Remote Sensing Satellite-based Air Pollution Monitoring in Lao PDR

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Ministry of Natural Resources and Environment
Natural Resources and Environment Research Institute
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- PAPGAPI in Lao PDR
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1. Practical Activities of Air Pollution Observation

Hotspot monitoring occurred on January to June 2020

Amount of hotspot happened in each province of Lao PDR
NO2 & SO2 Monitoring

Nitrogen Dioxide (NO2)

Air Quality Index (AQI)

Air Quality Monitoring

NO2 Tropospheric Column (30% Cloud Screened) daily 0.25 deg. [OMI OMI NO2d v603] 19m2 2019-04-01T00:00:00

NO2 Total Column on 01 Jan 2019 - 31 Dec 2019

NO2 Troposphere Column on 01 Jan 2019 - 31 Dec 2019

SO2 Surface Mass Concentration on Jan-April 2019

SO2 Column Mass Density on Jan-April 2019

Selected date range was 2019-04-01 - 2019-04-30. Title reflects the date range of the gridded data that went into making this result.

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Carbon Monoxide (CO)

Time Averaged Map of CO Surface Concentration in ppbv (ENSEMBLE) monthly 0.5 x 0.625 deg. [MERRA-2 Model M2TMNXCHM v5.12.4] ppbv over 2019-Jan, Region 90.8789E, 5.0977N, 111.4453E, 30.2344N

Carbon Monoxide (CO) monitoring by Merra-2 from Jan-July 2019
Monitoring PM2.5 air pollution evented from the Vientiane Capital KM32 waste landfill site based on Satellite analysis as Aerosol Optical Depth (AOD) between 2022-01-30 and 2022-02-05.

var AOD = ee.ImageCollection("MODIS/006/MCD19A2_GRANULES");

Sources:
https://developers.google.com/earth-engine/datasets/catalog/MODIS_006_MCD19A2_GRANULES

https://icode.best/i/82837843694197
https://lpdaac.usgs.gov/products/mcd19a2v006/
NRERI-FAO Cooperation

Spatio-temporal dynamics of air pollution and the delineation of hotspots in the Lao People's Democratic Republic

Yearly means for the period 2015–2021 for a) aerosol optical depth (AOD) and b) ultraviolet aerosol index (UVAI) and average column amounts of c) nitrogen dioxide (molec/cm²); d) ozone (DU) and e) sulphur dioxide (DU).

Images taken from the field data collection. a) Interview with villagers/farmers to assess the contribution of farming to air pollution in Parkou district in Luangprabang. b) Field location survey and data collection in Luangprabang. c) Discussion with governmental officials to assess the contribution of anthropogenic activity to air pollution in Luangprabang. c) Interview with villagers to assess the contribution of farming practices to air pollution Chomphet district, Luangprabang.

Five provinces with highest pollution indicators based on provincial means of each pollution indicator averaged over study period (left: geographic locations; right: provinces ranked).
2. Project for Building the Pan-Asia Partnership for Geospatial Air Pollution Information (PAPGAPi) in Lao PDR

Address:
Ministry of Natural Resources and Environment
Natural Resources and Environment Research Institute
Nongbeuk Rd, Nongping Village, Sikhottabong District,
Vientiane Capital of Laos,
P.O.Box: 7864

Geographical Coordinate of the Pandora Site
Latitude: 17°59'52.56"N
Longitude: 102°34'55.74"E
Height: 169 a.s.l
PAPGAPi Project

- **Report**
  - Official Declaration
  - NIER & KOICA
  - NRERI
  - Minister
  - Approved
  - DPF

- **February 17, 2022**
  - MOU
  - DPF
  - NIER & KOICA

- Site

Note:
- Natural Resources and Environment Research Institute (NRERI), MONRE of Lao PDR
- Department of Planning and Finance (DPF), MONRE of Lao PDR

- Survey / find out the suitable site for Pandora installation
- Submitted the “Check list for the Pandora Site and Installation”
- PANDORA installation completely  **July 16, 2023**
PANDORA Location and Pandora Installation

North

East

South

West

Planned Place
5. Installing Guard Railing for Pandora

4. Installing Pandora’s Sensor and Control Box
8. Meeting with Vice Minister of MONRE of Lao PDR
Hand-over Meeting of Pandora Instrument
Observing Pandora Instrument

Clean PANDORA’s Len

put plastic bottle for preventing rain and its humidity

glue the floor to prevent rain
3. Future Cooperation

Ministry of Natural Resources and Environment (MONRE), Lao PDR
- Natural Resources and Environment Research Institute (NRERI)
  - Remote Sensing and Mapping Division (RSMD)
  - Modelling Division (MD)

