ASEAN IVO FORUM 2016
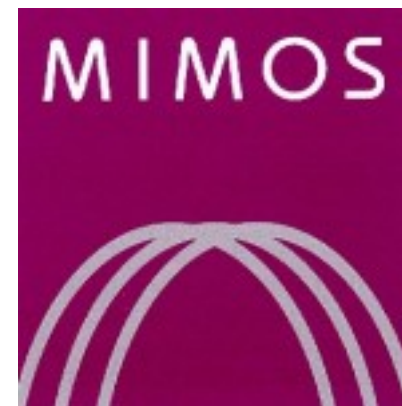
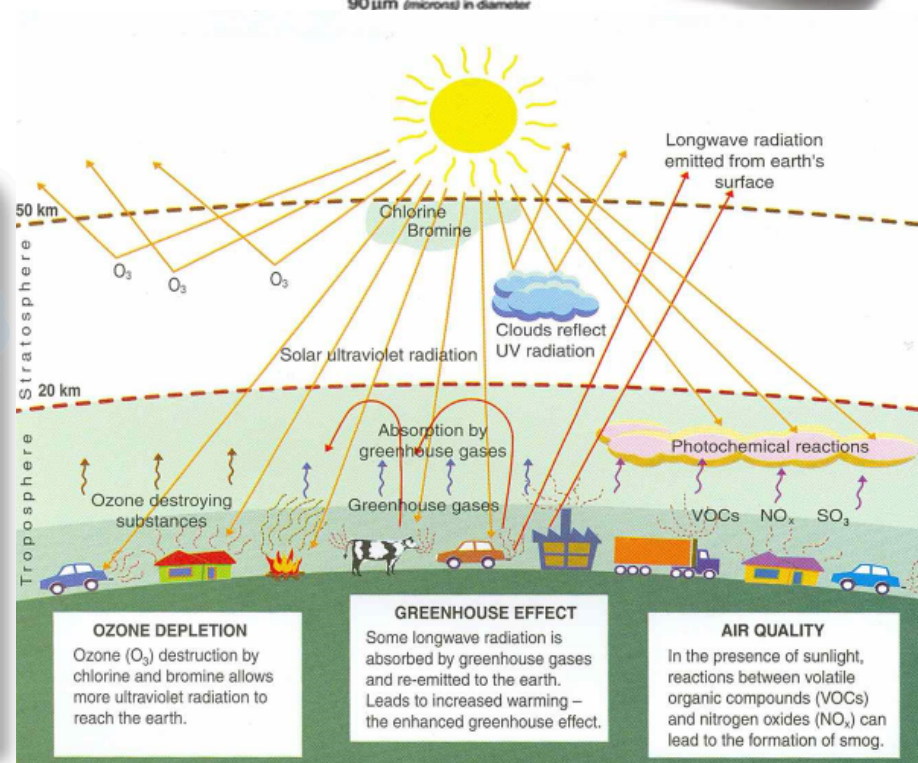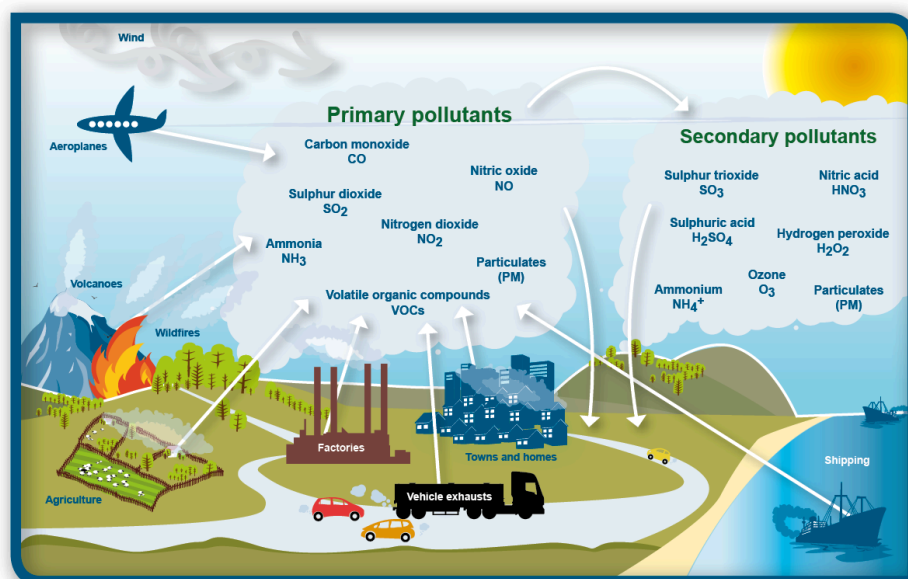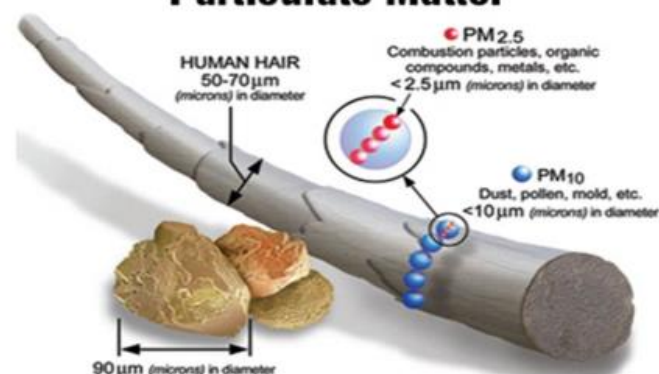# AIR QUALITY MONITORING SYSTEM

