



# Environment Monitoring In Indonesia (Prepared)

[basuki@itb.ac.id](mailto:basuki@itb.ac.id)

Institut Teknologi Bandung



# Outline

- Background
- Current Conditions
- IDEATE
- Future Plans



# Background

- In 2015 , there were huge fire in forestry and impact many peoples around the world
- There was limited information and data related to the fire in Forestry especially related with public data
- Fire in the forestry
  - No AWS
  - No sensor connected
  - The MODIS Data came from satellite, within 24 hours
  - Land Clearing on Coconut palm oil plantation
  - More than 10 Million Hectar on Indonesia



# Radar Data

## SADDEWA Satellite Disaster Early Warning System

OBSERVASI :  K. Awan |  IR1 |  IR2 |  IR3 |  IR4 |  AWS |

PREDIKSI :  |  |  |  |  |  |  |  |

[TUTORIAL \(Petunjuk\)](#)

Hujan 5 Km

Reset

Jam 00.00 WIB

Jam 01.00 WIB

Jam 02.00 WIB

Jam 03.00 WIB

Jam 04.00 WIB

Jam 05.00 WIB

Jam 06.00 WIB

Jam 07.00 WIB

Jam 08.00 WIB

Jam 09.00 WIB

Jam 10.00 WIB

Jam 11.00 WIB

Jam 12.00 WIB

Jam 13.00 WIB

Jam 14.00 WIB

Jam 15.00 WIB



### DISCLAIMER

#### OBITUARI

Current UTC Time: Senin, 5:42:26  
Current Time: Senin, 12:42:26

Latest OBSERVASI update: 06 March 2017  
Latest PREDIKSI update: 06 March 2017

**Kejadian Hujan Ekstrem Saat Ini:**  
Tidak ada kejadian hujan ekstrem saat ini

### Visitors

ID 2,192	GB 10
US 194	FR 3
SG 53	CN 3
RU 19	NL 2
JP 11	TH 2

Pageviews: 21,437

<http://sadewa.sains.lapan.go.id/>



# Current Conditions



<http://fires.globalforestwatch.org/map/#activeLayers=viirsFires%2CactiveFires%2CarchiveFires%2CboundingBoxes&activeBasemap=topo&x=112&y=-3&z=5>



# Aerosol Sensor in Indonesia (NASA)

- Initiated by NASA
- Collaboration with several institution (incl ITB)
- Six Sensor
  - Bandung
  - Jakarta
  - Palangkaraya
  - Pekanbaru
  - Jambi
- PM 10

+ CAMPAIGNS

+ COLLABORATORS

**- DATA**

+ LOGISTICS

+ NASA PROJECTS

+ OPERATIONS

+ PUBLICATIONS

+ SITE INFORMATION

+ STAFF

+ SYSTEM DESCRIPTION

The principal investigator(s) of the 'Bandung' site:  
 Puji Lestari  
 Brent Holben  
 If you intend to use the following data please contact principal investigator(s) via e-mail:  
[pujilest@indo.net.id](mailto:pujilest@indo.net.id)  
[Brent.N.Holben@nasa.gov](mailto:Brent.N.Holben@nasa.gov)

Operational Time at 'Bandung' Site  
 2213 Days [ 6.063 Years]  
 Start Date: 12-MAY-2009; Latest Date: 01-AUG-2016

Total Processed Data [Years represent total data equivalent]  
 Level 1.0 AOD: 1762 Days [ 4.827 Years]  
 Level 1.5 AOD: 1496 Days [ 4.099 Years]  
 Level 2.0 AOD: 717 Days [ 1.964 Years]

[Return to the World Map](#) | [Switch to Version 2 Inversions](#) | [Switch to Version 3 Direct Sun](#)

**AERONET DATA ACCESS**

**DATA SYNERGY TOOL**

+ Data Display

**AEROSOL OPTICAL DEPTH (V3)**

+ Data Display

+ Download Tool

+ Web Service

**AEROSOL OPTICAL DEPTH (V2)**

+ Data Display

+ Download Tool

+ Download All Sites

+ Climatology Tables

+ Climatology Maps

**Data Display Controls**

**AERONET Data Type:**  
 AOD  
 Water Vapor  
 440-870 Angstrom  
 SDA Fine/Coarse AOD  
 SDA Fine Mode Fraction

AOD Level (2016):  Level 1.0  Level 1.5  
 Data Format:  All points  Daily averages  
 Triplet Error Bars (All Points Only):  Off  On

