



Spatial Data Infrastructure (SDI)

Introduction of the Spatial Data Infrastructure (SDI) and Some SDI-based Applications

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Lecture Outline

- Spatial Data Infrastructure (SDI) Concepts
- SDI Structure and Components
- SDI Database Component
- PostgreSQL, Simple Features & Structured Query Language (SQL)
- Some Web-based Information System Using SDI

SDIs are frameworks of policies, institutional arrangements, data, services, technologies and people (Stefanakis and Prastacos, 2008).



Promote the accessibility and usability of geospatial content

SDI's three-tier architecture

Users and Applications

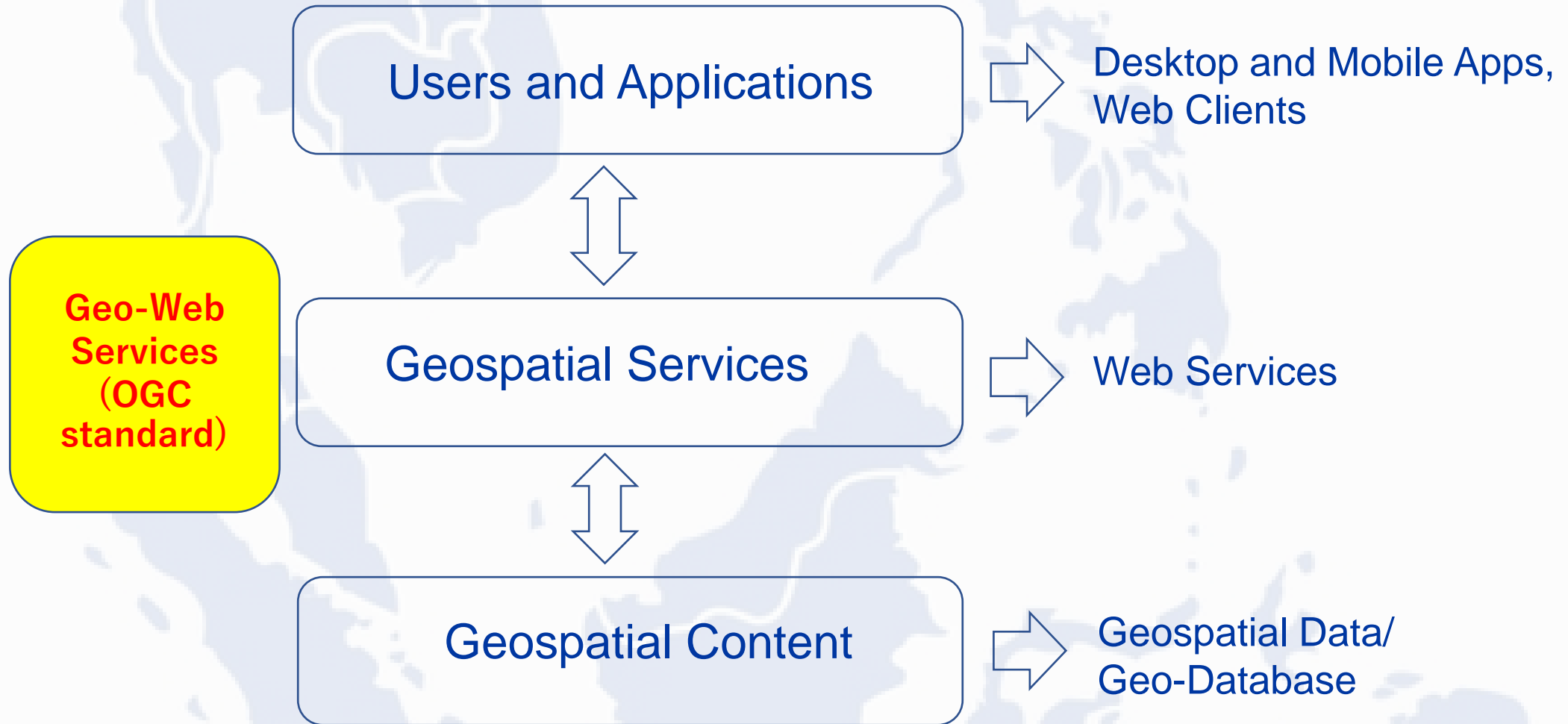


Web Services



Geospatial Content

SDI's three-tier architecture





Spatial Data Infrastructure (SDI)

Open Source Software / Libraries Used

Applications / Clients

OpenLayers
Leaflets
OpenStreetMap

Web Services

Mapserver (NASA)

Database

PostgreSQL/PostGIS

Operating System

Linux (The Internet of Things)

Server

Apache

Programming Languages

Javascript

Java

PHP

Python

C++

Objective-C



Spatial Data Infrastructure (SDI)

SDI's Database Component

PostgreSQL

- is an object-relational database management system (ORDBMS) available for many platforms including Linux, FreeBSD, Solaris, Microsoft Windows and Mac OS X
- PostgreSQL is developed by the PostgreSQL Global Development Group
- it implements majority of the SQL:2008 standard (Wikipedia)
- PostgreSQL License (MIT License)

SDI's Database Component

PostGIS

PostGIS is a spatial database extender of PostgreSQL. It adds support for geographic objects allowing locations queries to be run in Structured Query Language (SQL) (<https://postgis.net/>).

Spatially enabled PostgreSQL database tables have geometry and spatial reference system columns.



Spatial Data Infrastructure (SDI)

SDI's Database Component

Simple Features

PostGIS supports “**Simple Features**” objects defined by OGC. It also supports the “**Simple Features SQL**”. In PostGIS, spatial objects are expressed in two standard ways: The **Well-Known Text (WKT)** and **Well-Known Binary (WKB)**.



Simple Features

- Elements of the simple feature objects are pairs of x and y values separated by space.
- Adjacent x and y pairs are separated by a comma.