Associate Professor Dr. Robiah Ahmad

Introduction

- HAZE –smoke, dust, moisture and vapor suspended in air
- Long term exposure - arsenic, chromium, cadmium and other carcinogenic elements.

Relative Size of Particulate Matter

HUMAN HAIR
50-70µm (microns) in diameter

PM2.5
Combustion particles, organic compounds, metals, etc.
<2.5µm (microns) in diameter

PM10
Dust, pollen, mold, etc.
<10µm (microns) in diameter

90µm (microns) in diameter

Wind

Primary pollutants

Aeroplanes

Carbon monoxide CO

Nitric oxide NO

Secondary pollutants

Sulphur trioxide SO3

Nitric acid HNO3

Sulphur dioxide SO2

Nitrogen dioxide NO2

Sulphuric acid H2SO4

Hydrogen peroxide H2O2

Ammonia NH3

Particulates (PM)

Ammonium NH4+

Ozone O3

Particulates (PM)

Volcanoes

Volatile organic compounds VOCs

Wildfires

Factories

Towns and homes

Shipping

Agriculture

Vehicle exhausts

Longwave radiation emitted from earth's surface

50 km

Chlorine Bromine

Stratosphere

O3 O3 O3

Clouds reflect UV radiation

Solar ultraviolet radiation

20 km

Absorption by greenhouse gases

Photochemical reactions

Troposphere

Ozone destroying substances

Greenhouse gases

VOCs NOx SO3

OZONE DEPLETION
Ozone (O3) destruction by chlorine and bromine allows more ultraviolet radiation to reach the earth.

GREENHOUSE EFFECT
Some longwave radiation is absorbed by greenhouse gases and re-emitted to the earth. Leads to increased warming – the enhanced greenhouse effect.

AIR QUALITY
In the presence of sunlight, reactions between volatile organic compounds (VOCs) and nitrogen oxides (NOx) can lead to the formation of smog.

