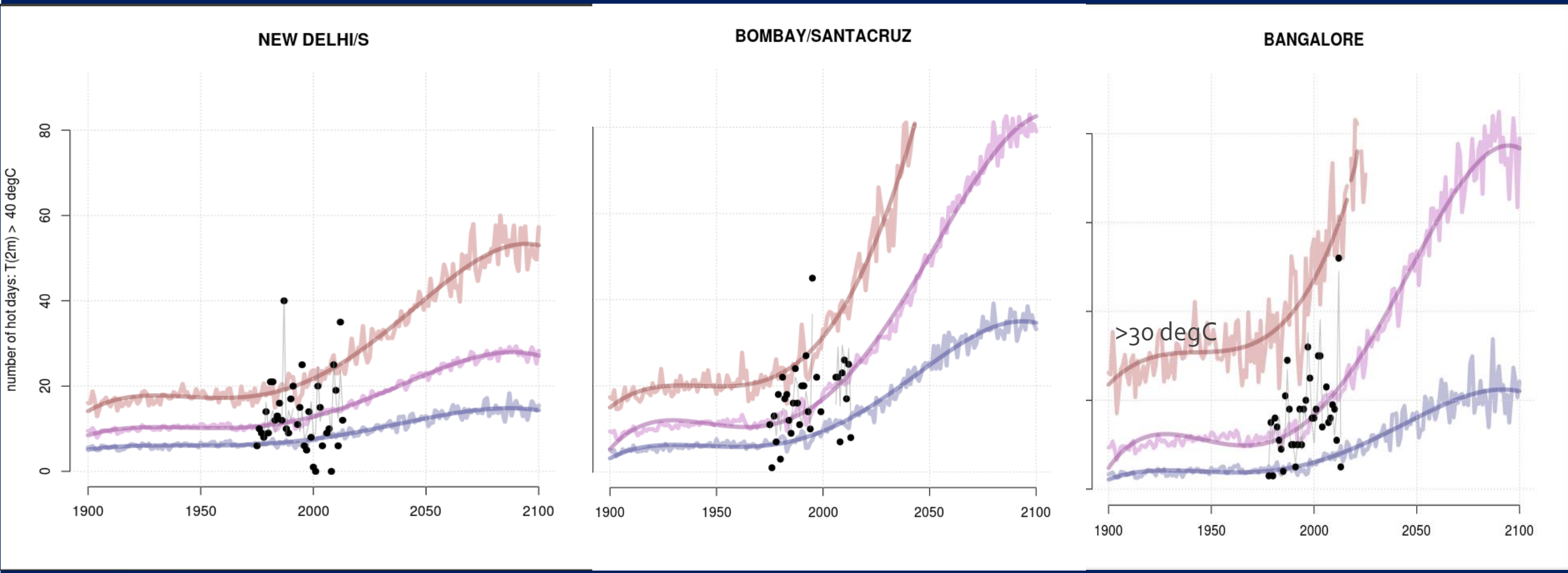


Extreme precipitation (Climate Scenario RCP 8.5)**: Bangalore**





Analysis of “hot days” under scenario RCP4.5



Close match between the mean temperature and number of days above a certain threshold (“hot days”). The upper and lower curves represent typically hot and cold seasons (mostly inter-annual spread), whereas the middle curve is the ensemble mean.