Examples:

Point coordinates: 125.2 deg. long 40.56 deg. lat



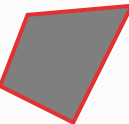
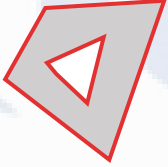




POINT (125.2 40.56)

Polygon Coordinates: 98.3 1.53,103.18 1.8,104.97 -3.28,98.6 -3.6,98.3 1.53

POLYGON((98.3 1.53,103.18 1.8,104.97 -3.28,98.6 -3.6,98.3 1.53))

Simple Features

Simple Features (Spatial Objects) expressed in **Well-Known Text (WKT)**

- POINT(0 0) 
- LINESTRING(0 0,1 1,1 2) 
- POLYGON((30 10, 40 40, 20 40, 10 20, 30 10)) 
- POLYGON((35 10, 45 45, 15 40, 10 20, 35 10),(20 30, 35 35, 30 20, 20 30)) 
- MULTIPOINT(0 0,1 2) 
- MULTILINESTRING((0 0,1 1,1 2),(2 3,3 2,5 4)) 
- MULTIPOLYGON (((45 10, 55 40, 35 40, 25 20, 45 10)), ((35 10, 45 45, 15 40, 10 20, 35 10),(20 30, 35 35, 30 20, 20 30))) 
- GEOMETRYCOLLECTION(POINT(2 3),LINESTRING(2 4,3 4,4 4)) 



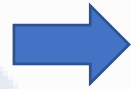
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Simple Features

In the PostGIS Database, Geometry (spatial objects) are stored in **Well-Known Binary (WKB)**

WKT

POINT(97.1 19.8)



WKB (geometry)

0101000020E61000003AAC1D14764B584073F3860E94DE3340

Simple Features

Important PostGIS SQL functions that convert objects between WKT and WKB

WKT = ST_AsText(geometry)

(WKB) geometry = ST_GeomFromText(WKT, SRID)

Changing Map Projection On the Fly

(WKB) *new* geometry = ST_Transform(geometry, SRID)

*Spatial Reference Identifier (SRID) → e.g. 4326 (WGS84; World Geodetic System)
32654 (UTM zone 54N Tokyo)*



Spatial Data Infrastructure (SDI)

Some PostgreSQL/PostGIS Notable Users

Skype

Instagram

TripAdvisor

OpenStreetMap

Sony Online

BASF

International Space Station

National Oceanic and Atmospheric Administration (NOAA) National Weather Service

United Kingdom's National Weather Service

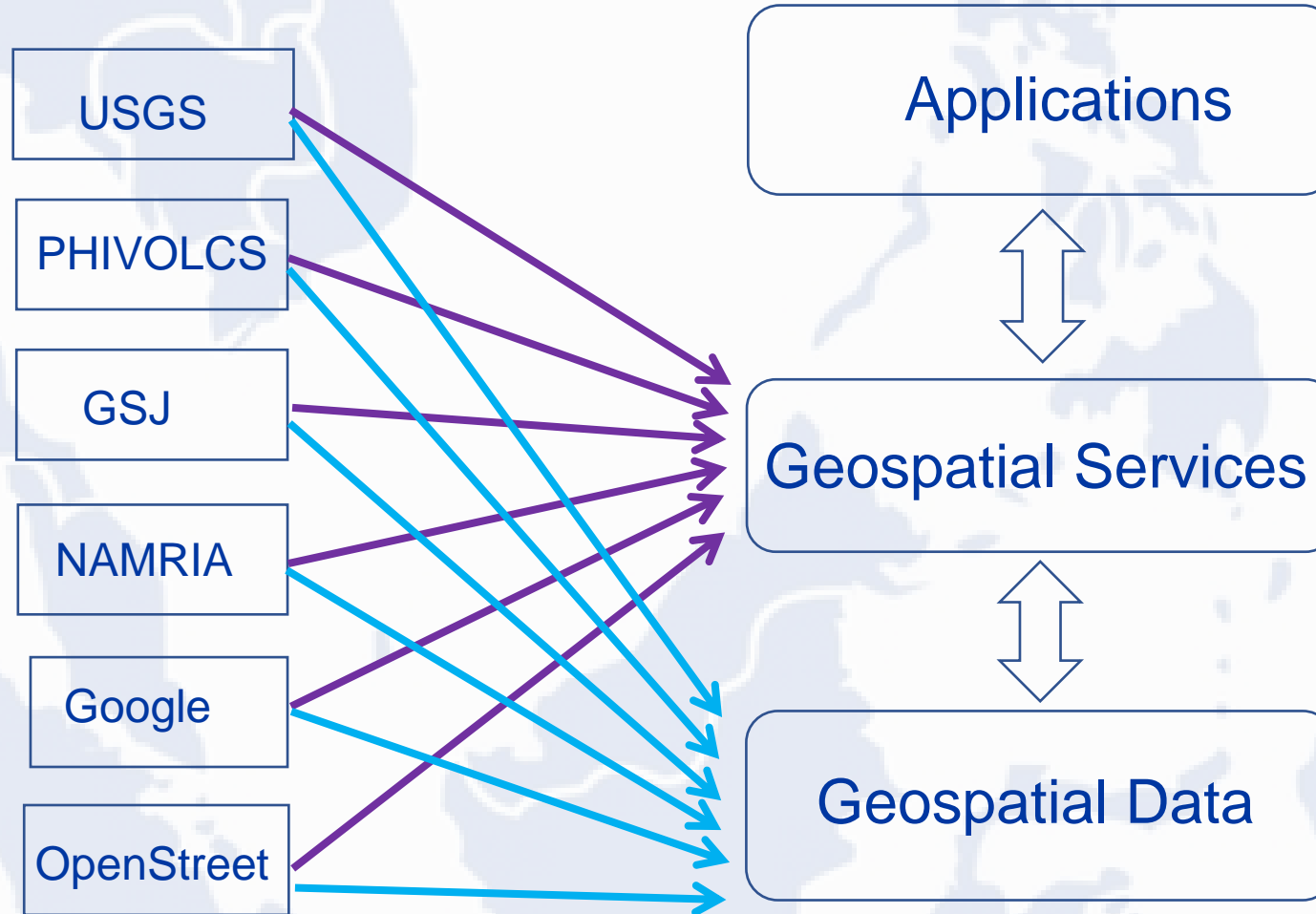
Amazon Redshift

The Guardian

FlightAware

Spatial Data Infrastructure (SDI)