SELECT CHARTS FOR LARGER IMAGES

Choose year :	2009	2010	2011	2012	2013	2014	2015	2016
Choose month of 2016 :	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG

Related Product Availability for Bandung (select each day below):

- Back Trajectory Analyses - Availability - More Information
- MPLNET Images - Availability - More Information
- Show TERRA-MODIS | AQUA-MODIS Rapid Response Images - Availability - More Information
- LandSat Image
- Visible Satellite Images (Check Availability) - More Information
- Infrared Satellite Images (Check Availability) - More Information

**AOD Level 1.0 data from AUG of 2016**

Bandung , S 06°53'16", E 107°36'36", Alt 826 m,  
 PI : Puji\_Lestari and Brent\_Holben, pujilest@indo.net.id  
 Level 1.0 AOT; Data from AUG 2016

**AOD Level 1.0 data from AUG 1 of 2016**

Bandung , S 06°53'16", E 107°36'36", Alt 826 m,  
 PI : Puji\_Lestari and Brent\_Holben, pujilest@indo.net.id  
 Level 1.0 AOT; Data from 1 AUG 2016

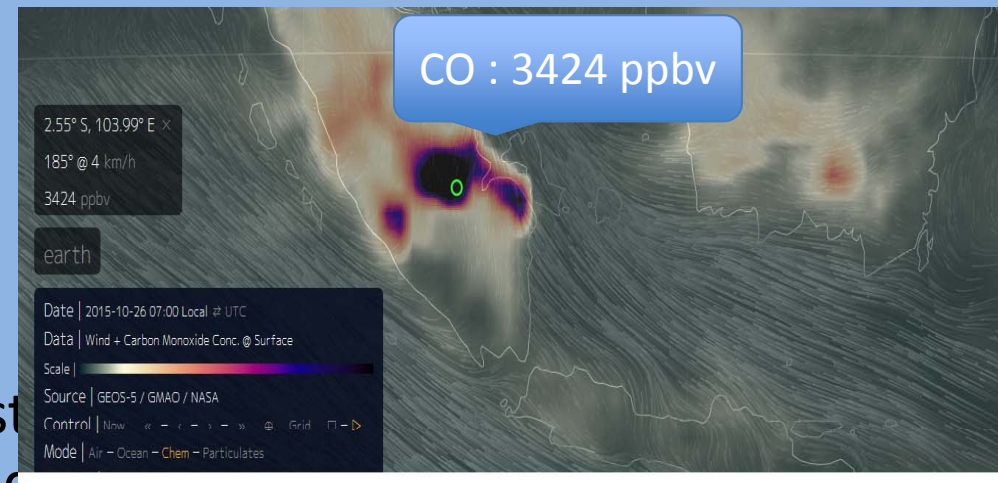
[http://aeronet.gsfc.nasa.gov/cgi-](http://aeronet.gsfc.nasa.gov/cgi-bin/type_one_station_opera_v2_new?site=Bandung&nachal=0&year=24&month=7&aero_water=0&level=1&if_day=0&if_err=0&place_code=10&year_or_month=0)

[bin/type\\_one\\_station\\_opera\\_v2\\_new?site=Bandung&nachal=0&year=24&month=7&aero\\_water=0&level=1&if\\_day=0&if\\_err=0&place\\_code=10&year\\_or\\_month=0](http://aeronet.gsfc.nasa.gov/cgi-bin/type_one_station_opera_v2_new?site=Bandung&nachal=0&year=24&month=7&aero_water=0&level=1&if_day=0&if_err=0&place_code=10&year_or_month=0)



# Earth.nullschool.net (2015)

- The Fire affected by the Wind direction and speed
- The indicators :
  - COsc , Carbon Monoxide surface concentration
  - Wind directions and speed
- a visualization of global weather conditions forecast by supercomputers updated every three hours
- Good as a models
- Need more precise informartion on the location affected







# PM2.5 and PM10 sensor

Jakarta South (US Consulate) Air Pollution: Real-time Air Quality Index (AQI)

Jakarta South (US Consulate) AQI: Jakarta South (US Consulate) **29** Good Updated on Wed. 6:00 Primary pollutant: pm10

Current Past 48 hours data

Time	PM2.5 AQI	PM10 AQI
6	-	29
12	-	29
18	-	29
Tuesday 6	-	29
12	-	29
18	-	29
Wednesday 6	46	156

Weather Information

Time	Temp.	Pressure	Humidity
6	26	-	100
12	26	-	100
18	26	-	100
Tuesday 6	26	-	100
12	26	-	100
18	26	-	100
Wednesday 6	26	-	100