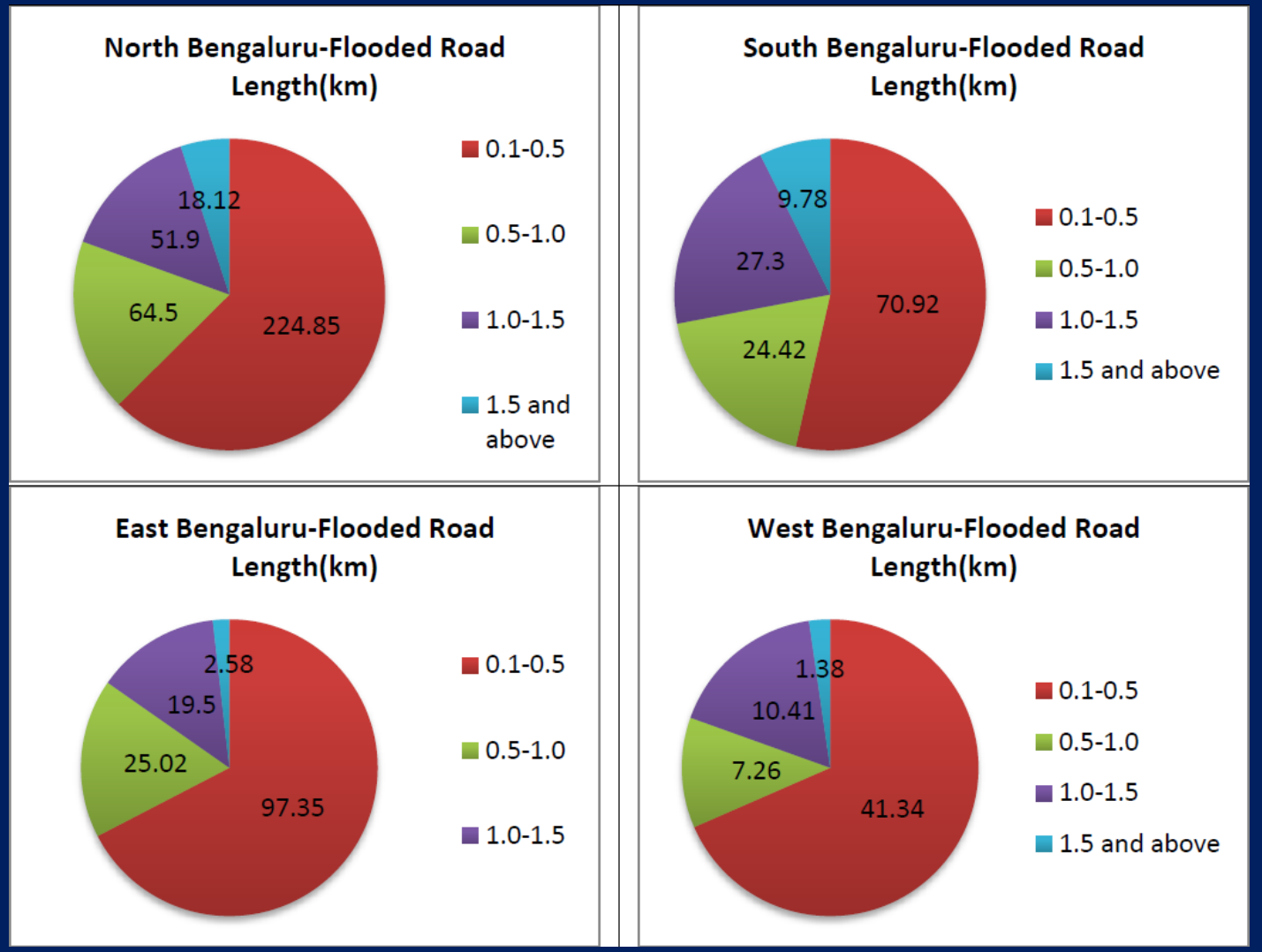
Identification of flood risk on urban road network

Modelling urban flooding is more complex than rural flooding.