Needs

HEALTH

- Impair Visibility,
- WHO – air pollutants kills around 7 million people, 1 in 8 deaths worldwide[a],
- Chronic Obstructive Pulmonary Disease (COPD)
- Lung Cancer
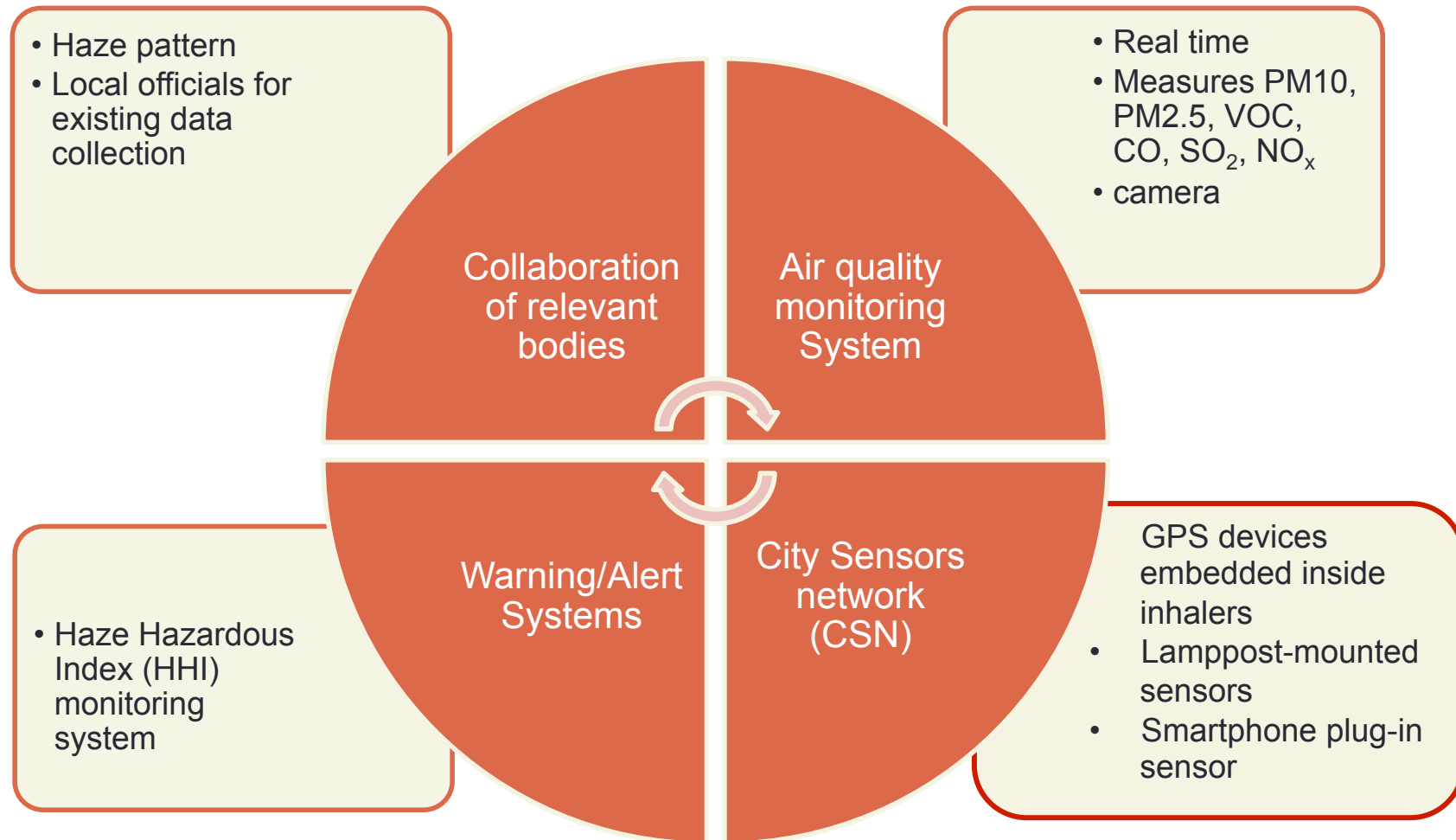- Respiratory Infections Among Children.