Economic and Social Commission for Asia and Pacific (ESCAP)

Korea International Cooperation Agency (KOICA)

National Institute of Environmental Research (NIER)

Korea Environment Corporation (K-eco)

ASEAN Research and Training Center for Space Technology and Applications

Sentinel Asia
Space4SDGs (Geospatial data with SDGs)-GeoSDGs

Satellite Derived Annual PM 2.5 Data Sets in Support of the United Nations Sustainable Development Goals

- **Goal 3** – Good Health and Well Being
  - **Target 3. 9; Indicator 3. 9. 1** Mortality rate attributed to household and ambient air pollution (mean annual levels of air pollution level (PM 2. 5))

- **Goal 11** – Sustainable Cities and Communities
  - **Target 11. 6; Indicator 11. 6. 2** Annual mean levels of fine particulate matter (e.g. PM 2. 5 and PM 10) in cities (Population weighted)

- Capacity building on application of Satellite technology in the Natural Resources and Environment etc.
- Human Resources Development. Eg. Supporting fellowship for Lao’s office in Master, Doctoral, Researches etc.
- MONRE- ESCAP/KOICA/NIER Cooperation Grant/founding and technical for MONRE of Laos.
- MOU between NRERI-KOICA/NIER Cooperation on Application of Korea’s Satellite Technology for Natural Resources and Environment Management in Lao PDR
- On job-training, research with ESCAP, KOICA and NIER regarding Space Technology, for instance climate change (CO2 & CH4 GHG), air pollution monitoring (PM2.5 & PM10) along the Lao’s Sub-Mekong River Basin, urban water quality, EIA in mineral project in Lao PDR, disaster (flood, drought, landslide etc.), detect the area of geothermal energy potential, Carbon stock in forest along the Lao’s sub-Mekong river basin under the policies and strategies of **Carbon-neutral and Carbon net-zero** in Lao PDR.

RSMD’s List of Future Projects (2023-2025)

I. Air Quality Monitoring
1) Monitoring urban air quality based on the observation of Aerosol Optical Depth (AOD) in Lao PDR.
2) The use of remotely sensed satellite to assess the PM$_{2.5}$ and PM$_{10}$ concentration in main cities of Lao PDR.
3) Tran-boundary haze pollution issue in Southeast Asia: Using remotely sensed satellite to monitor the Tran-boundary Haze Pollution in northern of Laos.

II. Disaster Risk Reduction (DRR)
1) Application of remotely sensed satellite to estimate the flood risk in Lao PDR.
2) Using satellite remotely sensed-data to study the drought risk in the Laos’ Sub-Mekong basin for economic growth.
3) Using satellite remotely sensed-data to study the drought risk in the Laos’ Sub-Mekong basin for sustainable water resources management.
4) Assessment of landslide hazard zonation to reduce the losses of socio-economic using remote sensing and GIS technologies in Lao PDR.

III. Water Management
1) Application of remote sensing and GIS for mapping and wetland inventory along sub-Mekong basin for natural resources management in Lao PDR.
2) Using remote sense and GIS to monitor forest cover and land-use change along sub-Mekong basin for sustainable water resources management in Lao PDR.
3) The monitoring water quality along Lao’s sub-Mekong River basin using Remotely Sensed Satellite.

IV. Climate Change Monitoring
1) Application of Remotely Sensed Satellite to estimate land surface temperature and soil moisture stress index for planning agricultural land management in Lao PDR.
2) Using Remote Sensing and GIS for Studying Effect to Urban Heat Island (UHI) Effect from Land Cover Change in Municipal Area (Vientiane Capital, Luang Prabang, Savannakhet and Champasack Province), Lao PDR.

V. Land Management
1) SLEUTH Model-based Land Use Change Simulation for planning Socio-Economic Development in Lao PDR using Satellite Remotely Sensed Imagery.
2) Application of remote sense and GIS to monitor the change of the Mekong River’s bank based on Universal Soil Loss Equation (USLE) in Lao PDR.
3) Forecasting urban growth based on remote sensing, GIS and SLEUTH model for 8th Five-Year National Socio-economic Development Plan (2016-2020) in Lao PDR.

VI. Web-GIS (Web Mapping)
1) Establishing GIS Web to manage the spatial databases of natural resources and environment using PostGIS, GeoServer and Openlayers for Natural Resources and Environment Research Institute.
ขอบคุณด้วย คุณ
Khop Jai Lai Lai
Thank You So Much for Your Attention