Data requirement for modelling

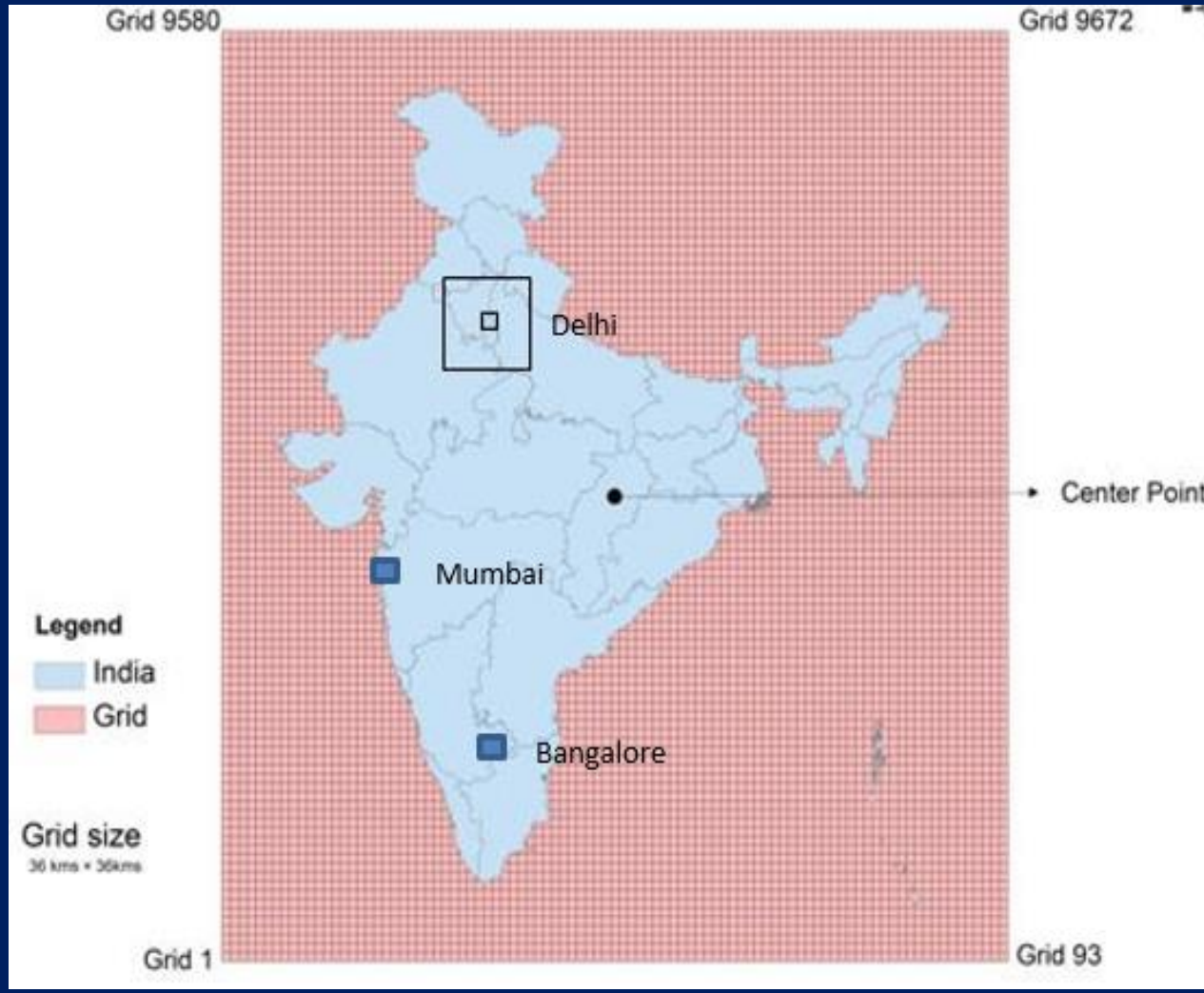
- Topography
- Hydrology
- Rivers
- Ground water
- Climate and rain fall data
- Geology
- Drainage network
- Solid waste management
- Land use and land cover changes

Example: Flooded road in Bangalore (in km)



Adjustments for emissions from the transport sectors for the case cities

- The available transport emission levels is based on India's national averages on 36x36 km grids
- The emission levels related to transport for areas representing case cities should be adjusted for the base year up to 2050 based on trends in mobility and motorization