SDI Promotes the sharing of spatial data among geospatial information systems

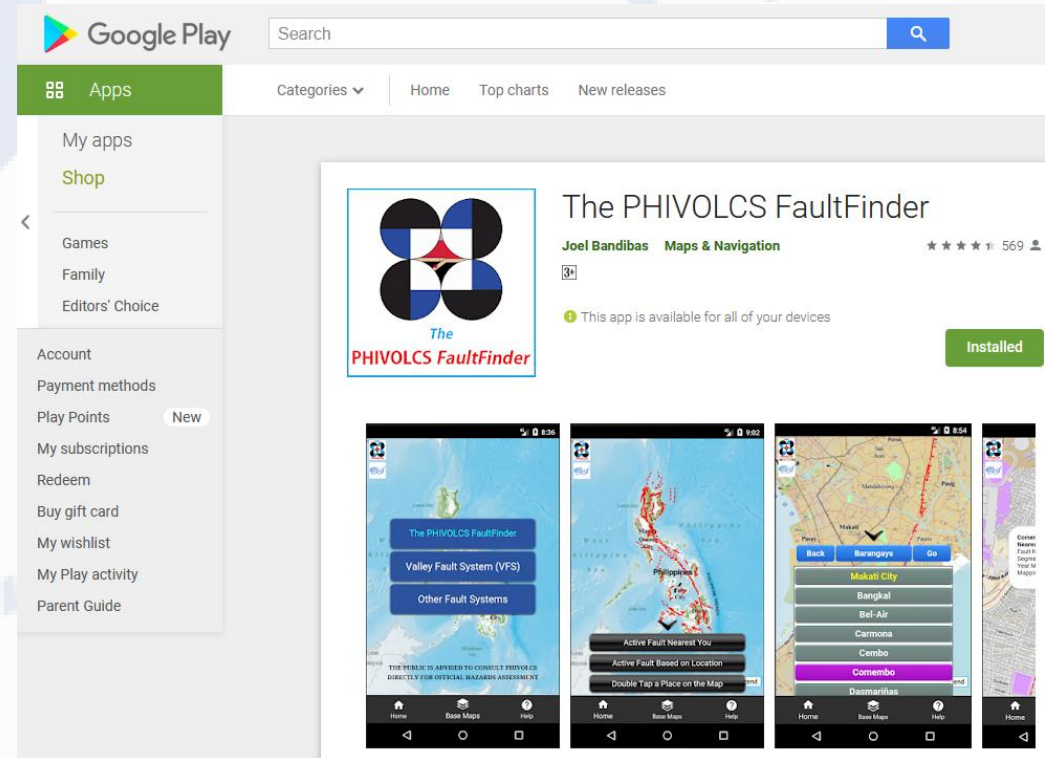
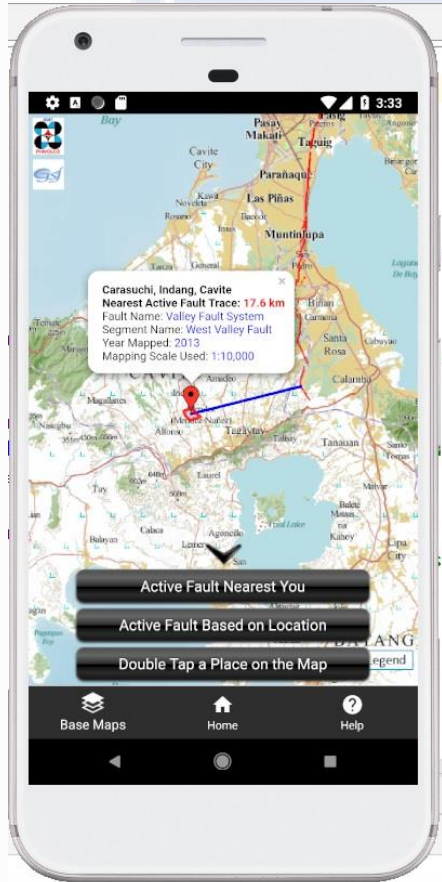




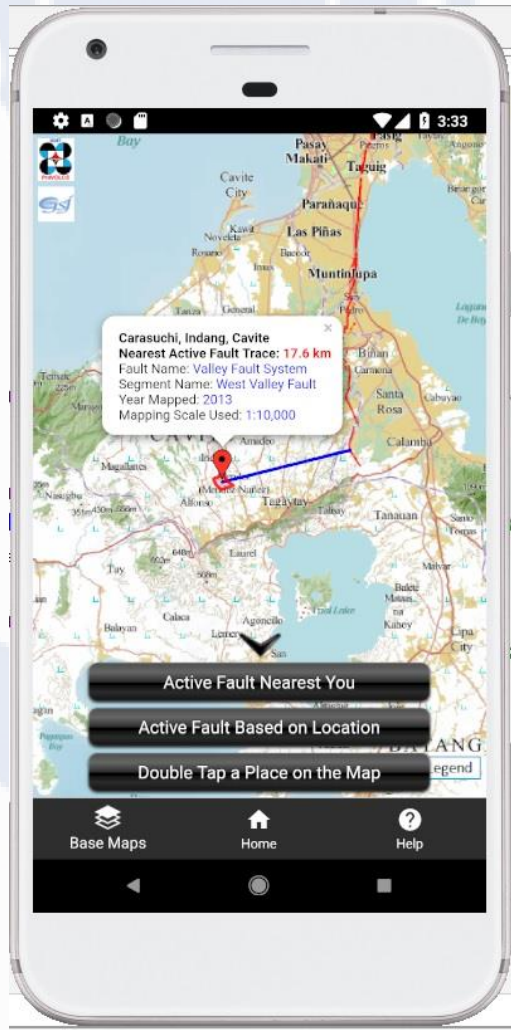
Spatial Data Infrastructure (SDI)

