WMO Vegetation Fire and Smoke Pollution Warning Advisory and Assessment System (VFSP-WAS): objective and plans

Web-site: https://community.wmo.int/activity-areas/gaw/science/modelling-applications/vfsp-was

Alexander Baklanov[1], Boon Ning Chew[2], Radenko Pavlovic[3], Daniel Tong[4], Mikhail Sofiev[5]

1 WMO, Science and Innovation Department, BP2300, CH-1211 Geneva, Switzerland, email: abaklanov@wmo.int
2 Meteorological Service Singapore (MSS), ASEAN Specialized Meteorological Centre (ASMC), Singapore
3 Environment and Climate Change Canada, Centre for Meteorological and Environmental Prediction, Canada
4 Mason University & NASA, USA
5 Finnish Meteorological Institute, Helsinki, Finland

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CITES 2021

Interdisciplinary Biomass Burning Initiative (IBBI)

IBBI was founded in 2012, by

- **WMO GAW** (World Meteorological Organization, Global Atmosphere Watch Program)
- **IGAC** (International Global Atmospheric Chemistry)
- **iLEAPS** (Integrated Land Ecosystem-Atmosphere Processes Study)

IBBI activities address five key topics:

- Fire products (burned area, fire radiative power, emission factors, etc.);
- Fire models and the representation of fires within models at different spatial scales;
- Observations of fires, smoke and atmospheric composition;
- The influence of fires on air quality; and
- The link between fires and climate change

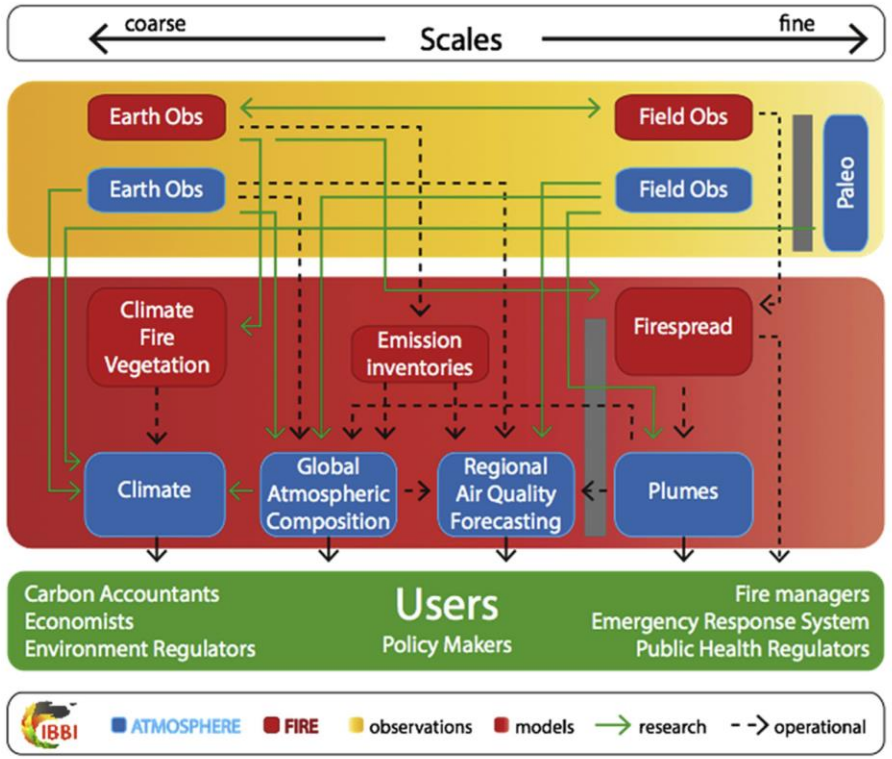

Fig. 1. Biomass burning data processing pathways and two major blocks (grey boxes) identified during the 3rd IBBI workshop.

UNISDR IWPM International Wildfire Preparedness Mechanism

giz

Global Wildland Fire Network

IBBI

UNITED NATIONS UNIVERSITY

BMKG

Forecasting Emissions from Vegetation Fires and their Impacts on Human Health and Security in South East Asia

International workshop organized by the World Meteorological Organisation (WMO) and the International Biomass Burning Initiative (IBBI)
Supported by the WMO, UNISDR/IWPM, GIZ, IGAC, UNU, the Global Wildland Fire Network and Indonesian Agency for Meteorological, Climatology and Geophysics (BMKG), Jakarta, Indonesia
29 August – 1 September 2016

GOALS OF THE WORKSHOP:

1. Share experience and knowledge between SE Asian and international scientists, national agencies and practitioners on the underlying reasons, meteorological, environmental and human health impacts of vegetation fires and smoke pollution.
2. Provide initial overview of the tools for forecasting and train personnel of responsible agencies in forecasting vegetation fire smoke emissions, transport, air quality and impact on human health.
3. Explore the interest and feasibility in setting up Regional Facilities that can assist WMO Members in the region in forecasting vegetation fire smoke emissions, its transport, pollution and impacts and to evaluate the capacity of countries in the area in supporting/providing such facilities.

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Outcomes from the Jakarta Workshop

- Arising from the keen interest of WMO Members in several impacted regions, the note provides guidance for addressing the issues of vegetation fire and smoke pollution.
- It also proposes the establishment of a Vegetation Fire and Smoke Pollution Warning and Advisory System (VFSP-WAS) and to support the potential foundation of regional centers on the topic.