Jambi Air Pollution: Real-time Air Quality Index (AQI)

Jambi AQI: Jambi Real-time Air Quality Index (AQI). **62** Moderate Updated on Wed. 12:00 Temp.: 28°C

Current Past 48 hours data

Time	PM2.5 AQI	Temp.
6	62	28
12	62	28
18	62	28
Tuesday 6	62	28
12	62	28
18	62	28
Wednesday 6	62	28
12	62	28

Weather Information

Time	Temp.
6	28
12	28
18	28
Tuesday 6	28
12	28
18	28
Wednesday 6	28
12	28

Data : API

<http://aqicn.org/city/indonesia/jakarta/us-consulate/south/>





# Environment Sensor

- Environmental sensor with Pollutant standard Index (PSI)
  - PM10
  - SO<sub>2</sub>
  - CO
  - NO<sub>2</sub>
- Locally
- Not connected to the Network and Sensor Network
- Not connected to central database





# Weather model in @ITB

## Prediksi Interaktif

GoogleMap

## Global

Hujan

## Indonesia

Awan

Hujan (MM5)

Hujan (WRF)

Temperatur

Theta Ekuivalen

## Jawa

Awan

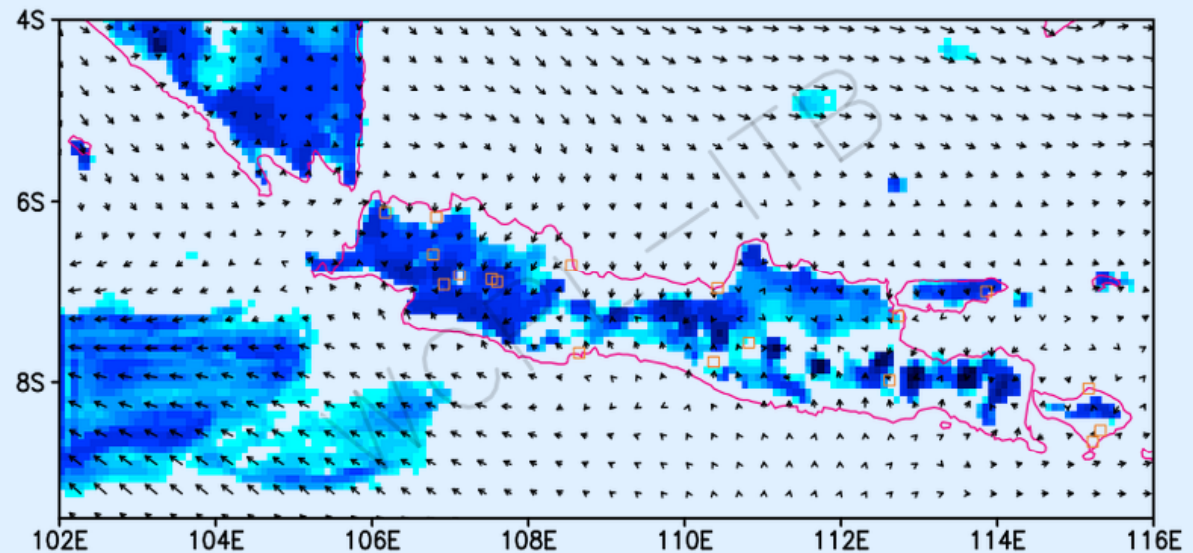
Hujan (MM5)

Hujan (WRF)

Temperatur

Theta Ekuivalen

## WCPL – WRF Experimental Weather Prediction (res. 9 km)



Valid from 2017-03-05 10:00 WIT to 2017-03-05 13:00 WIT  
Shaded : Rainfall (mm)

[http://weather.meteo.itb.ac.id/java\\_wrf\\_rain\\_cy00.php](http://weather.meteo.itb.ac.id/java_wrf_rain_cy00.php)



# IDEATE

- By combining the **satellite data** with **meteorological records**, Field established that Indonesian fires often occur in association with the ultra-dry conditions in the region that accompany El Niño, a major cyclical weather system. These dry out the underlying peat to the point at which it can catch fire and can't be extinguished until monsoon rains arrive months later. A next step might be to refine the predictions further by including the combined effects of **high temperatures and low humidity** on peat moisture, says Field.
- He also found that less than **4 millimeters of rain per day** during the annual dry season, from August to November – combined with El Niño conditions – seems to be a “tipping point” beyond which fires can suddenly take off.