SDI: PHIVOLCS FaultFinder

Native App is Published in Google Play Store



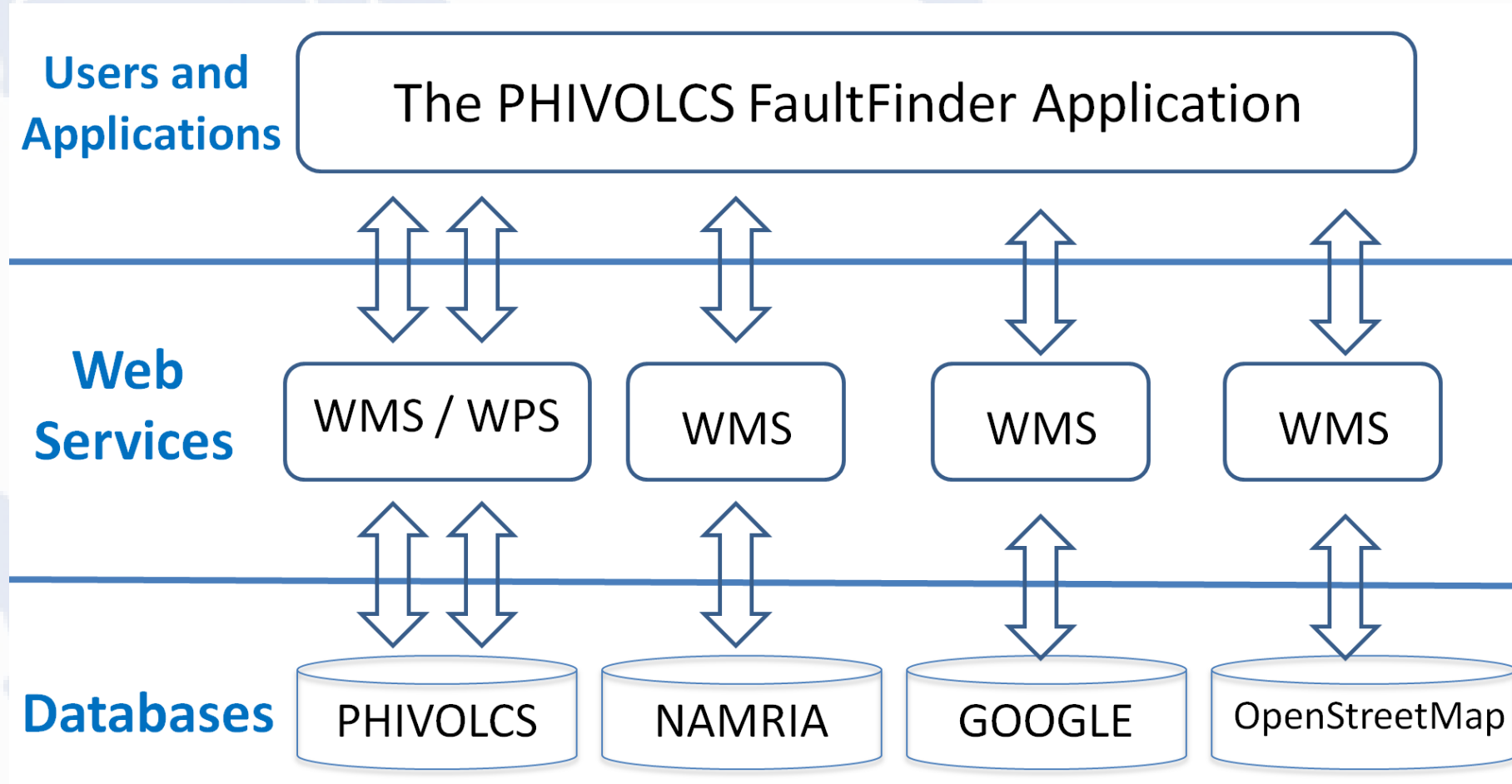
Web App can be accessed at <http://faultfinder.phivolcs.dost.gov.ph/>



SDI: PHIVOLCS FaultFinder

A mobile and web application that shows information about the distance between the user's current location, address or selected location on the map and the nearest active fault.

SDI: PHIVOLCS FaultFinder



SDI: PHIVOLCS FaultFinder

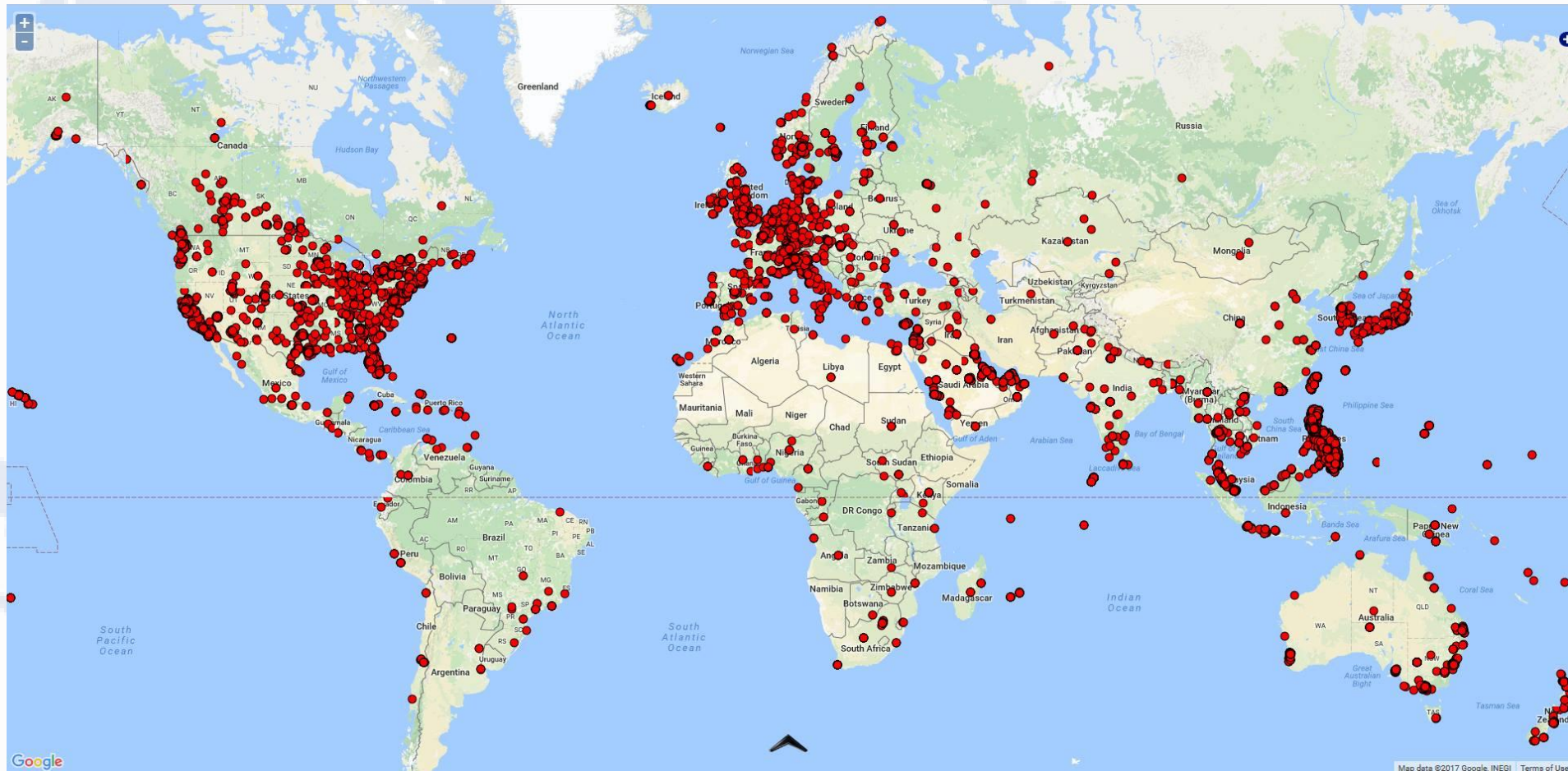


Querying the active fault database using administrative map spatial information.