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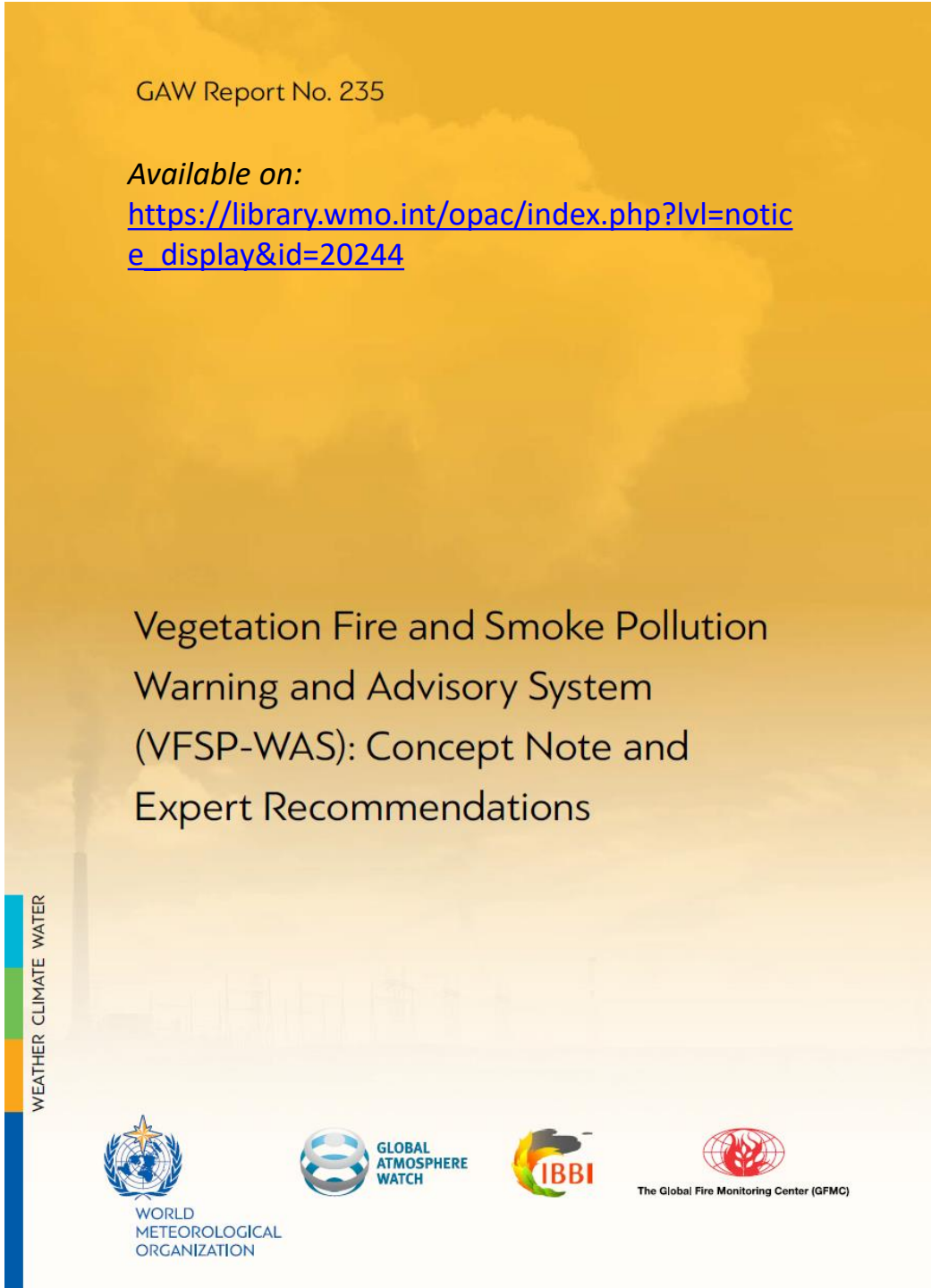
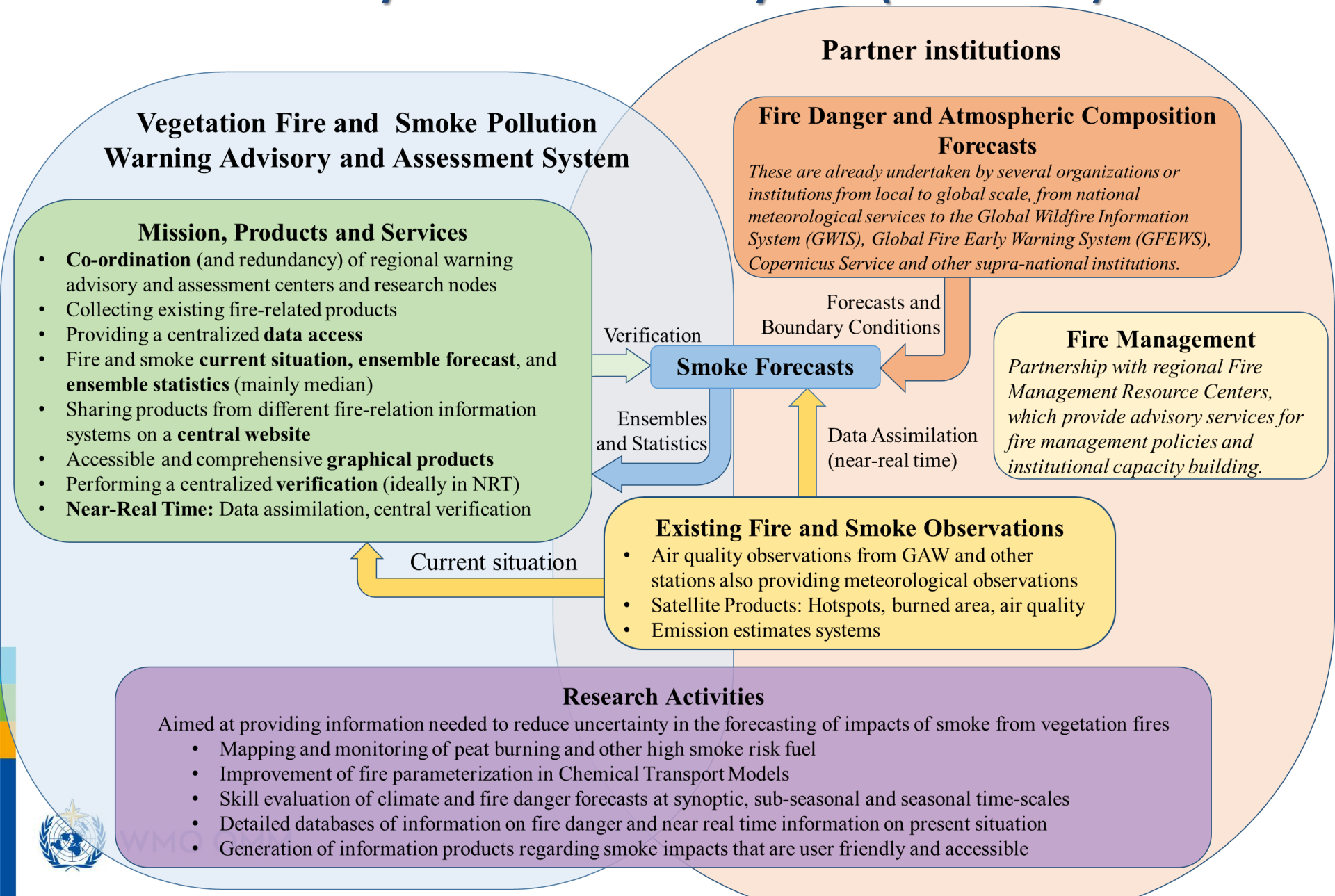


Overview of a Vegetation Fire and Smoke Pollution Warning Advisory and Assessment System (VFSP-WAS)



