SATREPS
Science and Technology Research Partnership for Sustainable Development Program

9th Nov 2015

G3 Japan

Development of Integrated GIS-MSD (Multimodal Sediment Disaster) Simulator

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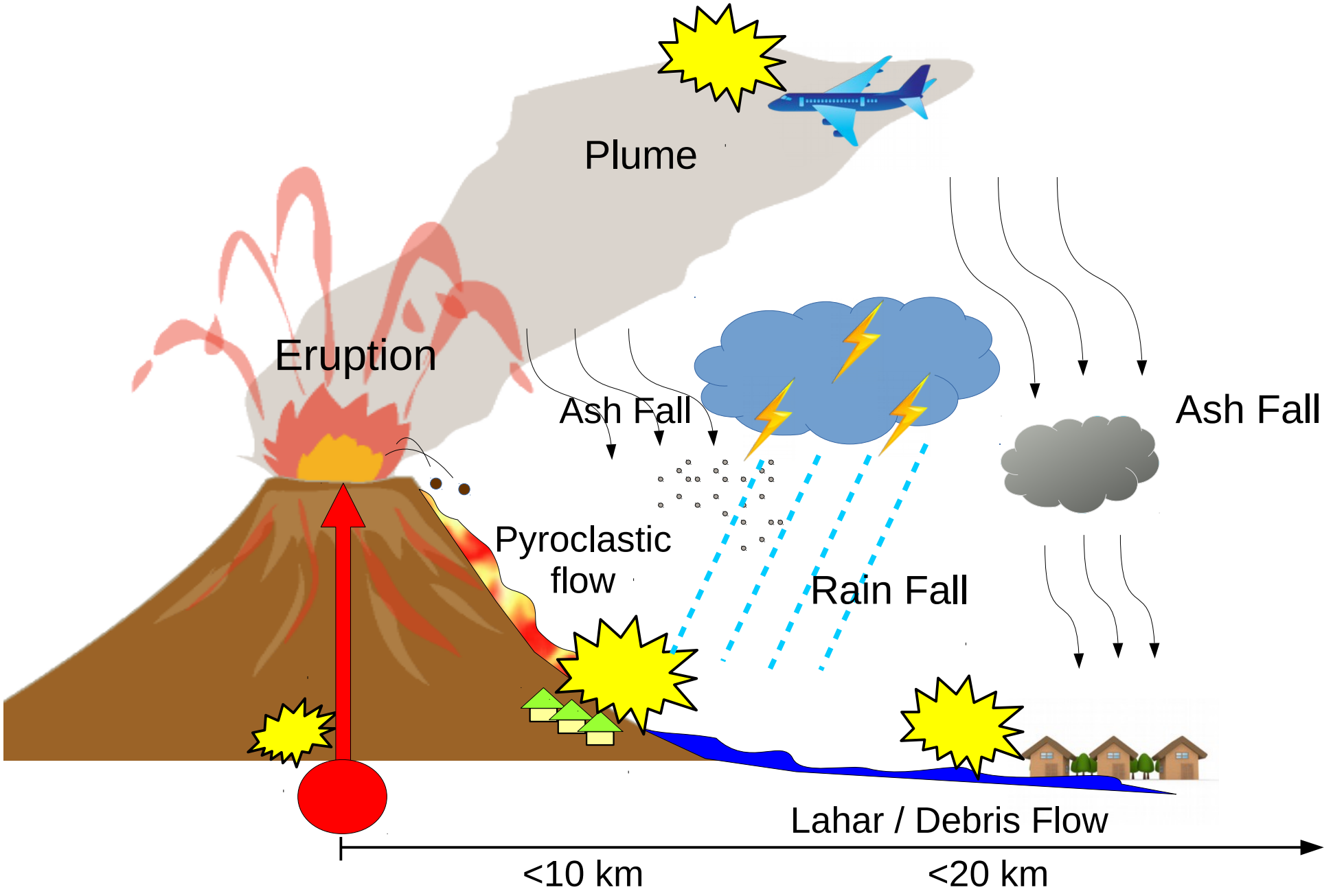
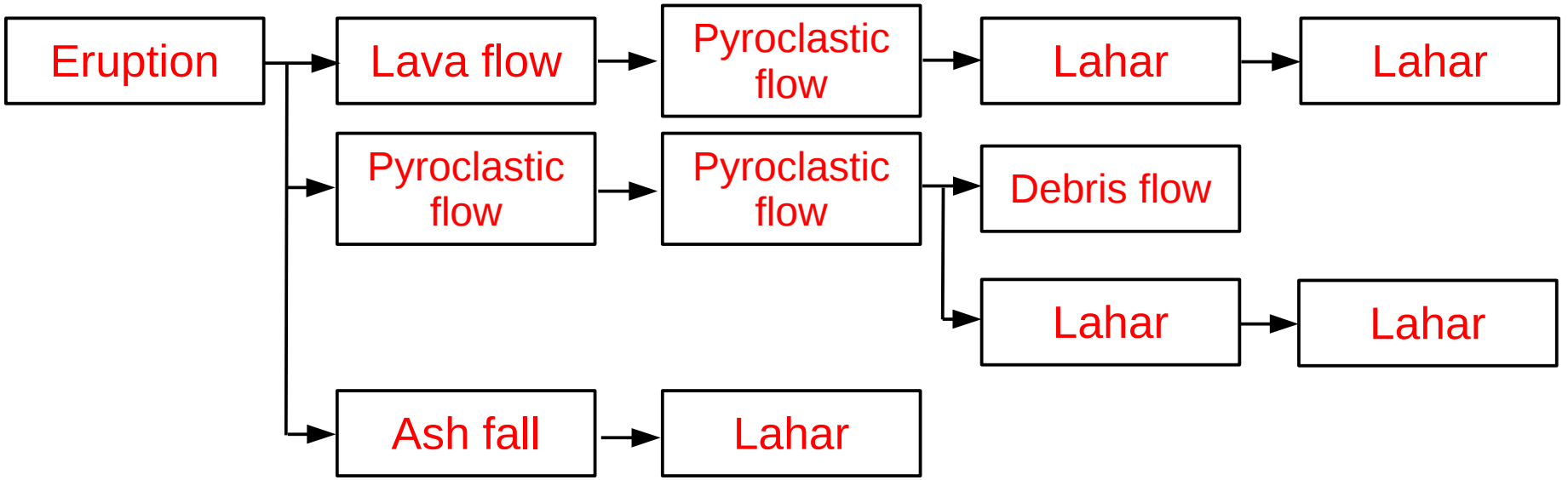
CONTENTS