Spatial Data Infrastructure (SDI)

PHIVOLCS FaultFinder Current Users Distribution

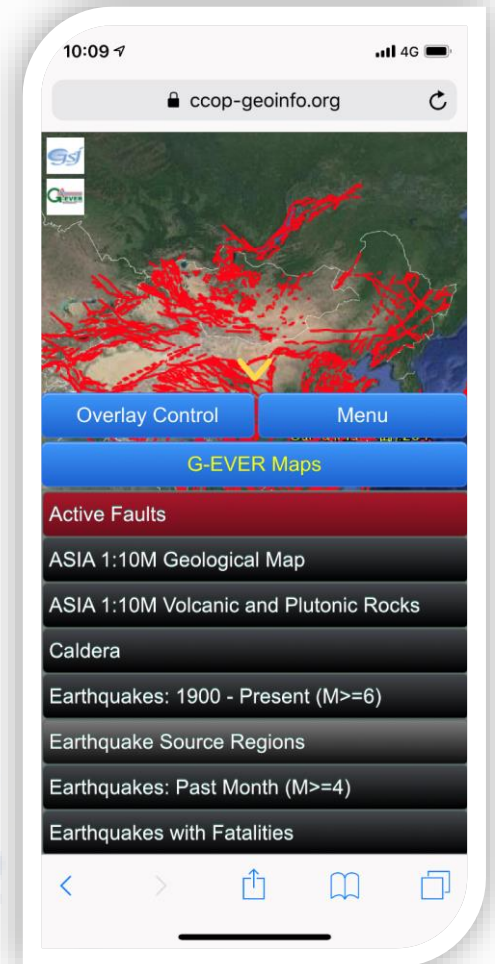


SDI: Asia-Pacific Region GeoHazardMobile

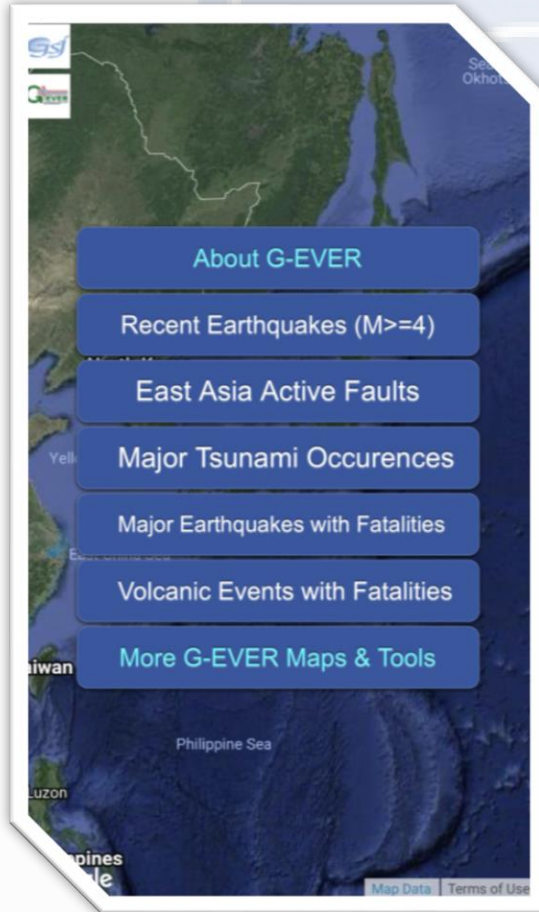
To make hazard information more accessible to a wide range of users.

To incorporate location and hazard information for a more effective hazard mitigation measures.

