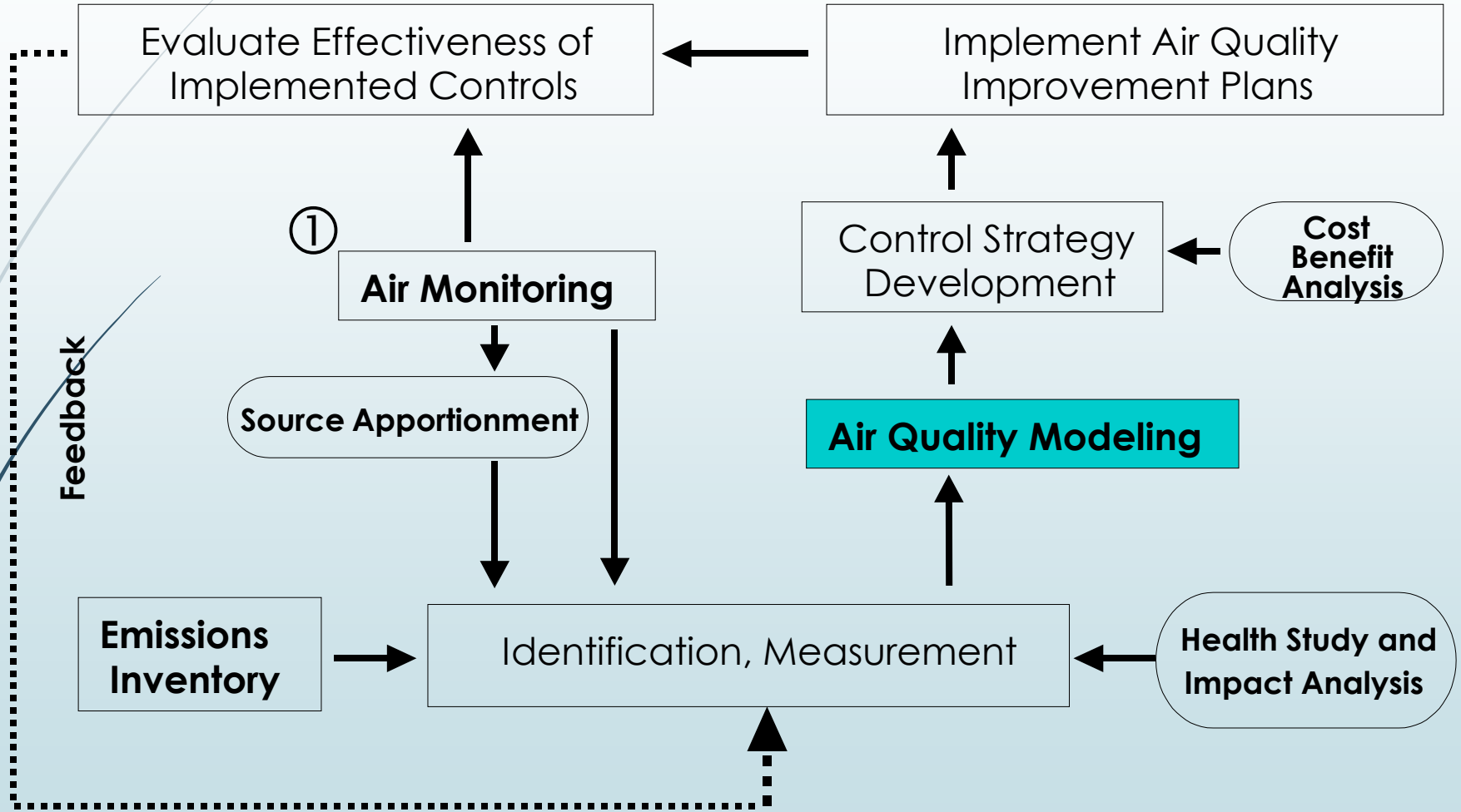
World Environment Day, 2018
Thematic Session on Air Pollution
Ministry of Environment, Forest and Climate Change (MoEF&CC)