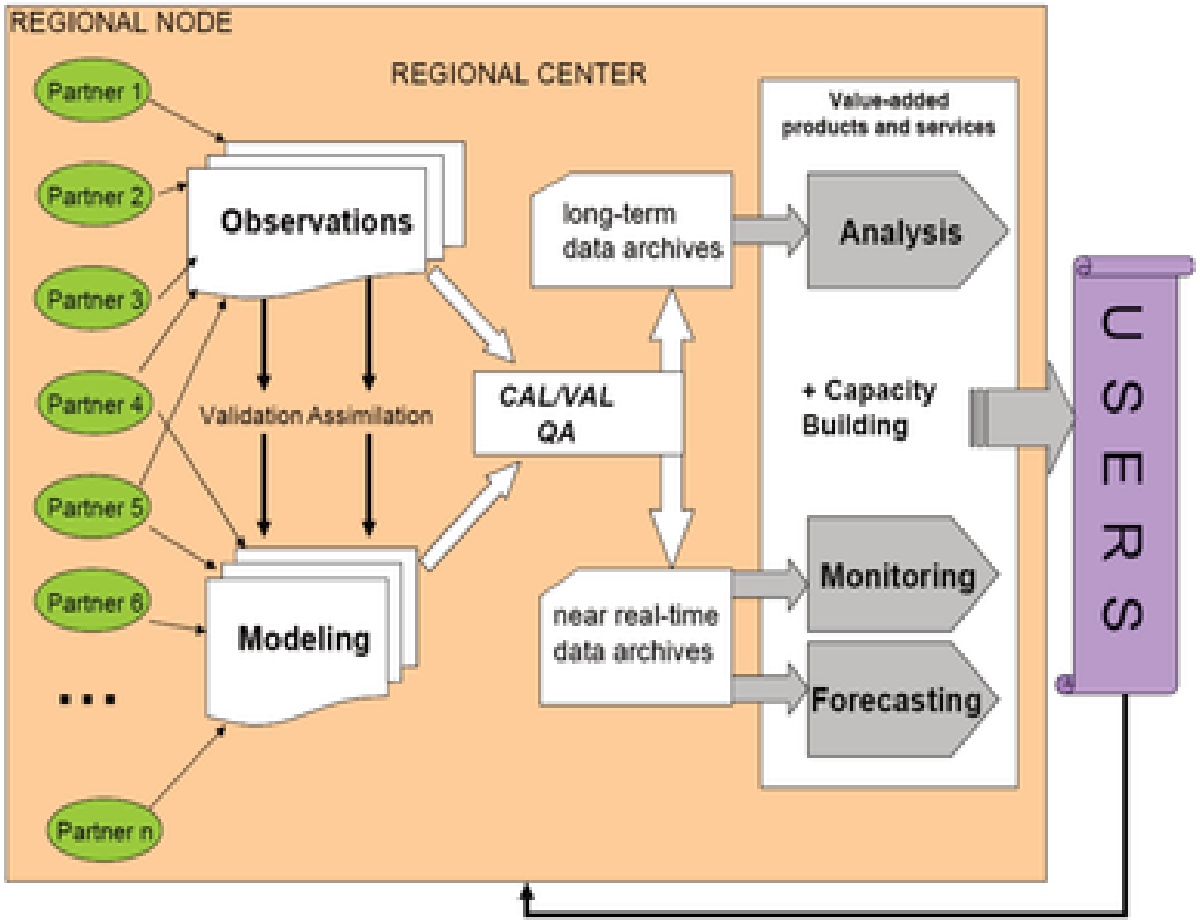
Research Topics in Focus:

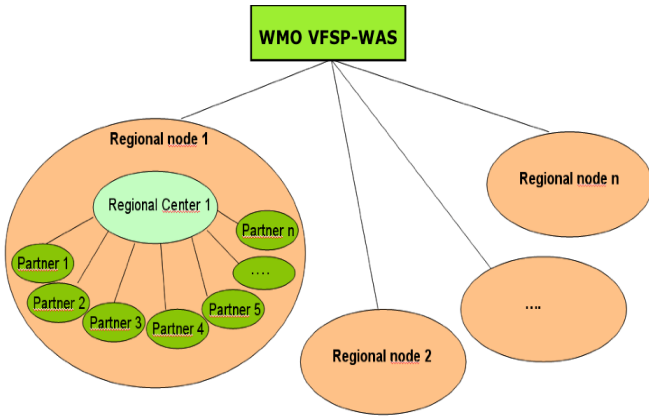
- **Fire danger and seasonal forecast**
  - *WMO WWRP S2S project*
  - *ECMWF/Copernicus service, GWIS*
- **Fire emissions and haze forecast**
  - *Fire Radiative Power*
  - *Smoke detection*
  - *Burnt area*
  - *CAMS global forecast and regional downscaling*
- **Observations and data production for verification and assimilation**
  - *GAW and other observations for verification*
  - *NRT data for assimilation*
  - *GALION with Lidar and ceilometer observations*
  - *Satellite new data and retrievals*
  - *Low-cost sensors applicability?*
- **Links and coordination with GWIS, GFMC and Regional Fire Management Centers**

WMO GAW VFSP-WAS & BB Coordination Team: (acc to the decision of WMO GAW/EPAC SSC 2021)

- Mikhail Sofiev, FMI (GAW APP SAG member)
- Chunhong Zhou, CMA (GAW APP SAG member)
- Radenko Pavlovic (ECCC), North America VFSP-WAS center co-leader
- Daniel Tong (GMU/NASA), North America VFSP-WAS center co-leader
- Boon Ning CHEW (NEA), Asia VFSP-WAS center leader
- Keywood, Melita (CSIRO), former IBBI co-chair, GAW SSC member
- Johannes Kaiser, DWD, former IBBI co-chair, GAW APP SAG ex-officio
- Robert Field, Columbia University, IBBI chair
- Mark Parrington, ECMWF, responsible for BB activities, IBBI Board member
- Johann Goldammer (uni-freiburg.de), Global Fire Monitoring Center
- Ariane Frassoni (inpe.br), leader of WMO WGNE aerosol study
- Alexander Baklanov, WMO Secrétariat S&I GAW representative
- Representatives of WMO Service and Infrastructure Commissions
- North America VFSP-WAS Steering Committee members (about 40 scientists)
- ….

Schematic structure of a WMO Regional Node and Fire and Smoke Pollution Warning and Advisory Center (RVFSP-WAC)





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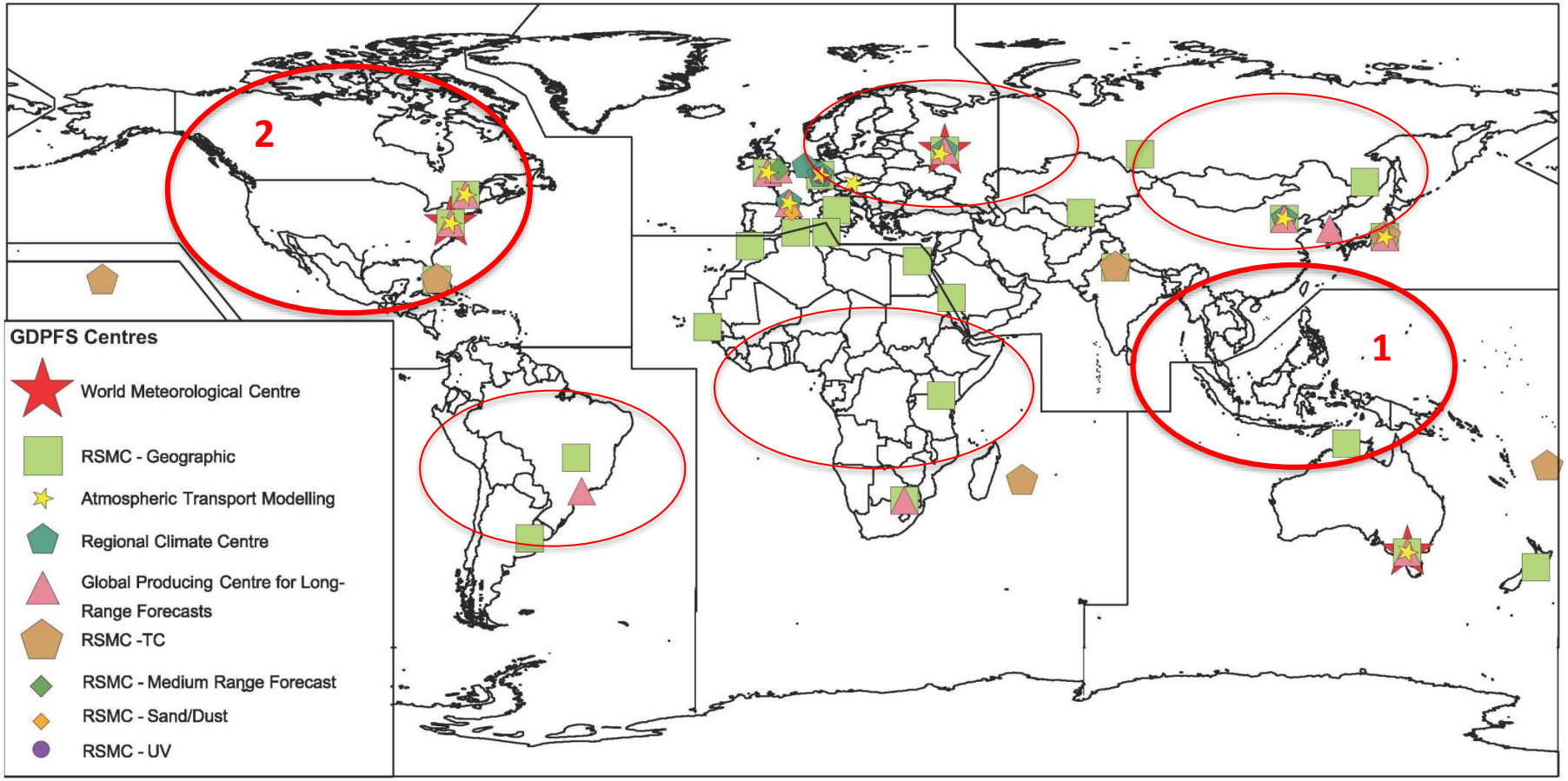
GDPFS and potential VFSP-WAS regional centers