The Web App can be accessed at <https://ccop-geoinfo.org/geohazard/>

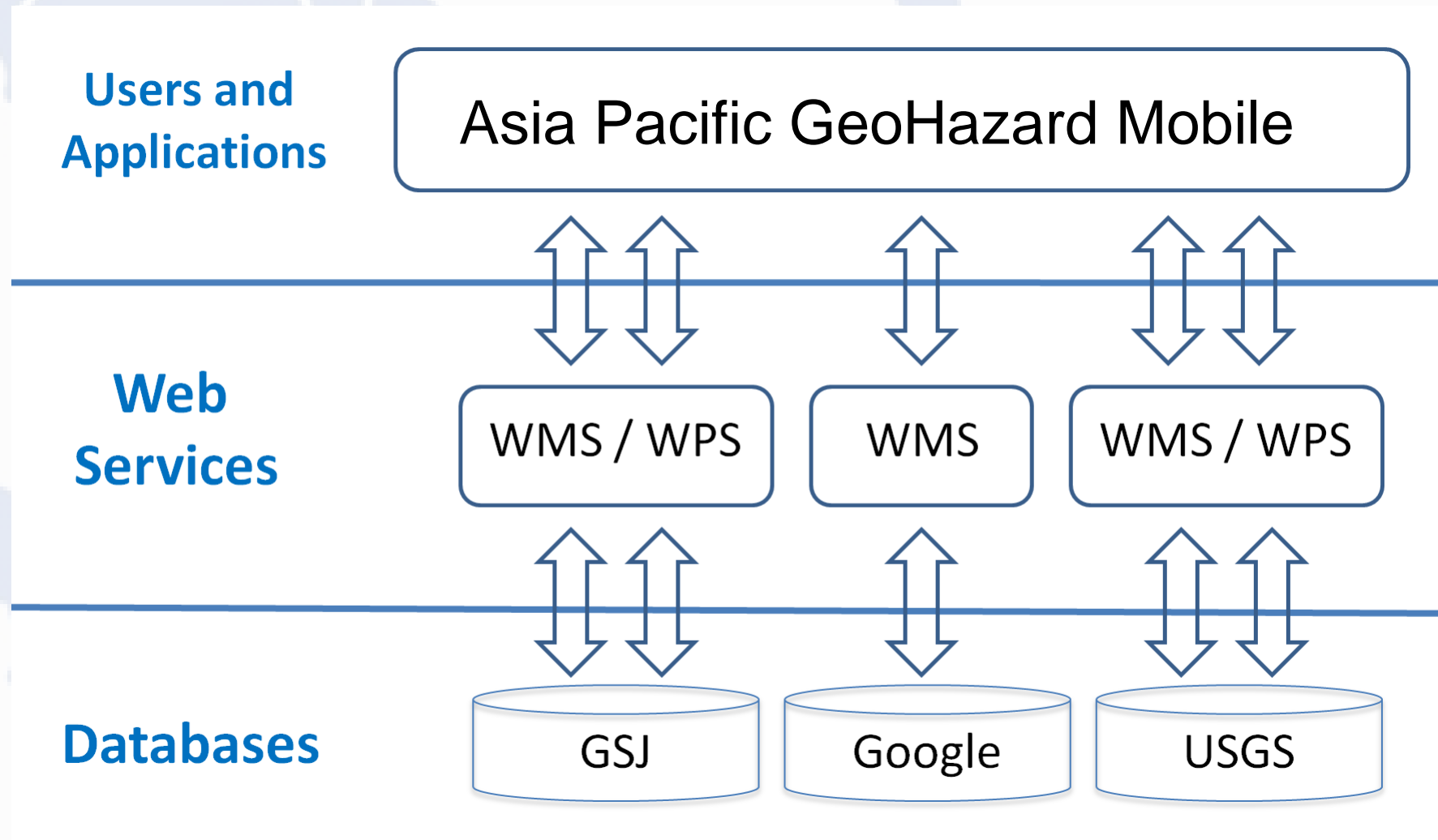


SDI: Asia-Pacific Region GeoHazardMobile

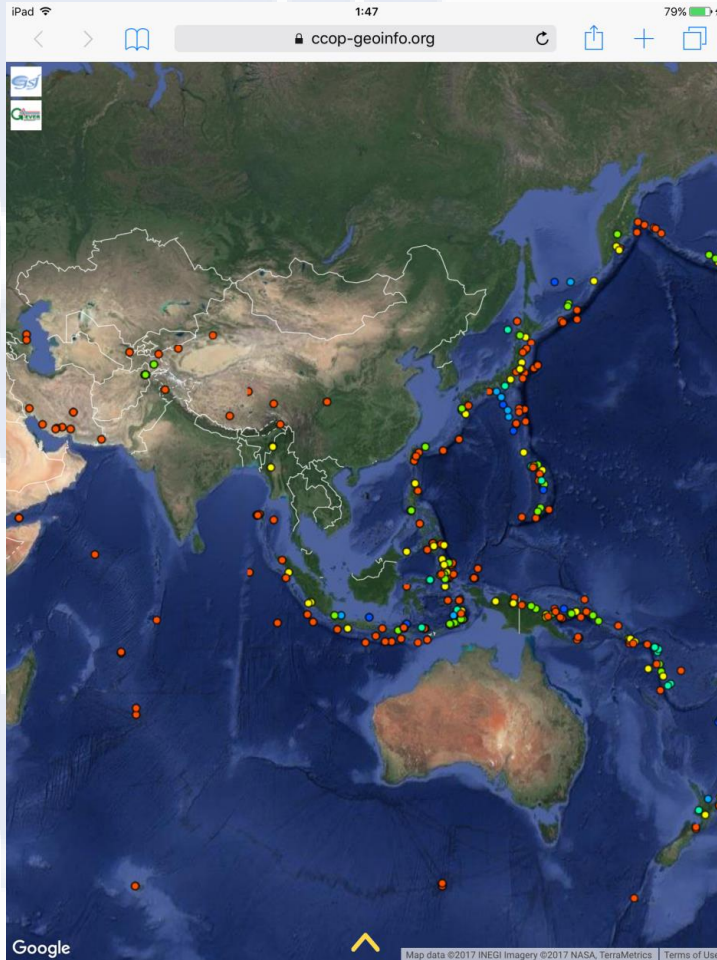


The Asia-Pacific Region GeoHazardMobile Mobile application shares earthquake and volcanic hazard and related information covering East and Southeast Asia. It also provides worldwide real time earthquake information.

SDI: Asia-Pacific Region GeoHazardMobile



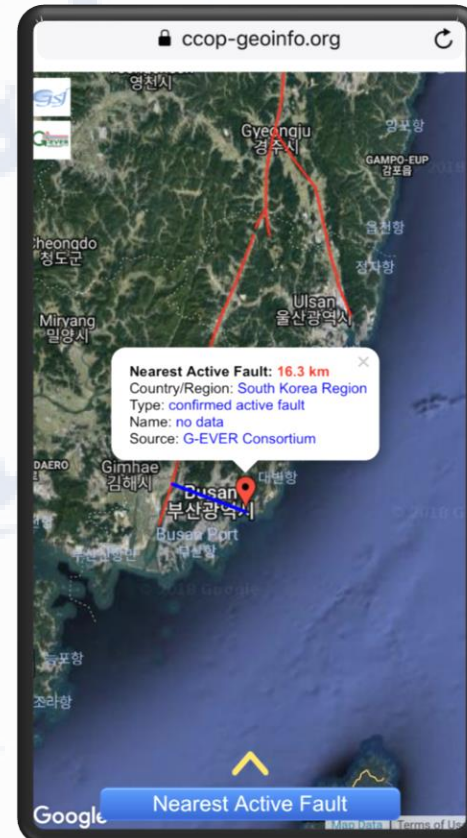
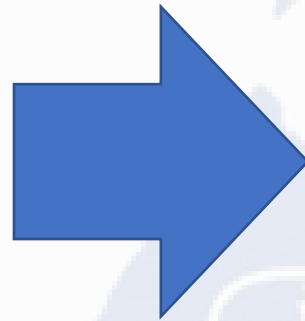
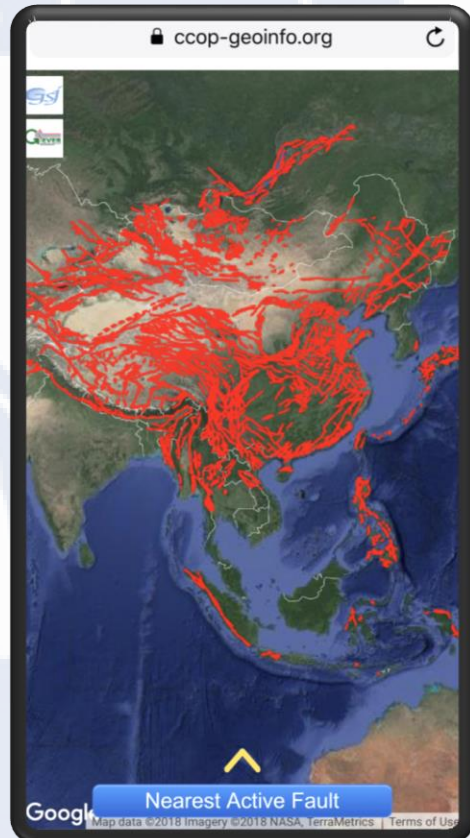
SDI: Asia-Pacific Region GeoHazardMobile



Earthquakes (past month) served as WMS generated on-the-fly using WPS and real time seismic data from USGS.