AGRICULTURE

- Atmospheric pollutants - can have direct toxic effects, or indirectly by changing soil pH
- PMs have a negative mechanical effect - cover the leaf blade reducing light penetration and blocking the opening of stomata.
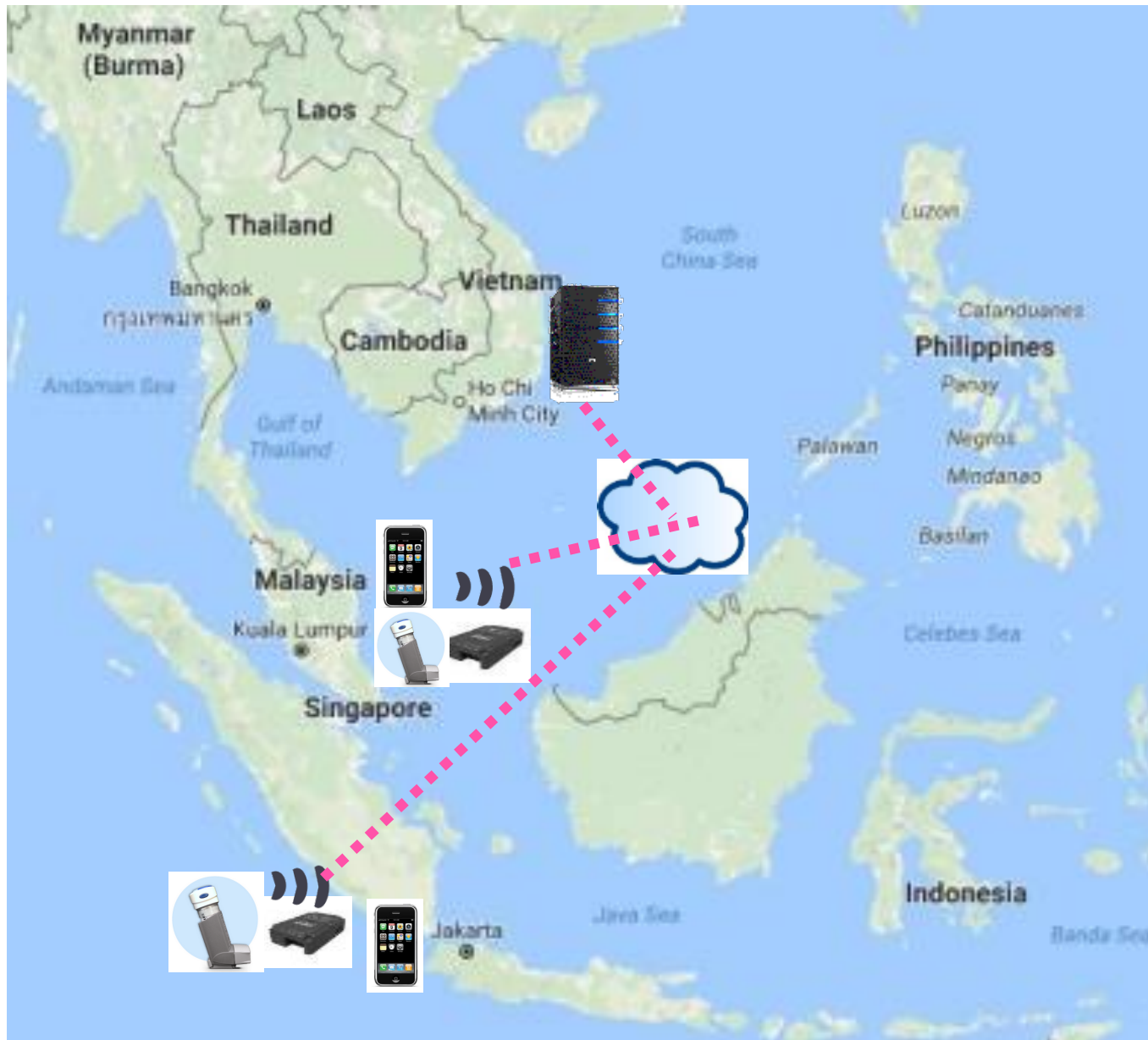- India's wheat and rice crop yields have dropped[b]