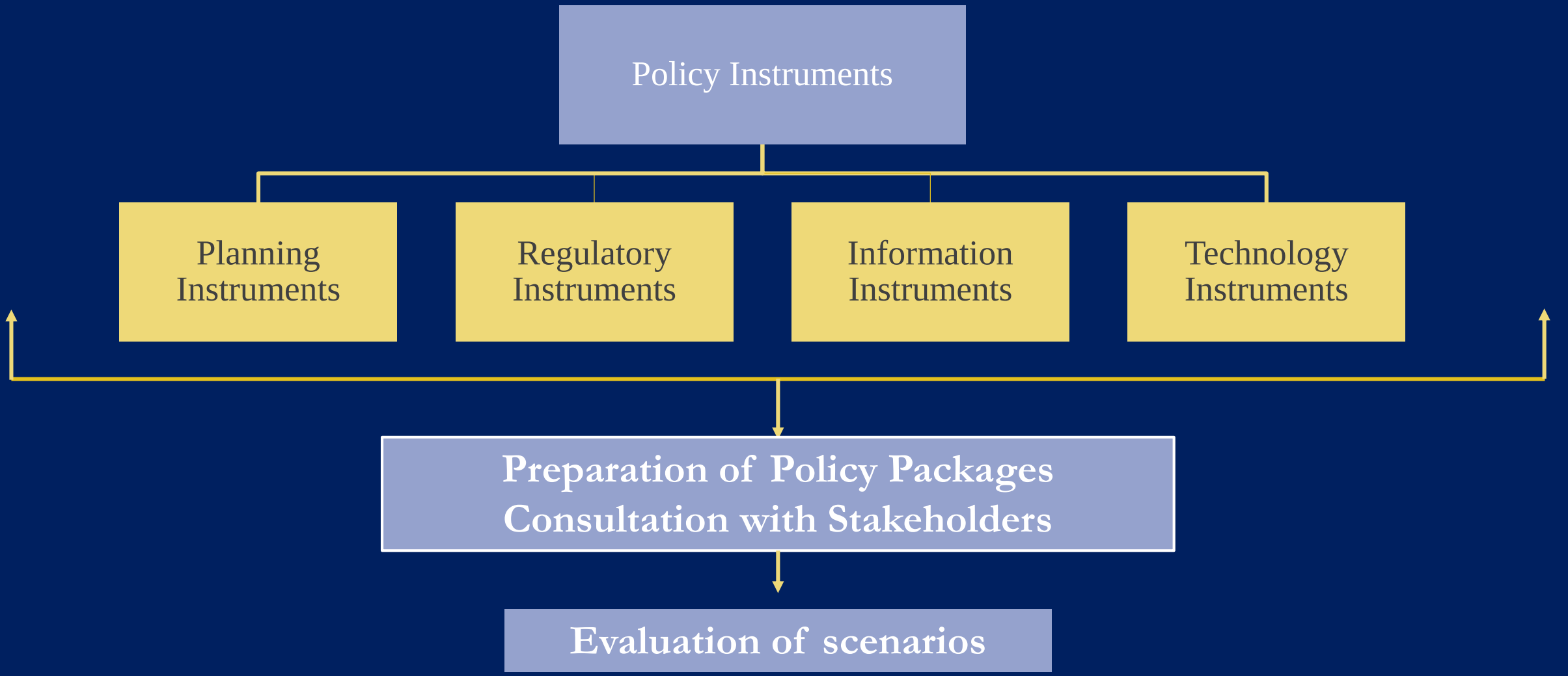
Converting emissions to concentration levels and health effects

- Emission data and data from climate scenario will be used to calculate concentration of different pollutants, including ozone
- WHO model will be used to calculate the health effects due air pollution under different scenarios

Scenario analyses: policy scenarios(s)

- Evaluation of the feasibilities of new technologies (DELPHI approach) and innovative policies
- Integrating strategies (policy packages) for reducing GHG emissions and adaptation to climate change for the case cities
- Analysis of flooding for the base scenario
- Calculation of ambient concentration of pollutants and health effects
- Calculation of the health effects
- Calculation of other indicators
- Calculating alternative policy scenarios to meet the overall objectives set for the transport sector

Policy Packages



Scenario analysis approach: Backcasting

Backcasting is a normative approach, appropriate for strategic decision making

Evaluation and Identification of barriers

Evaluation:

- Both quantitative and qualitative approach will be used for evaluation
- We will rely on Benefit Cost Analysis and Multi-Criteria Analysis (or similar approach to MCA)

Identification of barriers:

- Focus on Legal, Economic, Technological and in particular Institutional barriers

Consultations with Stakeholders:

Regular consultation with stakeholders through out the course of the project in each case cities (2 rounds so far)

Some preliminary results

- Integration of adaptation and mitigation scenarios/policies.
- Urban and land use planning policies to address climate extreme weather and to promote public transport, walking and cycling, social cohesion and economic growth associated with agglomeration
- Coordination with other urban infrastructure provisions and other sectors, in particular the energy and telecommunication sector
- Addressing risks, uncertainties and irreversibility in the scenario development
- Institutional reforms to strengthen urban and regional governments in particular with respect to their finances
- Involving stakeholders (public and private sector actors, service providers,…) in the development of the scenarios

Need for data for the development of scenarios, implementation & monitoring

A long and winding road

Thank you