# Define

- What we (Indonesia) need it ?
  - Automated Weather Station
    - Rainfall
    - Temperature
    - Humidity
  - Air quality Index and Pollution Standard index measurements
    - NO<sub>x</sub>, SO<sub>x</sub>, CO, NH<sub>3</sub>, O<sub>3</sub>, CH<sub>4</sub> and PM 2.5 (10)
  - Sensors and sensors network
  - Prediction models (computing capacity)
  - Socialize to peoples

[https://en.wikipedia.org/wiki/Pollutant\\_Standards\\_Index](https://en.wikipedia.org/wiki/Pollutant_Standards_Index)



# Constraints/obstacle

- In the field
  - There is no power
  - Limited coverage by telecommunications system
  - No sensor available
- Source of the fire
  - More than 50 km from nearest town



# Build Prototype

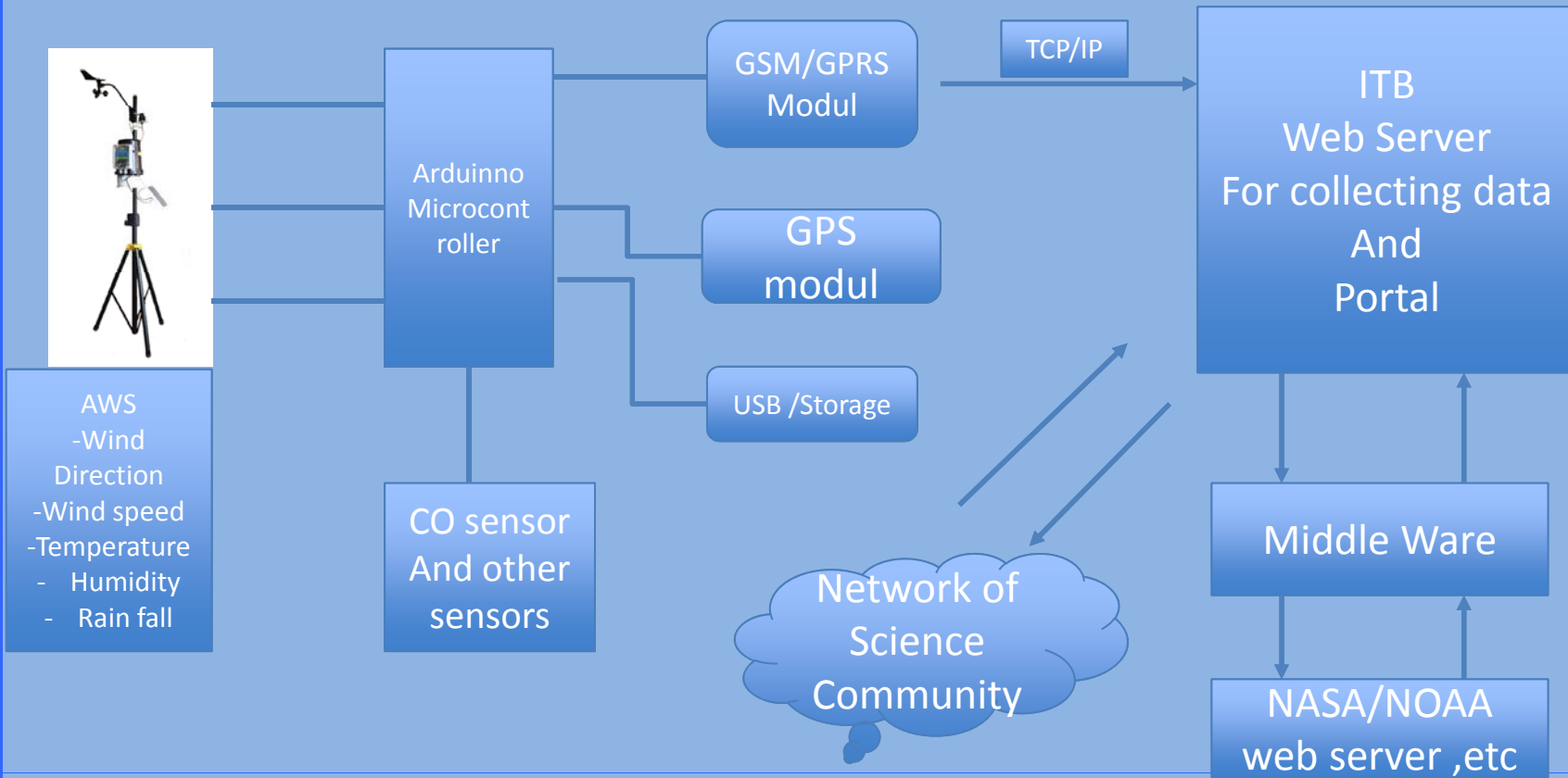
- Build prototype for AWS+sensor base on Arduino
  - Board (I/O)
  - Communication
    - GSM/GPRS/Wifi
    - Ethernet
    - USB/Storage System
  - Sensors
    - Temperature
    - Wind speed
    - Wind direction
    - Humidity
    - Rainfall rate
    - CO
    - Particulate Matters 2.5 and 10 Micron
    - CH4 ?
- Develop Service Oriented Services (SOA) for the
- Put the AWS+Sensors in the area with near forestry/ peatland