G3 mission : simulate multimodal sediment disaster



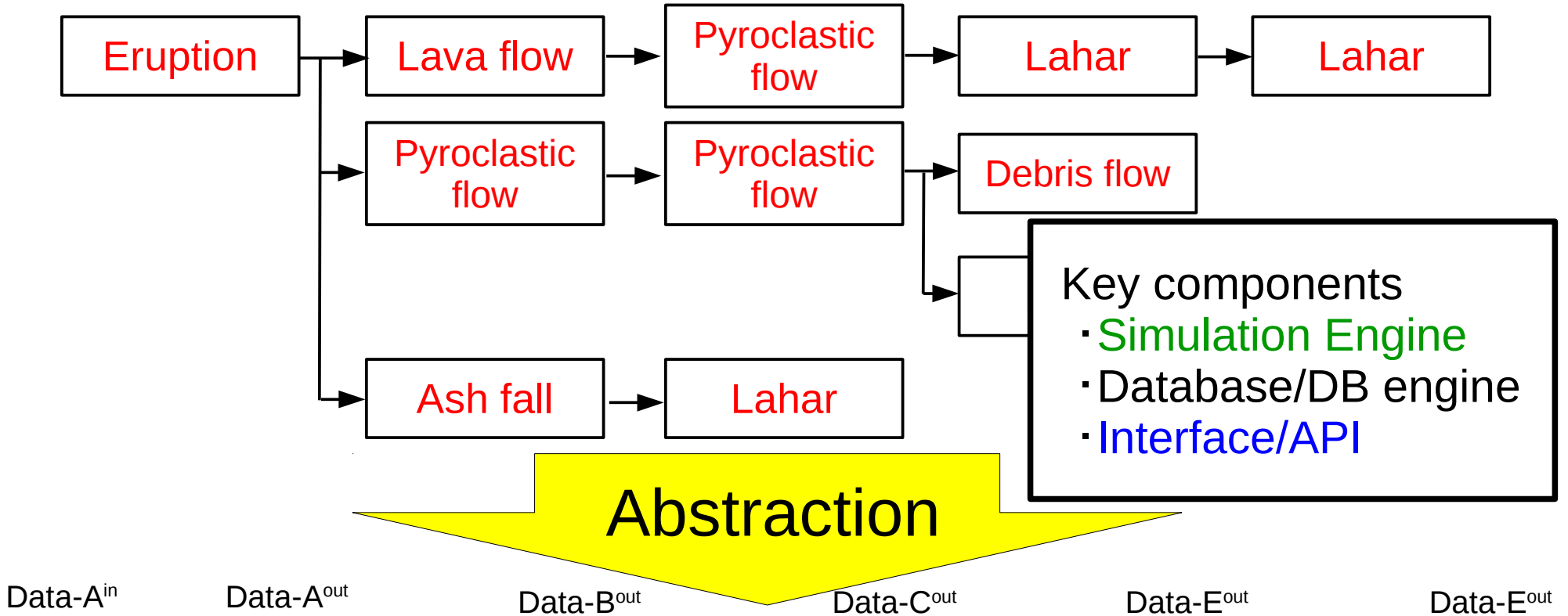
We translated above phenomena to “event chains”