SDI: Asia-Pacific Region GeoHazardMobile

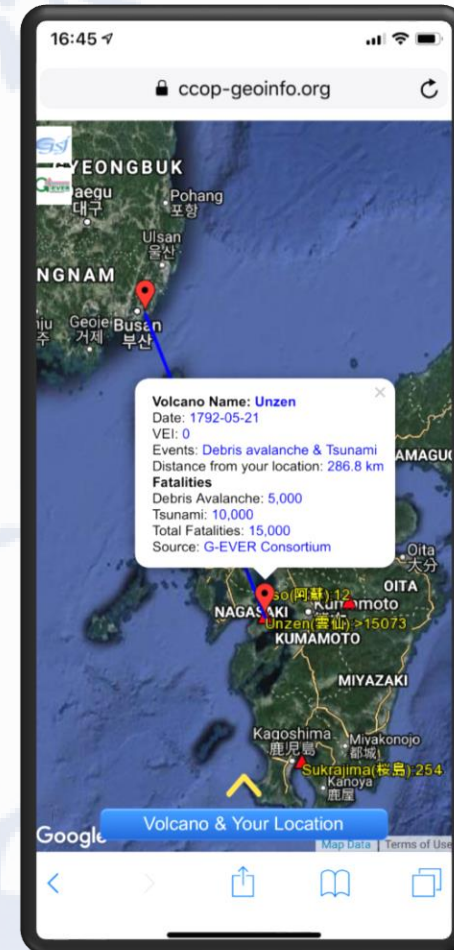
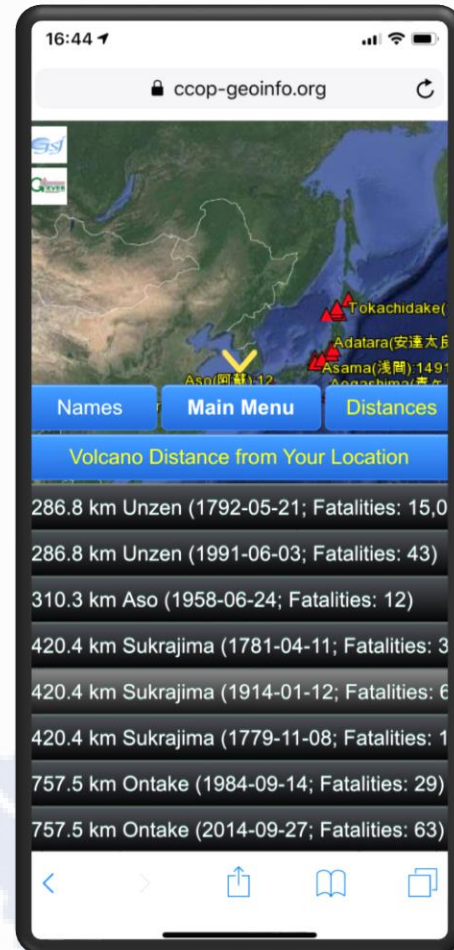
Active fault map of East and Southeast Asia.





Spatial Data Infrastructure (SDI)

SDI: Asia-Pacific Region GeoHazardMobile Volcanic eruptions with fatalities

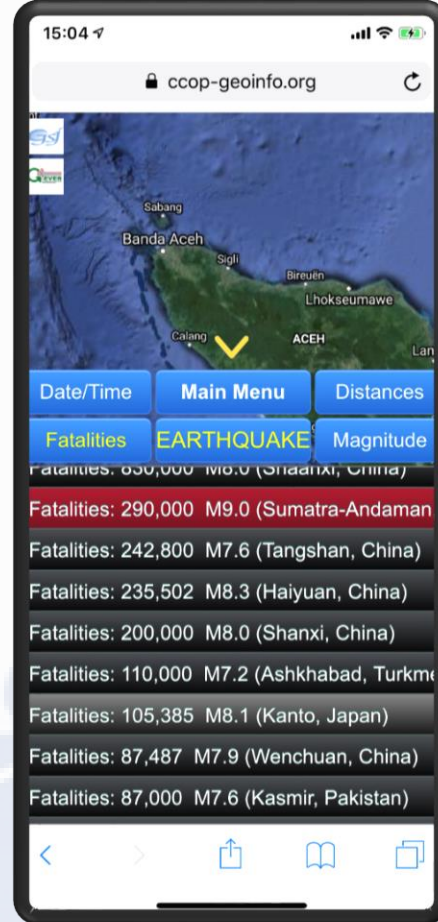
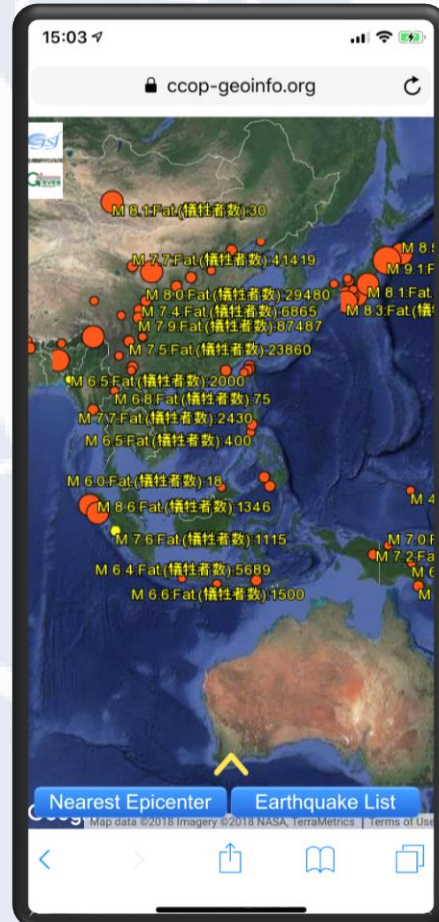




Spatial Data Infrastructure (SDI)

SDI: Asia-Pacific Region GeoHazardMobile

Major Earthquakes with Fatalities





Spatial Data Infrastructure (SDI)

SDI: Geoinformation Sharing Infrastructure for East and Southeast Asia (GSI)

URL: <https://ccop-gsi.org/main/>

GSI CCOP Geoinformation Sharing Infrastructure for East and Southeast Asia
 Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP)
 Geological Survey of Japan (GSJ), AIST

Logging In & Sharing Tools

CCOP Member Countries
 Timor-Leste

Click a flag to view the country's GSI WebGIS portal.