Air Quality Management Tools

Prof. Mukesh Khare

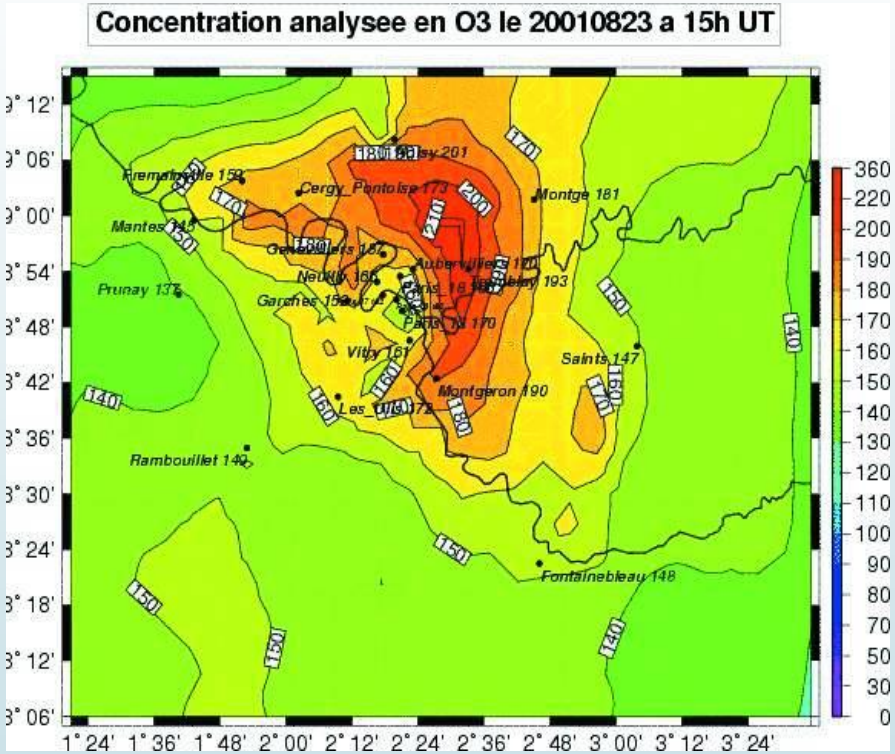
IIT Delhi

Urban Air Quality Management



Prediction & Forecasting Tools

- A Mathematical relationship between **Emissions, Meteorology** and **Air quality**
- No single model covers entire set of impacts
- Most appropriate MODEL is the need: for effective and efficient Urban Air Quality Management (UAQM) Framework Protocol
- Evaluate different emission control strategies under '*what if*' scenario



Tempo-Spatial and Multisectoral Air Quality Prediction Tools

Models / Attributes	Deterministic models	Stochastic models	Hybrid Models	ANN based Modelling	Neuro-Fuzzy based modelling
Highly non-linear	Fail to account non-linear phenomenon	Account Non-linear phenomenon	Account non-Linear Phenomena	Takes into account the non-linearity	Takes into account the non-linearity as well human reasoning
Episodic	Fail to predict Episodic conditions	Predict Episodic conditions	Predict Episodic conditions	Predict Episodic conditions	Predict Episodic concentrations
Short-term prediction	Fail to predict short-term prediction	Predict long-term and middle ranges	Predict short and long-term and middle ranges	Predict short-term prediction	Predict short-term prediction
Uncertainty involved in data	Does not account uncertainty	Account using statistical distributions	Account Uncertainty	Account by training data using back propagation algorithm	Account using fuzzy-rules
Experts knowledge	Does not take experts knowledge	does not take experts knowledge	Not Required	Does not take experts knowledge	Take experts knowledge

Multisectoral Regulatory AQMs

Parameters	ISCST3	AERMOD	ADMS-Urban	CALPUFF	CMAQ	WRF-Chem
Principal	Gaussian Plume	Gaussian Plume	Gaussian Plume	Gaussian Puff	Langrangian model	Numerical
Steady State	Yes	Yes	Yes	Non steady state	Non steady state	Non steady state
Regulatory model	-	USA, India	UK	USA	USA	-
Range of Prediction	Short	< 50 km	<100 km	<300 km	Long range	Long range
Secondary Pollutant Considered	No	No	No	No	Yes	Yes
Surface Met Data Requirement	Yes	Yes	Yes	Yes	Yes	Yes
Upper Air Met data	No	Yes	No	Yes	Yes	Yes
User friendly	Yes	Yes	Yes	Yes	No	No
Time Requirement	Less	Less	Less	Less	In Days	In Days
Output Grid Resolution	High (m)	High (m)	High(m)	Moderate (m)	Low (km)	Low (km)
Computational Cost	Low	Low	Low	Low	HPC	HPC
Roughness Factors Considered	No	Yes	Yes	Yes	Yes	Yes
Expert Knowledge Requirement	Basic	Basic	Basic	Basic	Advanced	Advanced

Criteria for Selection of Models for LMIC

- User friendly
- Less data requirement with more accuracy
- Low Computational cost and Time requirement
- High resolution (Street Level Model)

Challenges in LMIC

- Availability of meteorological data for AQM – Quality and Quantity
- Availability of Micro-scale meteorology for AQM i.e. (MO length, Vertical wind profile, wind fluctuation, celling height
- Integration of AQMs and MM.
- Expert knowledge - Operational and accurate interpretation
- HPC cost

AQM Tools– Operational Protocol

Emergency Response Centre (ERC)

- ERC : A part of existing pollution control authorities
- Purpose: Interface between the policy makers and the pollution control authorities
- Proposed ERC Team :
  - **Air Quality Modeler**
  - **Meteorologist**
  - **Transport Planner**
  - **Communication Engineer**
  - **Health Expert**
  - **Coordinator**

Thanks