Basic of the development of the MSD simulator

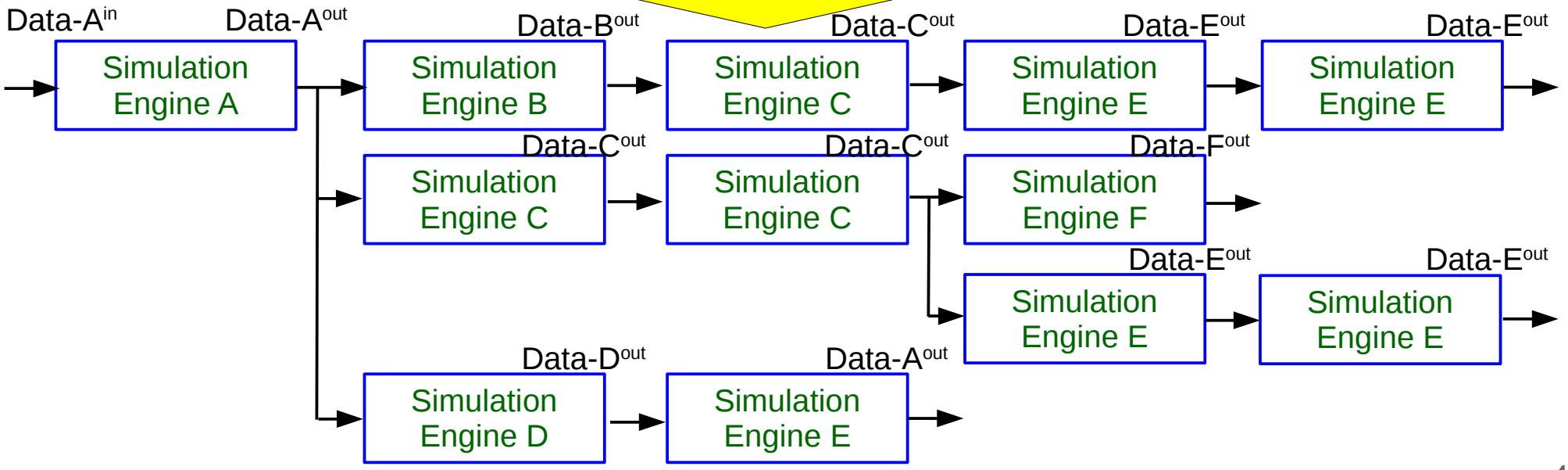


Multimodal disaster can be represented as event chains

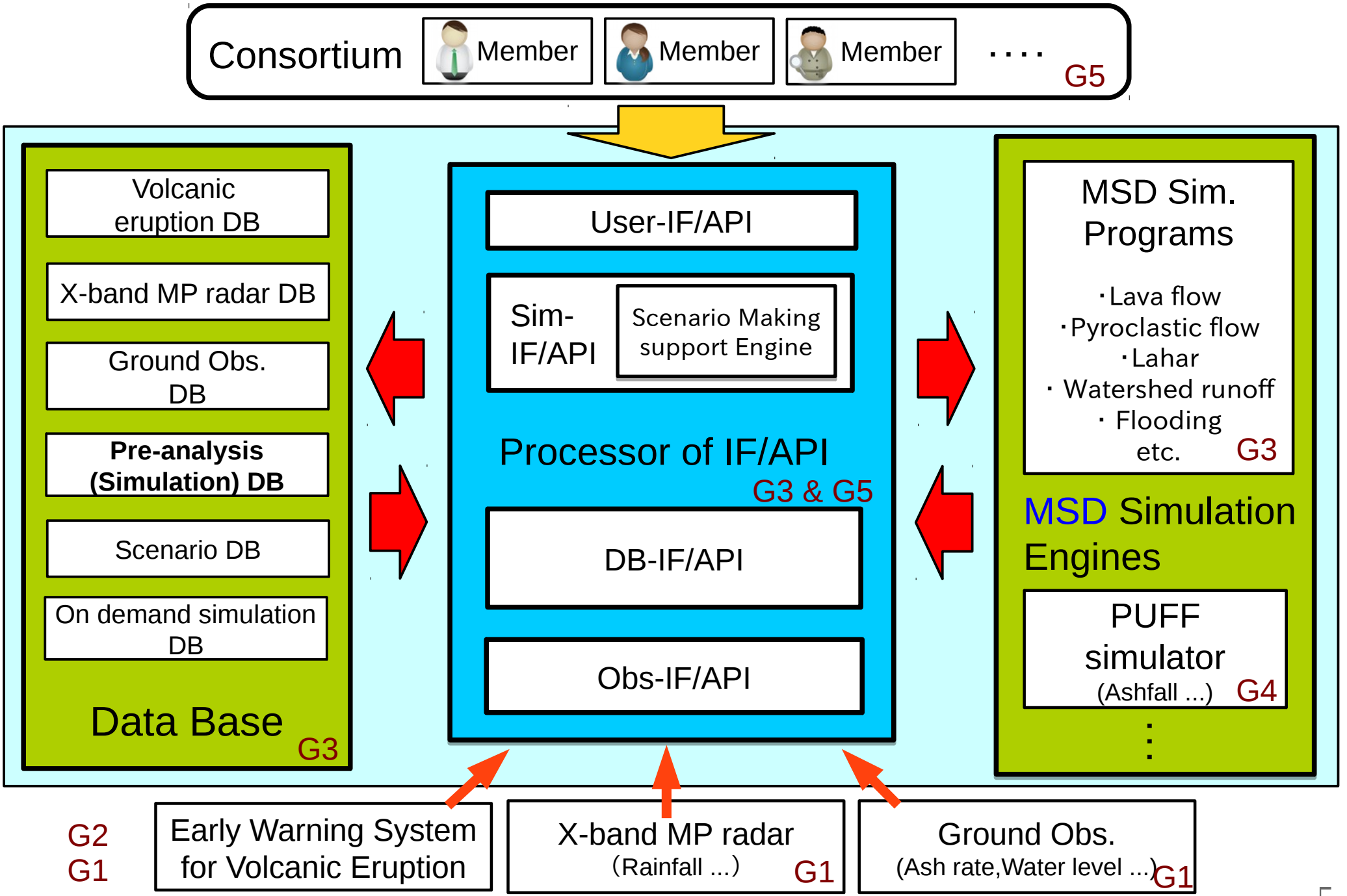
Basic of the development of the MSD simulator