- *Regions for possible VFSP-WAS centers*



Two first WMO VFSP-WAS regional centers on R&D phase:

1) for SE Asia (MSS, BMKG, etc) – hosted by MS Singapore

2) for Northern America (ECCC, NOAA, etc.) – hosted by Env. Canada

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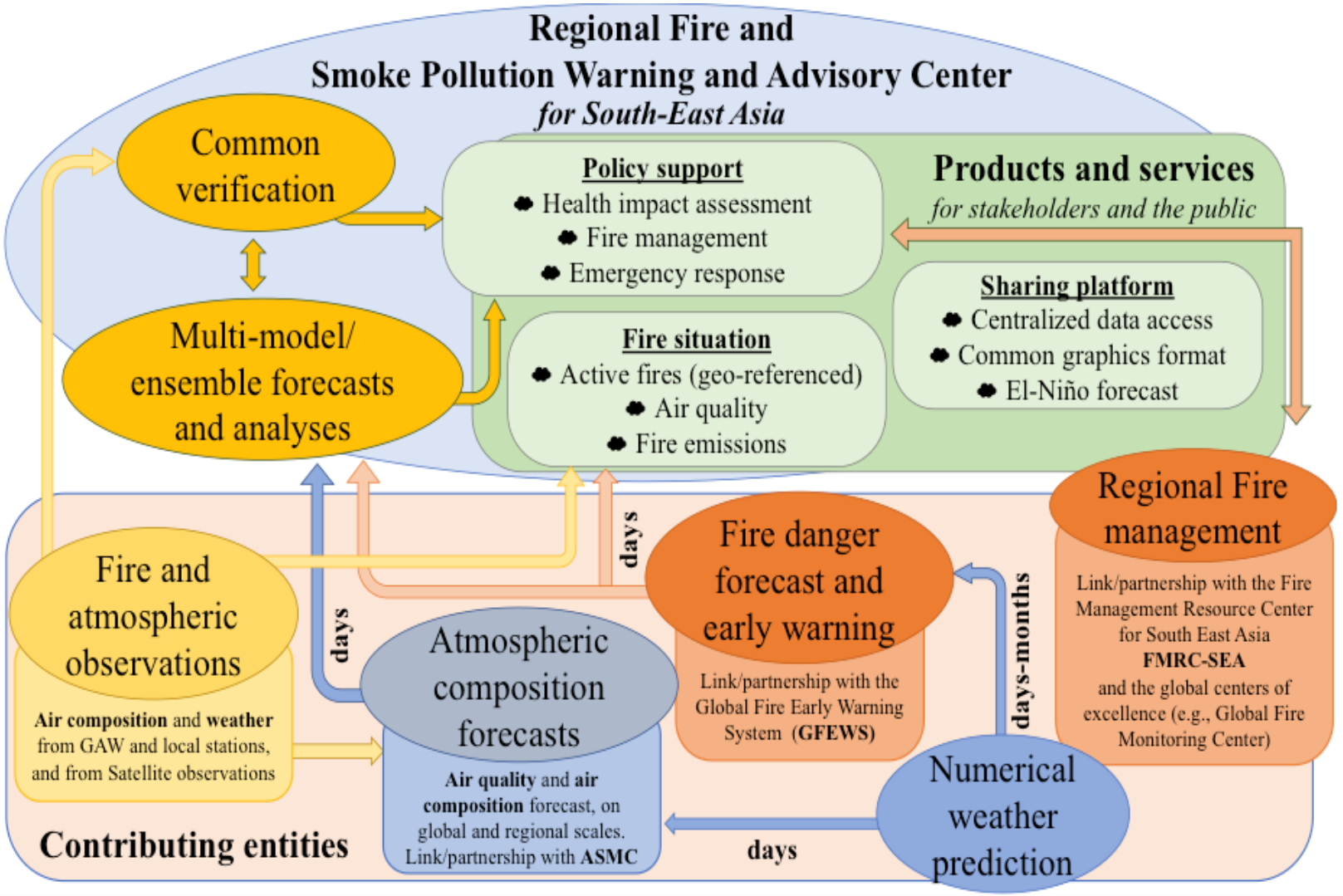
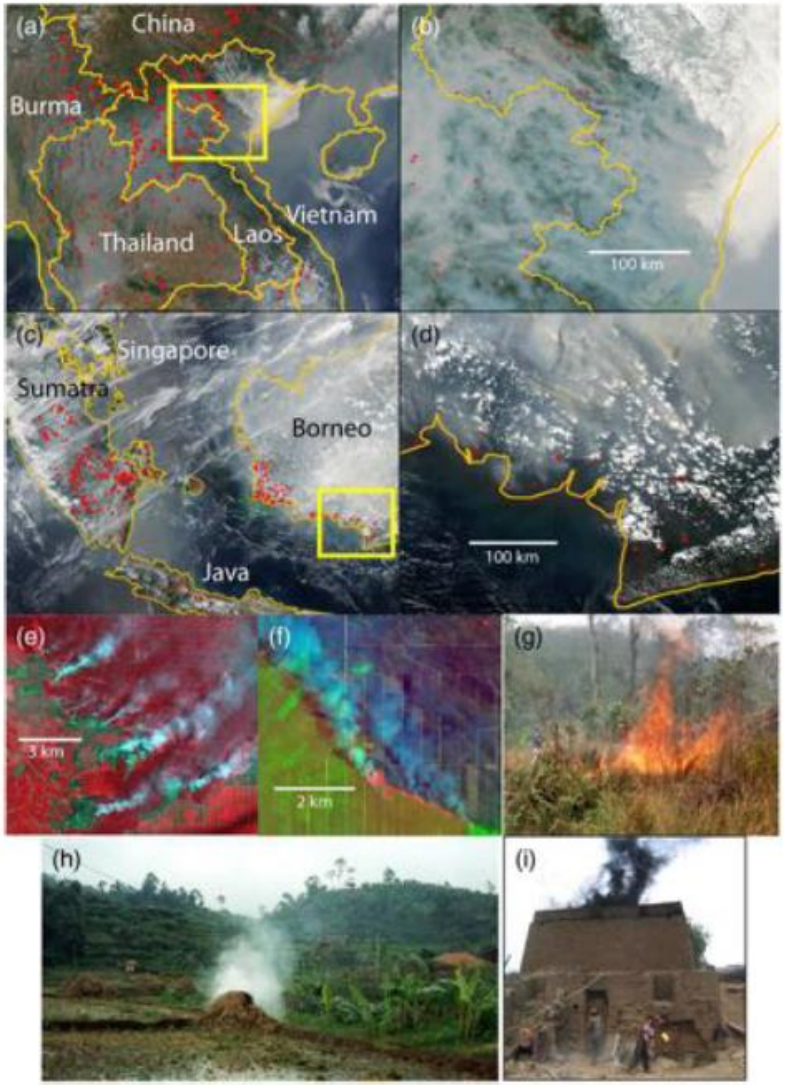
Workflow of a Regional Fire and Smoke Pollution Warning and Advisory Center:

Example for South-East Asia



Vegetation Fires and Haze in Southeast Asia

- Haze has recurrently affected the region since the early 1970s, arising from the common practice of open burning to clear land for agricultural purposes
- Fires typically occur during the traditional dry season of Jan – Apr in northern SE Asia and Jun – Oct in southern SE Asia
- Most severe haze episodes arise from peatland fires in southern SE Asia
- Haze pollution is usually worsened during an El Niño event (e.g. 1997, 2015)



Satellite images of fire events and photos of various types of agricultural burning (Reid et al., 2013)

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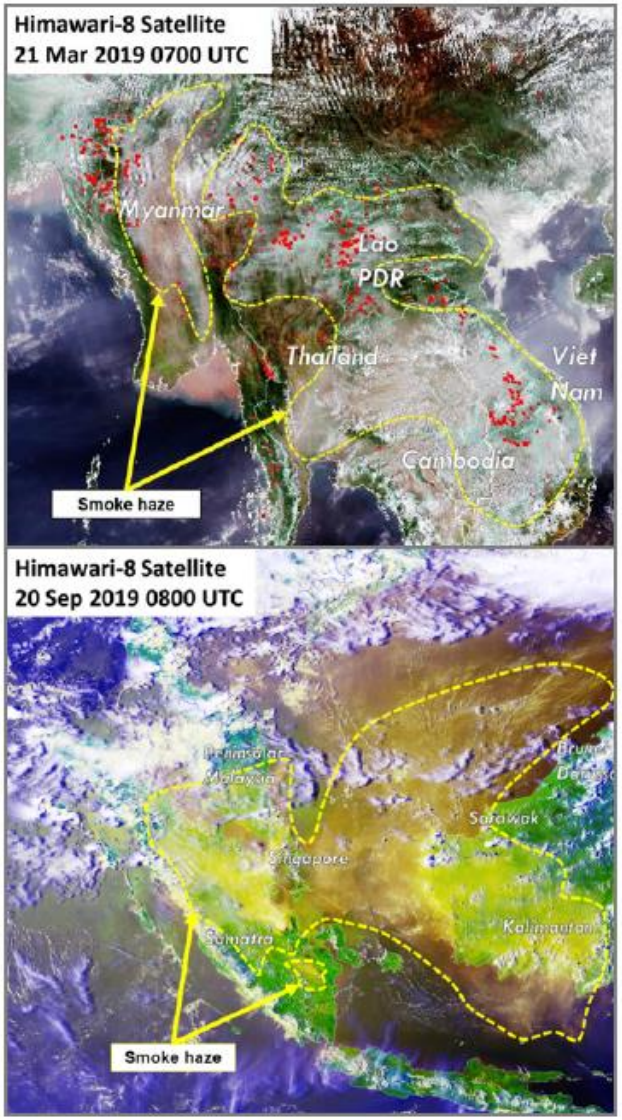
VFSP-WAS Southeast Asia Regional Centre

http://www.weather.gov.sg/vfsp-was/home/

- Build on >20 years of regional haze monitoring experience acquired by ASMC and also comparable initiatives e.g. SDS-WAS, ICAP
- Collaboration with interested partners and existing providers of relevant products and services
- Pilot website for the Southeast Asia VFSP-WAC released in 2018 and launched in research and development phase in 2019
- Full website in development to include:
  - Forecasts (ensemble, ICAP, weather, S2S)
  - Observations (satellite, weather, air quality)
  - Fire Risk (ASEAN FDRS, GFWED, others)



Drier than usual weather conditions led to increased fire activity and smoke pollution over Southeast Asia in 2019

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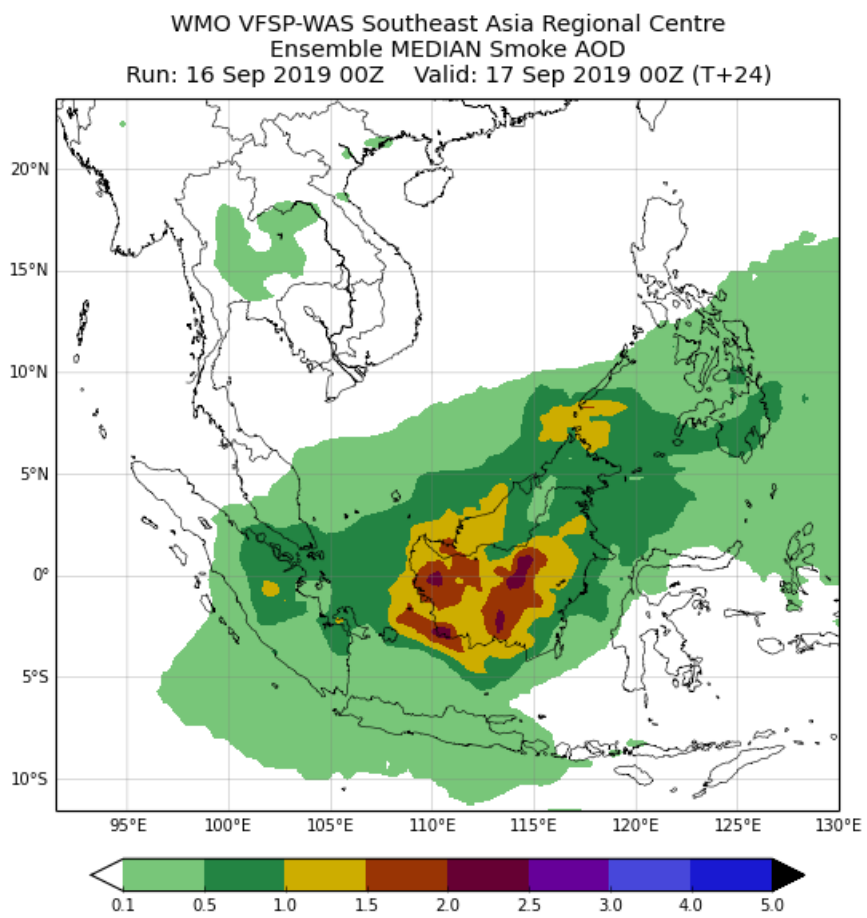
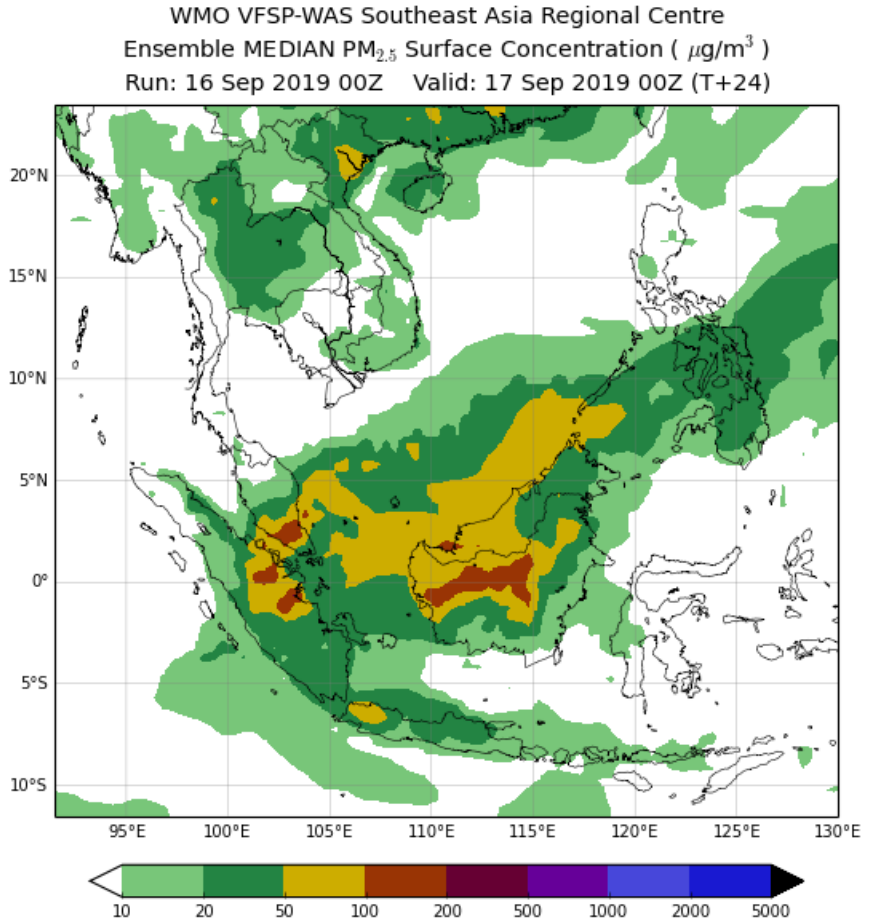
Example Southeast Asia VFSP-WAC multi-model ensemble median 1-day forecast of smoke