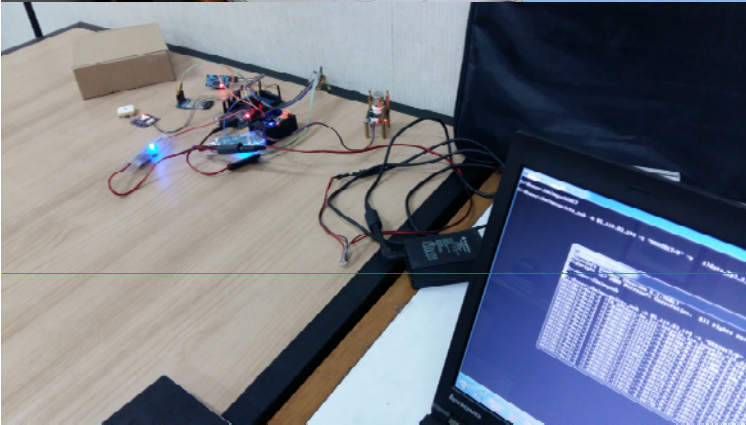
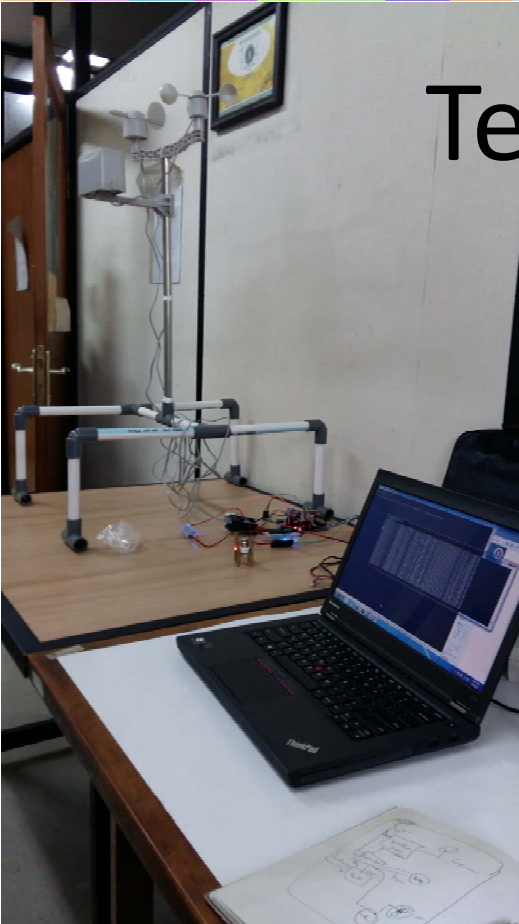
# Prototype 1.0

Forestry (School)



# Testing on the Lab

- AWS + Sensor
  - Windspeed, wind direction, temperature, pressure, humidity, CO2 sensor
  - GSM /GPRS





# Testing on the field

- Calibration of the equipment
- Testing in Near Oil Palm Plantation
  - Collaboration with Ministry of Environment and Forestry
- Measure on reliability of the data and system to the main server in ITB



# Main Challenges (Future)

- Data sharing
  - Data are available only in web based information systems
  - Need to develop web services to make those data available to others
    - <http://weather.meteo.itb.ac.id/aws.php> is one example that have some of their data available to others using web service (by request)
- Build the model for reduce impact on Disaster
  - Fire on Forestry / Land fires
  - CO/CO2 models
  - PM (Particulate Mattes 2.5 micron)
- Build the Sensor Network
  - AWS (Automatic Weather Station)
  - Carbon Monoxide (CO)
  - Carbon Dioxide (CO2)
  - Particulate Matter
  - Methane
- Start Build the WRF-Chem on ITB
- Simuation on Environment impact peoples