Abstraction



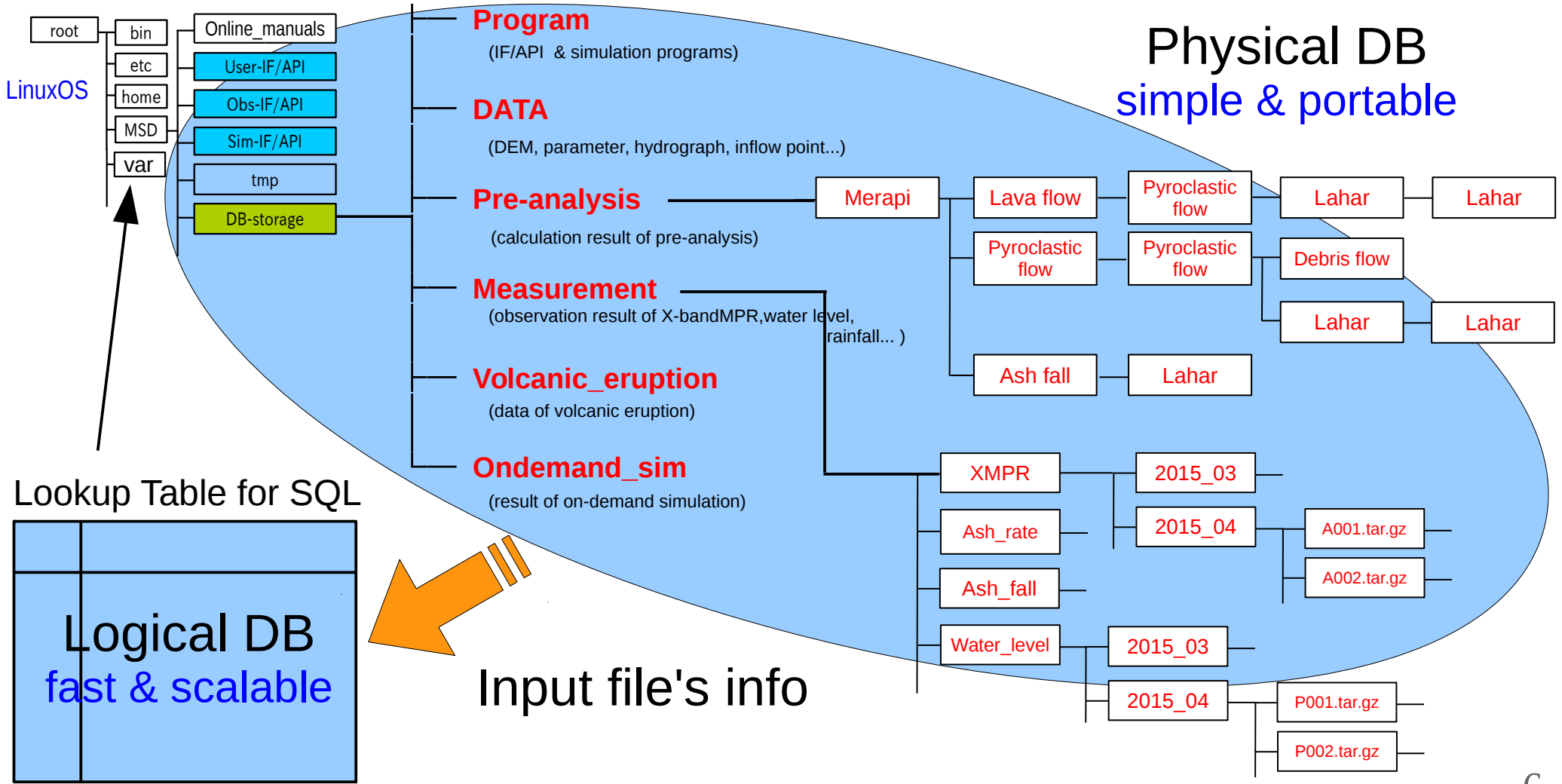
Architecture of the GIS-MSD Simulator



Database (DB) system of GIS-MSD Simulator

We designed the hybrid DB system

1. Physical based DB (Directory tree)
2. Logical based DB (SQL)

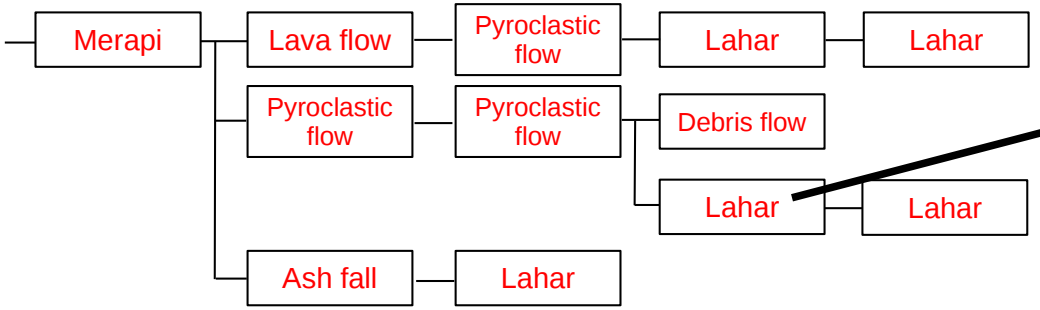


Database (DB) system of GIS-MSD Simulator

Data are contains as 2 basic file format with 1 compressing format:

> geotiff (for raster data, binary e.g. X-band, DEM)
> txt (for vector data, ascii e.g. ash-rate, water level)
> tar.gz (for compressing above and other data)