AOD (left) and $PM_{2.5}$ surface concentration (right) for the Southeast Asia region in September 2019

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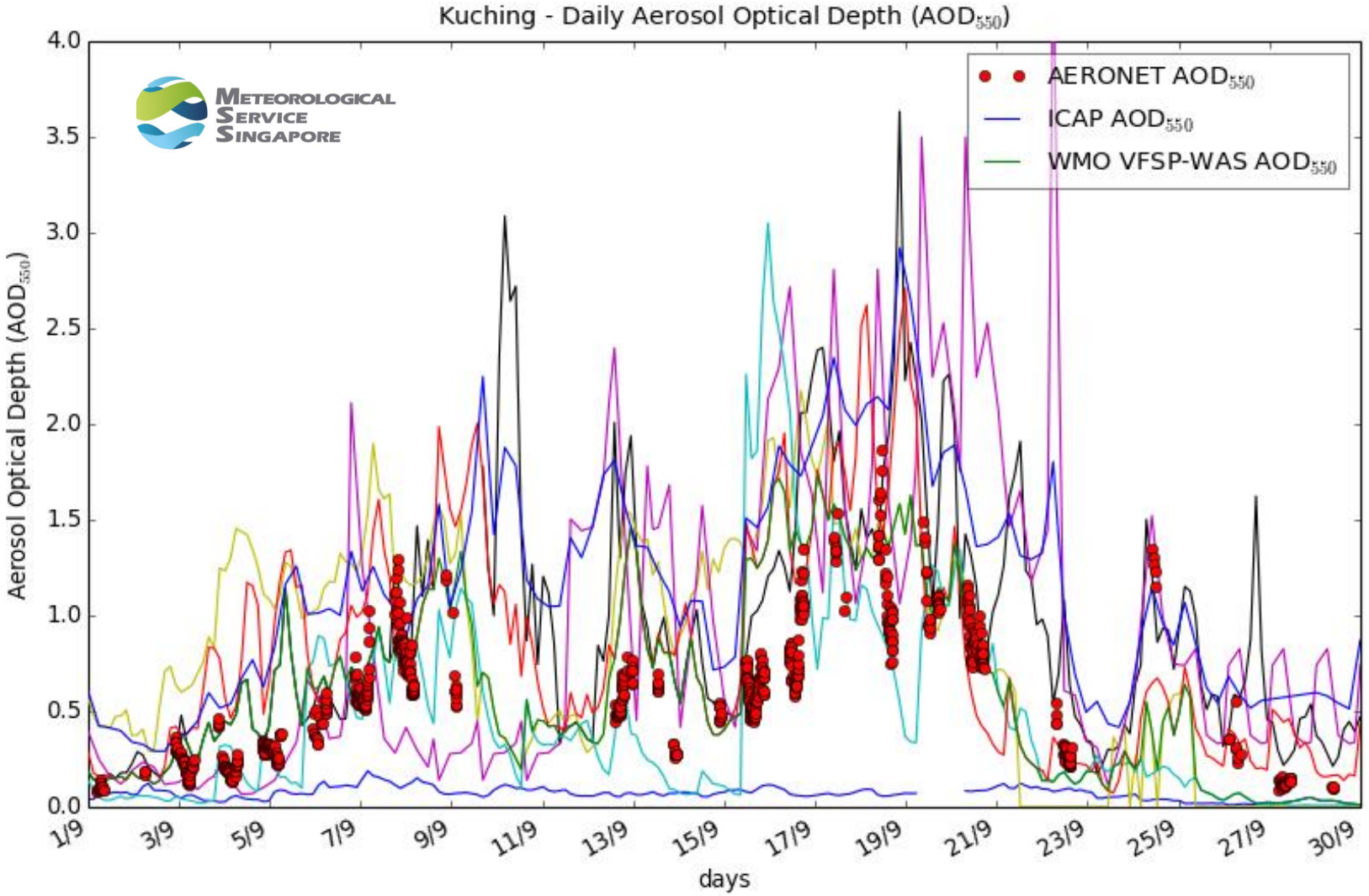
Near-real-time Southeast Asia VFSP-WAC forecast evaluation over Kuching, East Malaysia, during fire peaks in Sept. 2019



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Unlabeled colored lines represent individual model members of the Southeast Asia VFSP-WAC ensemble.