COORDINATED INTERNATIONAL EFFORT

- Unpredicted nature of haze
- The general public does not view haze as a serious health treat
- Countries in Southeast Asia have little control over what blows across their border
- ASEAN lacks the legal authority to force its members to act against their own interest

Approach

- Haze pattern
- Local officials for existing data collection

- Real time
- Measures PM10, PM2.5, VOC, CO, SO_2, NO_x
- camera

Collaboration of relevant bodies

Air quality monitoring System

Warning/Alert Systems

City Sensors network (CSN)

- Haze Hazardous Index (HHI) monitoring system

GPS devices embedded inside inhalers
- Lamppost-mounted sensors
- Smartphone plug-in sensor

Approach

Server:
- Web Server (open Source)
- Database
- Application
- Integration
- Data Analysis on Weather & Health Data

Mobile Device and Applications
- Real-time data
- Historical data
- Graph
- GPS
- HEALTH INDEX

Portable Sensor Device
* WIFI Based
* SENSORS:
- Humidity,
- Temperature
- Light,
- PM10, PM2.5,
- VOC, CO2

Medication Device;
- Location / GPS.
- Identity

Benefit

| Monitoring and assessment for local authorities as well as public | Prevention and Preparedness | Regional, National and joint emergency response | Procedures for deployment of people, materials, and equipment across borders | Technical cooperation and scientific research |

Difference with existing

Haze tracker ;

- https://www.hazetracker.org/firemap/

National Environment Agency

- http://www.haze.gov.sg. 24-hr PSI update. Singapore

Haze action online -

- http://haze.asean.org.
- The hotspots depicted in the map are derived from the NOAA-18 satellite.
- Hotspots go undetected when the area is not covered in the satellite pass or under cloudy / overcast conditions.
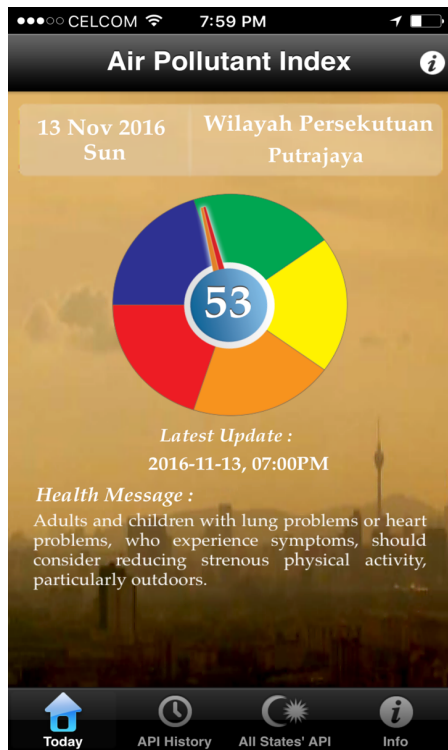
Static measurement stations

- Used by official authorities to monitor and publish air quality
- often costly, hard to maintain and not scalable in the long term

Localized data- Personal reflection; Analysis and prediction

- Data is localized – real-time and more accurate, scalable
- Based on the wind direction of the air movement so more timely response take be taken

Impact / Summary

Air Pollutant Index

13 Nov 2016 Sun — Wilayah Persekutuan Putrajaya

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Latest Update:
2016-11-13, 07:00PM

Health Message:
Adults and children with lung problems or heart problems, who experience symptoms, should consider reducing strenous physical activity, particularly outdoors.

Today | API History | All States' API | Info

It has been decades on measuring air quality
- Air Quality Index 1968

Advances in sensors, analytics, communication tools
- Citizen more aware, address the health outcomes of poor air quality

Crowd data sourcing
- Exploit the use of personal mobile phone for crowd sensing

Dynamic collective mapping of the air quality from the crowd
- Awareness and faster action taken, timely response

Urban population engagement and motivation
- Foster awareness towards environmental issues