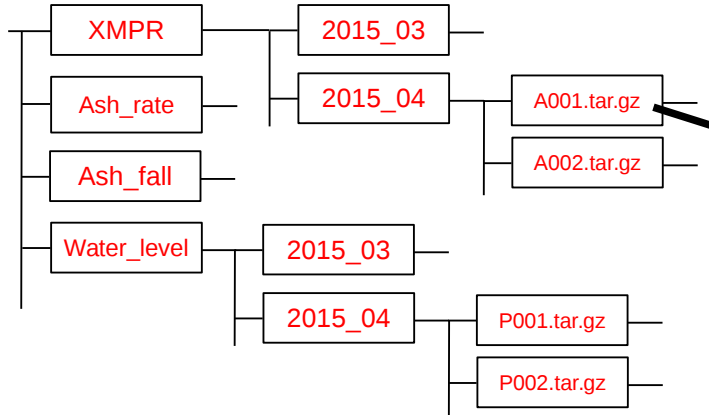
Pre-analysis



Each directory is contained 3 files

> info.conf
> in.tar.gz
> out.tar.gz

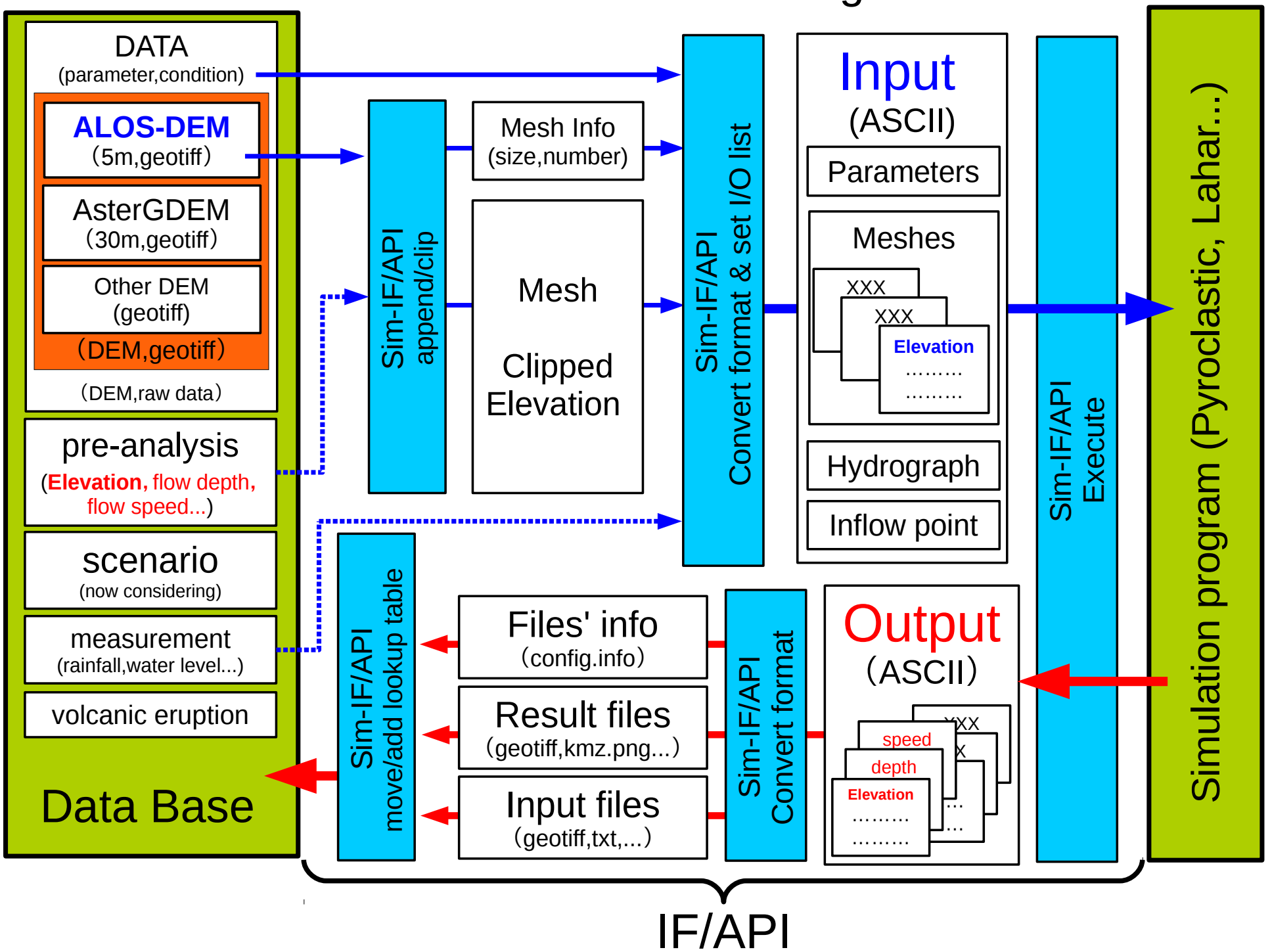
Measurement



0002_20151106_2026_000.tif
0002_20151106_2028_000.tif
0002_20151106_2030_000.tif
.
.
.

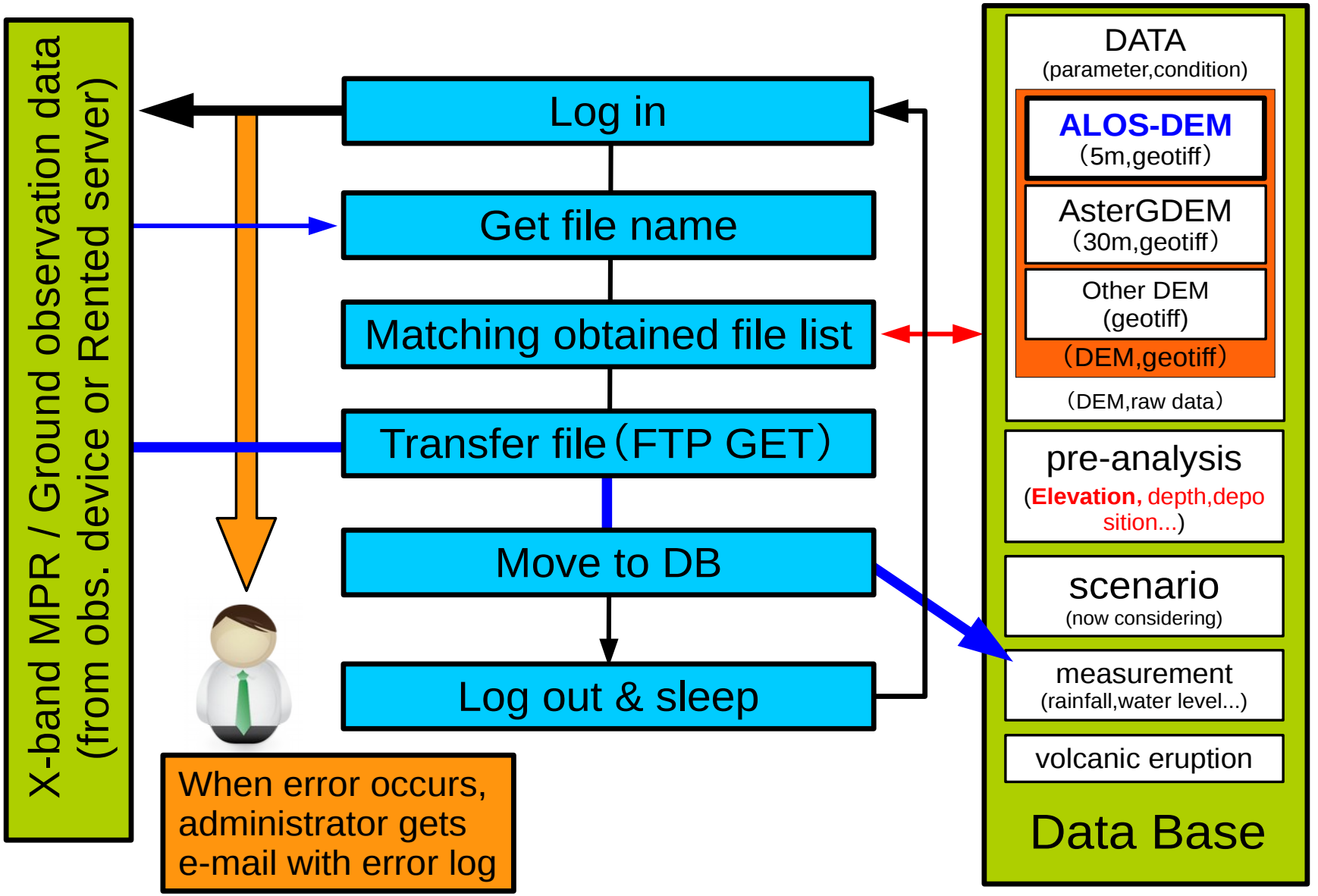
ALOS_merapi_05m.tif
LHR-paramters001.dat
LHR-hydro_001.dat
.
.
.