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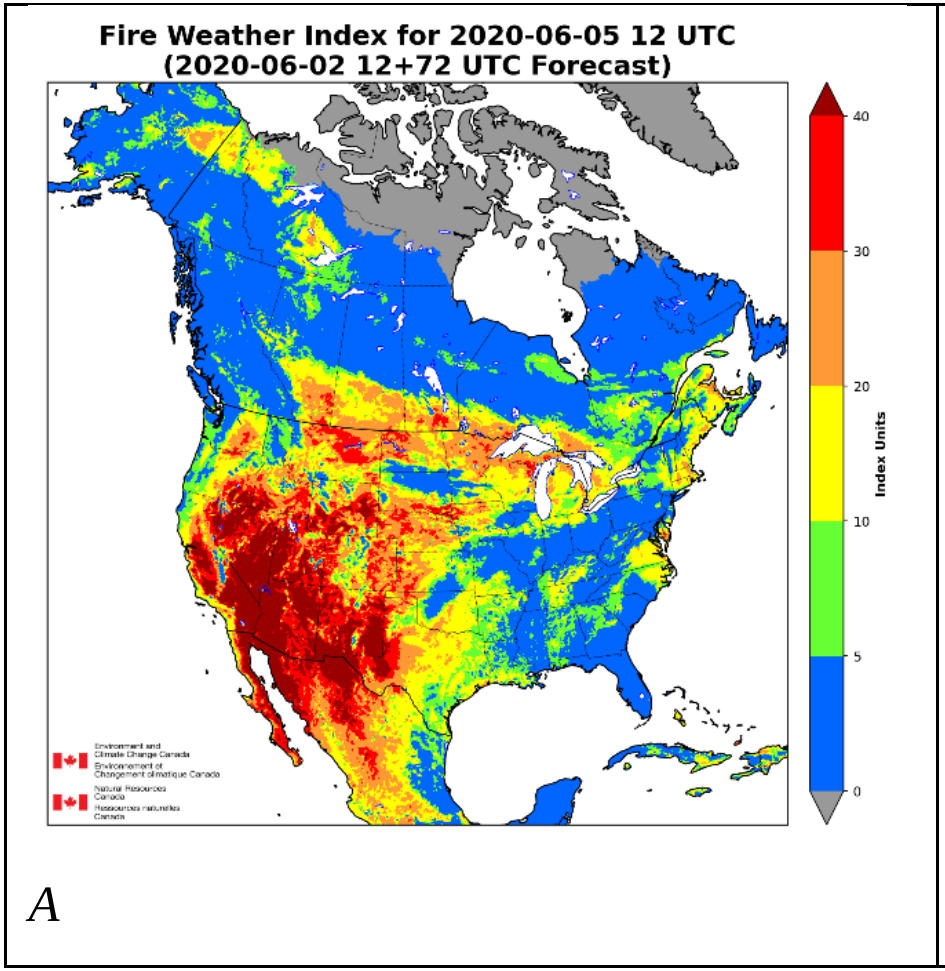
VFSP-WAS regional center for North America



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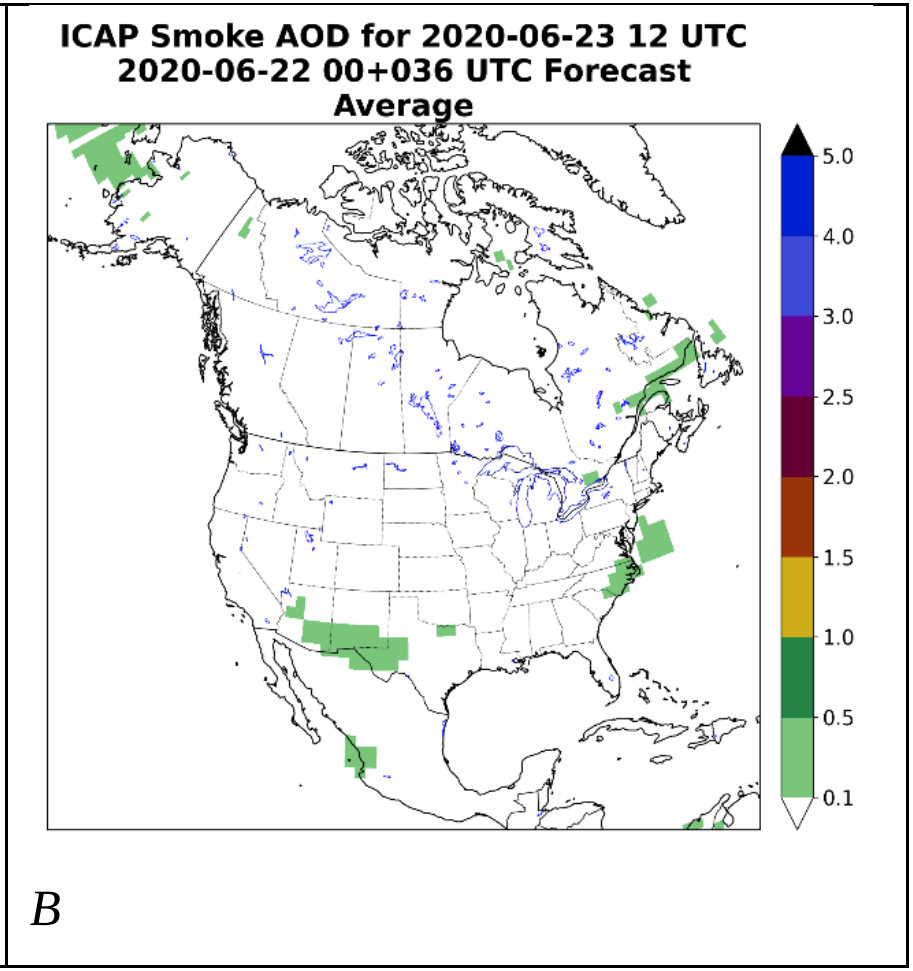

B

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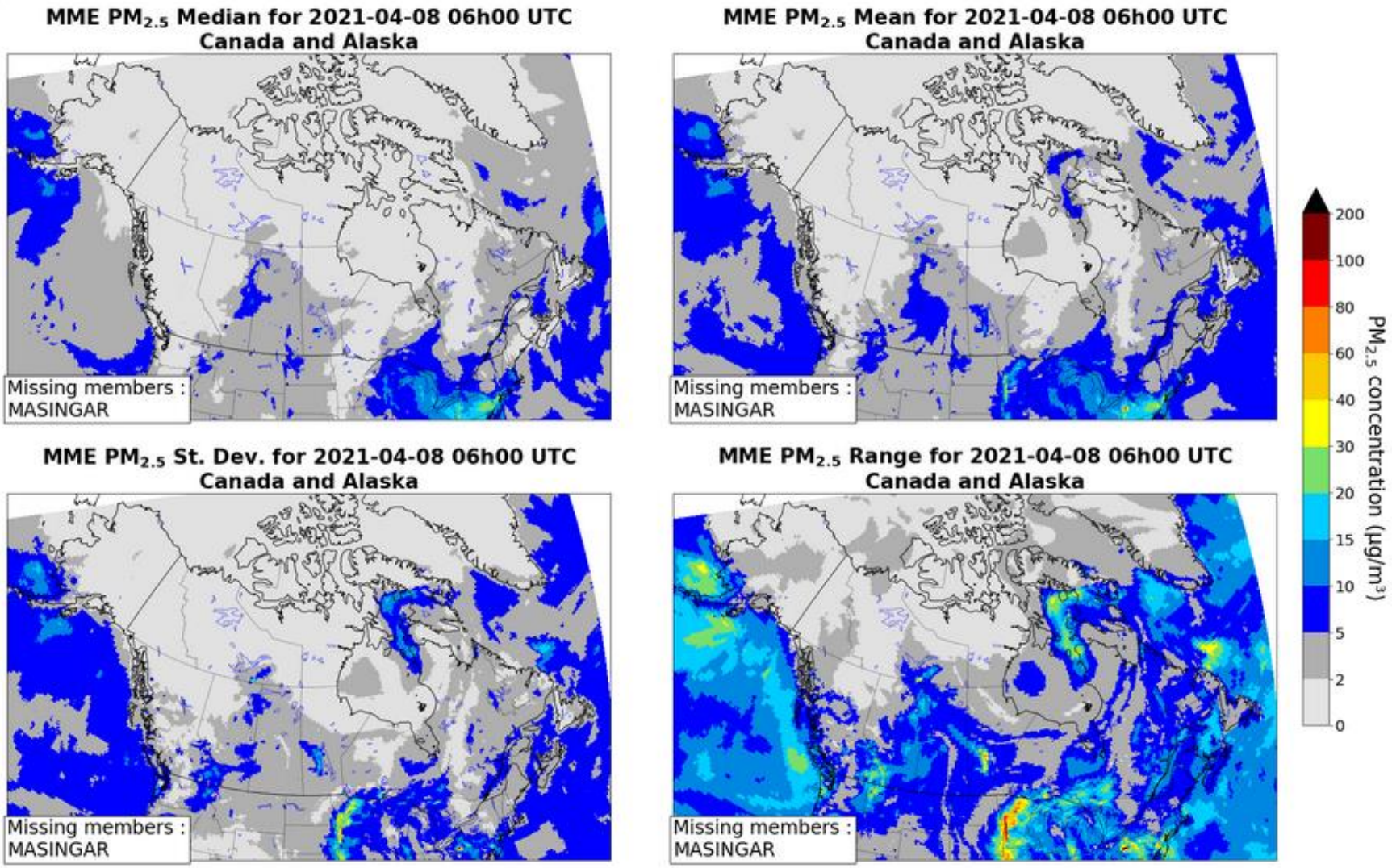
(A): Forecasted FWI valid at 2020-06-05 12UTC, from 2020-06-02 12UTC initial run; (B): forecasted average ICAP Smoke AOD valid at 2020-06-23 12UTC, from 2020-06-22 00UTC initial run