Featured GSI Thematic Portals
 ASEAN Mineral Resources
 Asia-Pacific Region Geological Hazards
 CCOP Groundwater Database
 OneGeology Covering East Asia

Search
 OneGeology
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Google Streets

OneGeology Asia Maps
 ASIA CCOP 1:2M Combined Bedrock and
 IDN GAI 1:1M Geological Map of Indonesi
 JPN GSJ 1:1M Combined Bedrock and Su
 KOR KIGAM 1M Bedrock Geology
 Laos 1:1M Bedrock Lithology
 MMR DGSME 1:1M Combined Bedrock a
 MYS Peninsula JMG 1:1M Combined Bed

Click to view the map, double-click for metadata.

Available Map Catalogs
 OneGeology Asia Maps
 THA-DMR : Harmonized Geology of Indo-Chi

Available WebGIS Portals
 OneGeology Covering East Asia

All Data Your Data Search

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View Map Overlay Control



SDI: Geoinformation Sharing Infrastructure for East and Southeast Asia (GSI)

Develop a new geoinformation sharing system using international standards and free and open-source software among the CCOP member countries.



Spatial Data Infrastructure (SDI)

SDI: GSi

Data Owners

Indonesia

Myanmar

Japan

Philippines

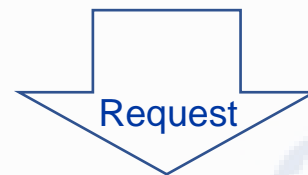
⋮

Thailand

Vietnam

Desktop Client (GSi Main Portal)
Web Application (GSi Mobile)
GSi Generated WebGIS Portals

Applications



Web Map Service (WMS)
Web Processing Service (WPS)

Web Services



PostgreSQL/PostGIS
Raster Data Files

Database



Spatial Data Infrastructure (SDI)

GSI Main Portal

GSI CCOP Geoinformation Sharing Infrastructure for East and Southeast Asia
 Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP)
 Geological Survey of Japan (GSJ), AIST

About GSI | Privacy Statement | GSI Data Policy | User's Guide

Logging In & Sharing Tools

CCOP Member Countries

Japan

Click a flag to view the country's GSI webGIS portal.

Featured GSi Thematic Portals

- ASEAN Mineral Resources
- Asia-Pacific Region Geological Hazards
- CCOP Groundwater Database
- OneGeology Covering East Asia

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Google Streets

ASTER Satellite Images of Japan

- ASTER 2002-04-06 Japan Akan Volcano (↑)
- ASTER 2002-04-06 Japan Kutcharo Volcano (↑)
- ASTER 2004-09-16 Japan Iwate Volcano (↑)
- ASTER 2004-09-16 Japan Towada Volcano (↑)
- ASTER 2006-07-27 Japan Toya Volcano (↑)
- ASTER 2008-09-20 Japan Tokachi Volcano (↑)
- ASTER 2011-09-29 Japan Daisetsu Volcano (↑)

Click to view the map, double-click for metadata.

Available Map Catalogs

- AMDIS Database Query Results (↑)
- ASEAN AMDIS Mineral Maps
- ASTER Satellite Images of Japanese Volcano (↑)
- Aster Satellite in Lao PDR (↓)

Available WebGIS Portals

- ASEAN Mineral Resources WebGIS Portal (↑)
- Asia-Pacific Region Geological Hazards Int'l (↑)
- BRUNEI WEB GSI PORTAL
- Cambodia Geology WebGIS Portal (↓)

All Data | Your Data | Search

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CCOP Member Countries Buttons to View Individual WebGIS Portal

List of GSi's Featured Thematic Portals



Spatial Data Infrastructure (SDI)

SDI: ASEAN Mineral Database Geospatial Information System (AMDIS)

URL: <https://ccop-gsi.org/amdis/>

ASEAN Mineral Database Geospatial Information System (AMDIS)
Association of Southeast Asian Nations (ASEAN)

ASEAN Member Countries

Philippines

Click map to view a country's mineral data.

Search for Minerals

ASEAN

Enter mineral name

Submit Reset

Upload Data

Formulate WMS

ASTER Satellite Image

Add External WMS

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ASEAN AMDIS Mineral Maps

- ASEAN ASOMM 1:1M Mineral Occurrence
- CAM GDMR 1:750K Mineral Resources
- IDN GAI 1:1M Indonesia Metallic Mineral
- IDN GAI 1:1M Indonesia Non-metallic Mineral
- LAO DOM 1:1M Mineral Map of Laos PDR
- MMR DGSE 1:1M Myanmar Mineral Resources
- MYS JMG 1:1M Metallic Mineral Map of Malaysia
- MYS JMG 1:1M Non-Metallic Mineral Map of Malaysia
- MYS JMG 1:1M Peninsular Malaysia Mineral
- PHL MGB 1:1M Philippine Metallic Mineral
- PHL MGB 1:1M Philippine Non-Metallic Mineral
- THA DMR 1:1M Thailand Mineral Resources
- VNM DGMV 1:1 Mineral Map of Vietnam

Available Map Catalogs

- AMDIS Database Query Results
- AMDIS New WMS Layers
- ASEAN AMDIS Mineral Maps
- Brunei Darussalam AMDIS Mineral Maps
- Cambodia AMDIS Mineral Maps
- Indonesia AMDIS Mineral Maps
- Lao PDR AMDIS Mineral Maps
- Malaysia AMDIS Mineral Maps
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Spatial Data Infrastructure (SDI)

SDI: ASEAN Mineral Resources Database Geospatial Information System

AMDIS is a cost-effective and easy to use ASEAN mineral resources geoinformation sharing system using international standards and free and open-source software.



Spatial Data Infrastructure (SDI)

SDI: AMDIS

Data Owners

Brunei

Cambodia

Indonesia

Laos

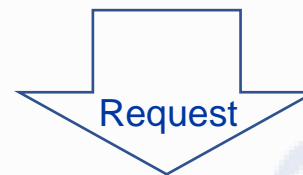
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Thailand

Vietnam

AMDIS Main Portal
Mobile Application (AMDIS Mobile)
GSI Main Portal

Applications



Web Map Service (WMS)
Web Processing Service (WPS)

Web Services



PostgreSQL/PostGIS
Raster Data Files

Database



Spatial Data Infrastructure (SDI)

AMDIS Geospatial System Main Portal

ASEAN Mineral Database Geospatial Information System (AMDIS)
Association of Southeast Asian Nations (ASEAN)

The Admin

ASEAN Member Countries: Philippines

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ASEAN map-based quick data search

Selected map catalog Layers

ASEAN mineral text search interface

AMDIS data sharing interface

AMDIS map catalogs

Map search & download interface

ASEAN AMDIS Mineral Maps

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