IF/API between simulation engine & DB

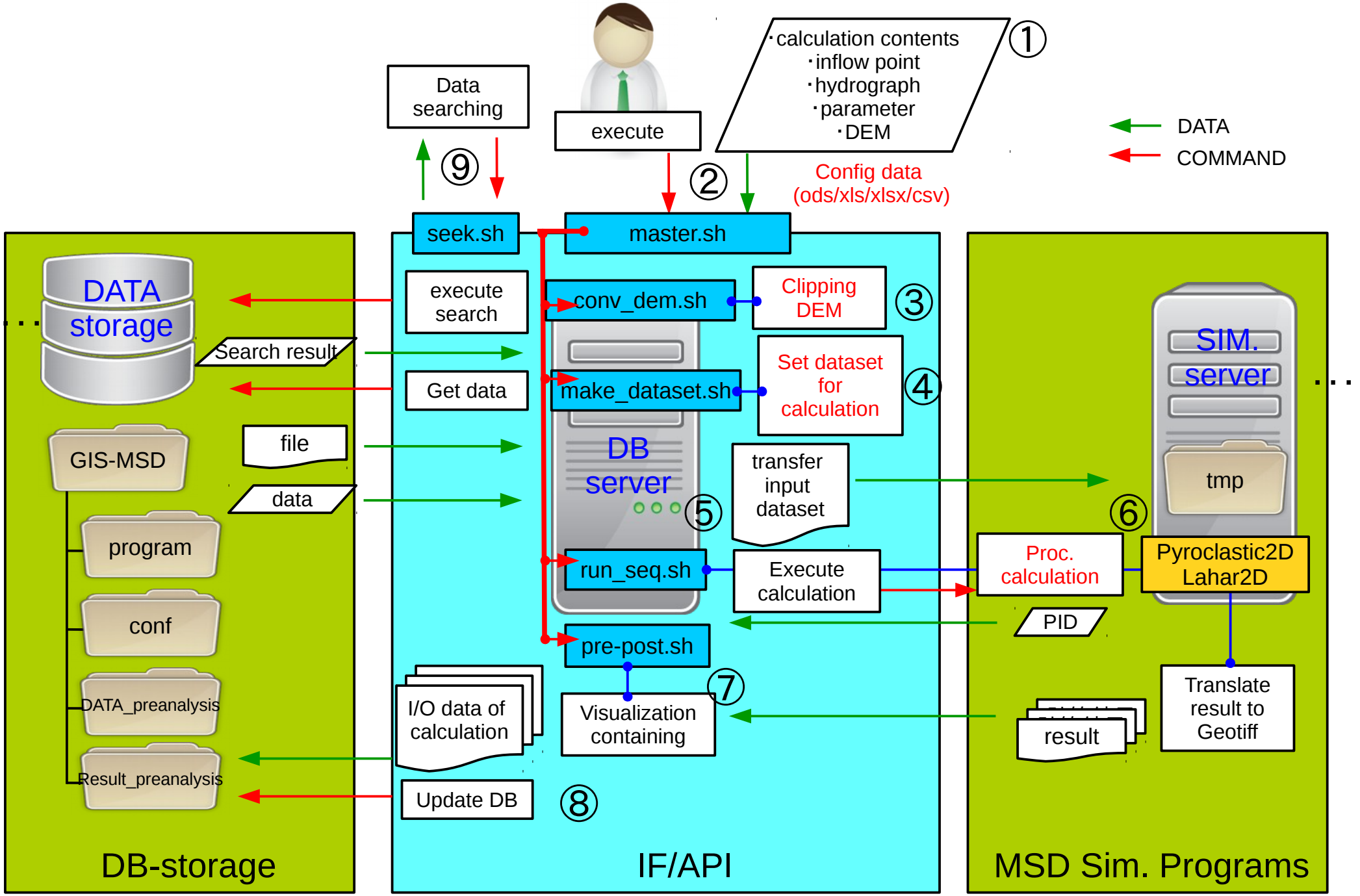


IF/API between measurement data & DB

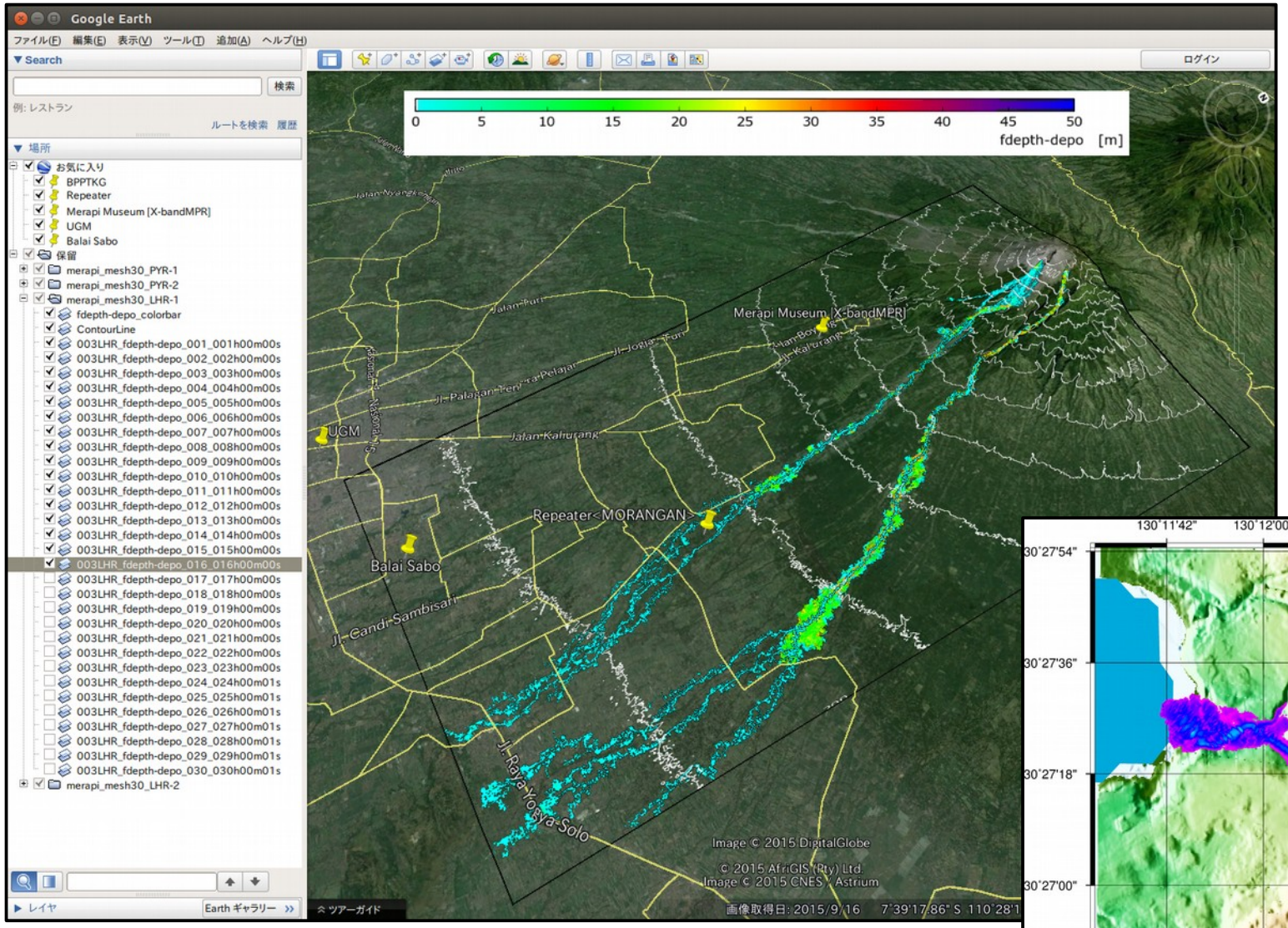
IF/API was already developed and tested using sakurajima observation systems