VFSP-WAS regional center for North America



The ensemble $PM_{2.5}$ forecast over Canada and Alaska valid at 2021-04-08 06UTC, from 2021-04-06 00UTC initial runs

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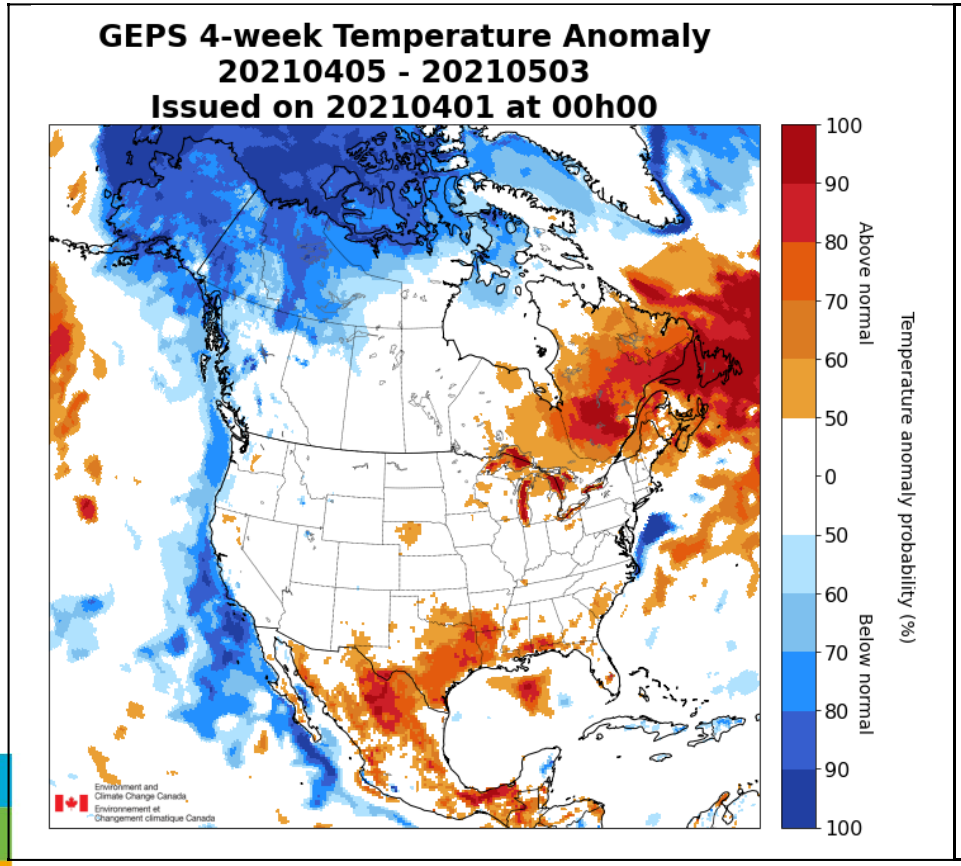
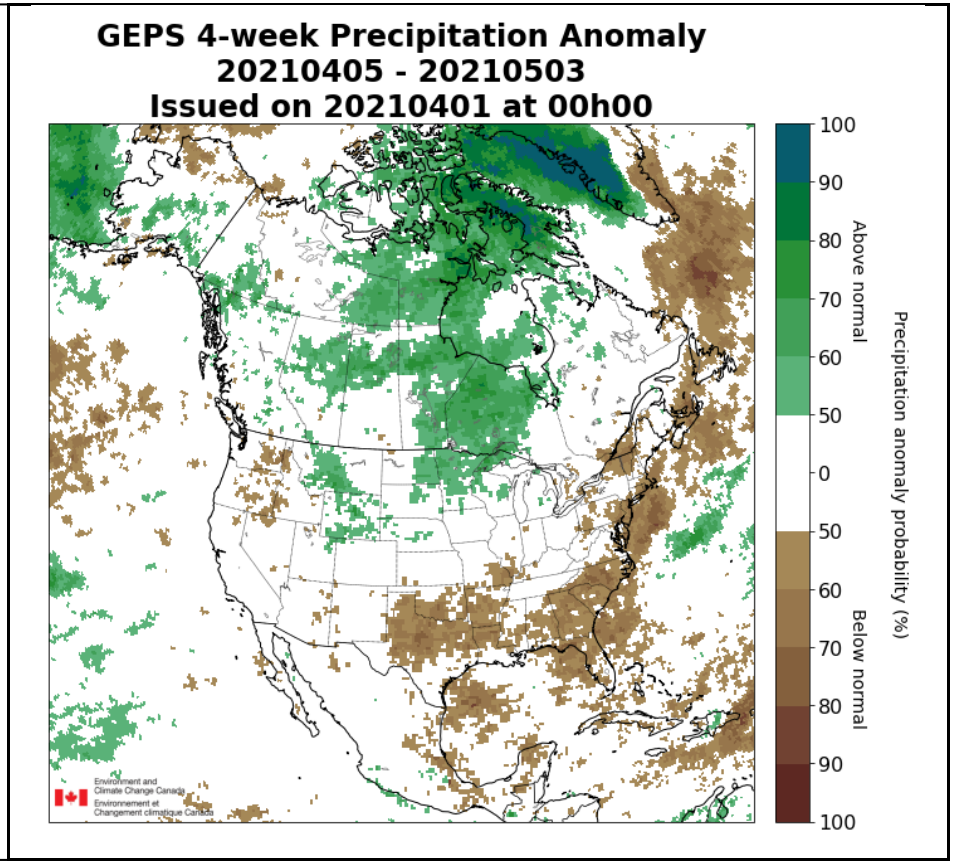
Sub-Seasonal Outlook

ECCC sub-seasonal precipitation and temperature anomaly maps using Global Ensemble Prediction System (GEPS).





Forecasted temperature (left) and precipitation (right) monthly anomalies issued on 2021-04-01 00UTC

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Thanks!

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