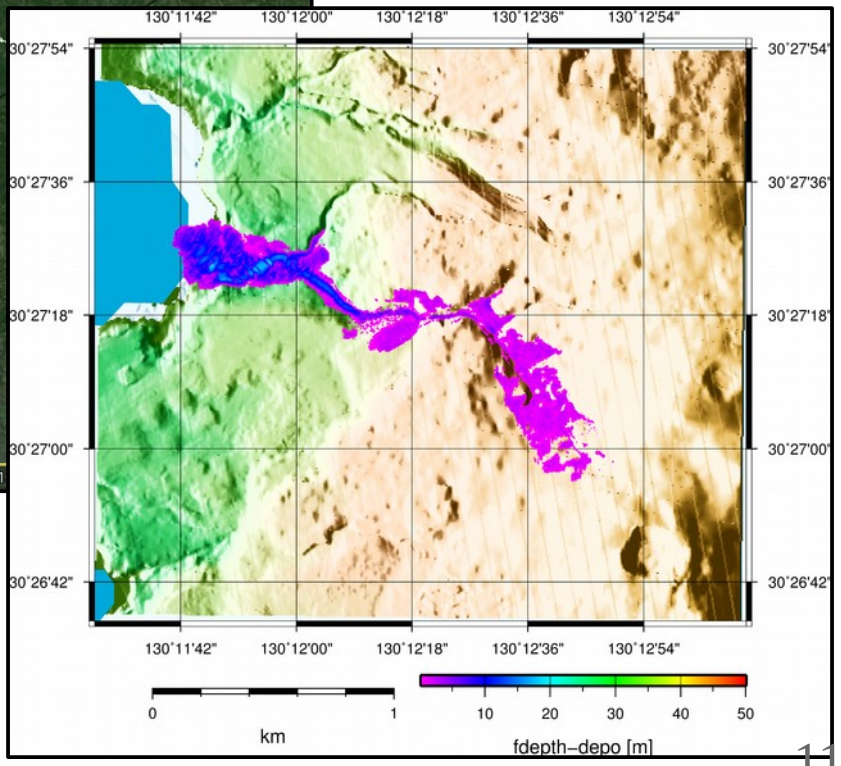
User IF/API for simulations



Visualized image of the simulation output



Single-Layer format (e.g. png)



Multi-Layer format (e.g. kmz for google-earth)

Development MSD Simulation programs

We have developed 3 simulation programs

1. Pyroclastic flow
2. Stony debris flow
3. Lahar

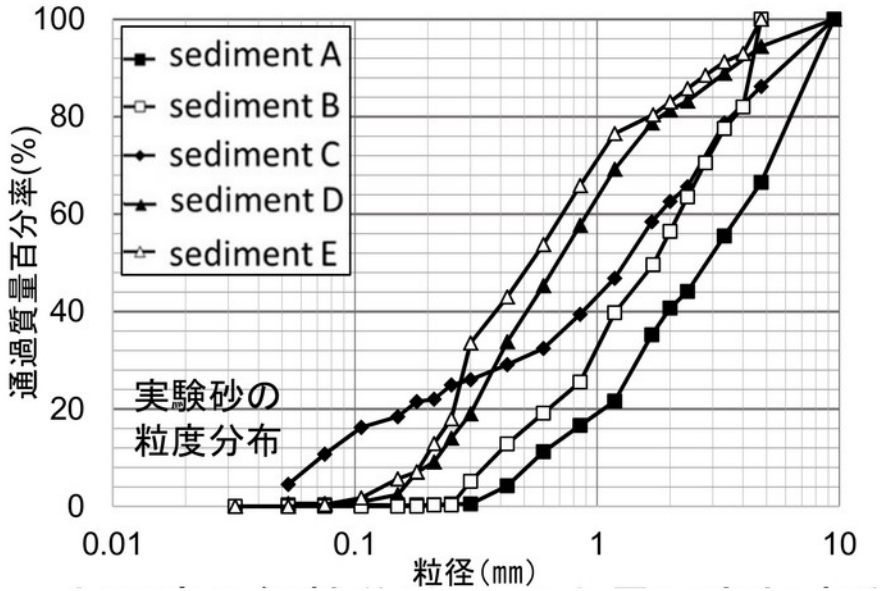
Pyroclastic flow simulation were applied in Semeru volcano
→ introduce in G5 presentation

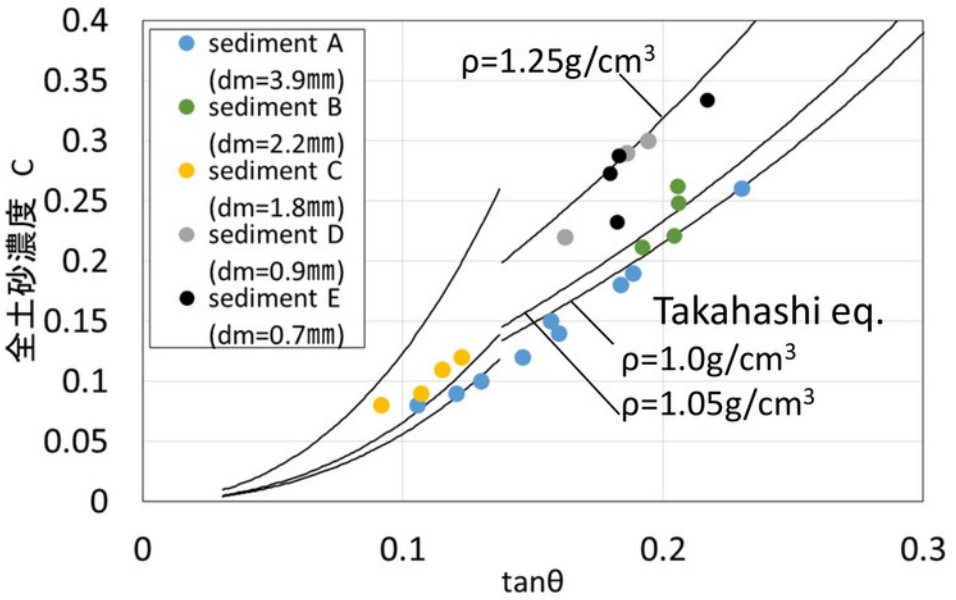
Stony debris flow simulation were applied in Merapi volcano

And we prepare IF/API to connect other simulations

1. Puff model (from G4)
2. Runoff model (Miyata sensei's model & our model)

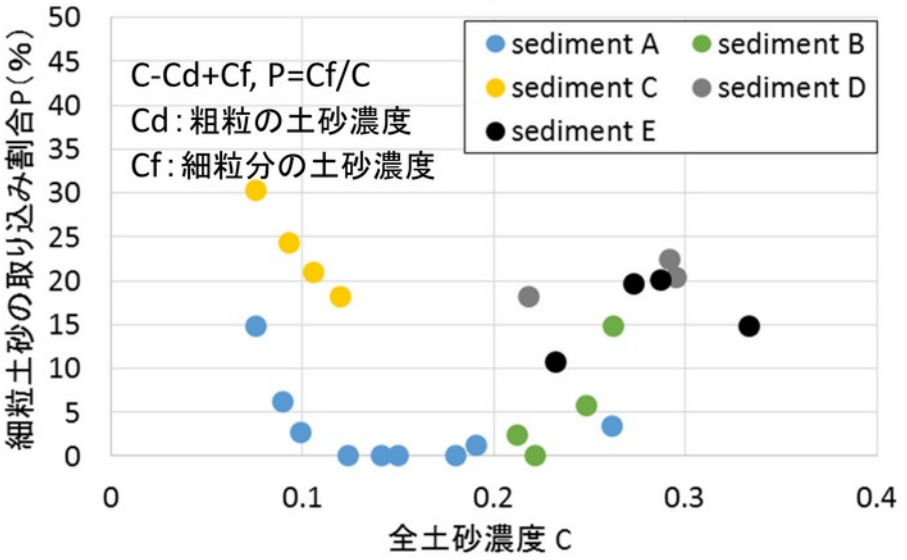
Modified Stony Debris flow model to simulate Mud flow





Fine grain is assumed to effect of ρ increasing (Nishiguchi et al., 2011). Calculate the content ratio of fine grains.

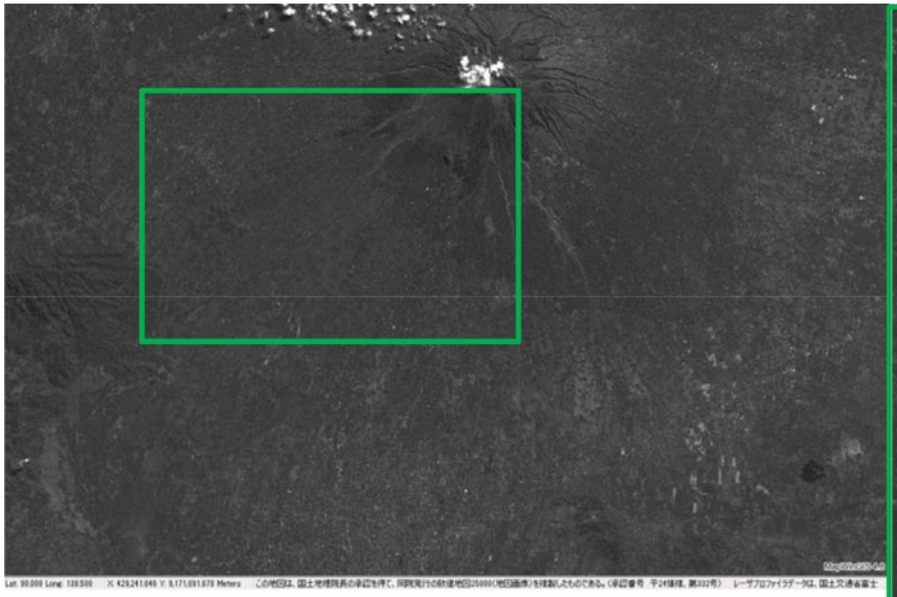
Experimental result shows the sediment concentration is affected by grain size and its content ratio.



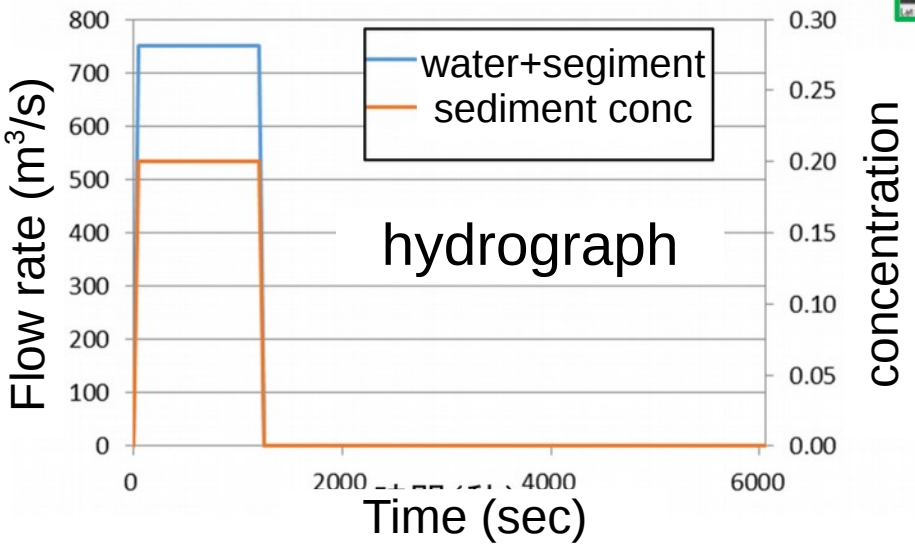
We modified equation to consider fine grain concentration.

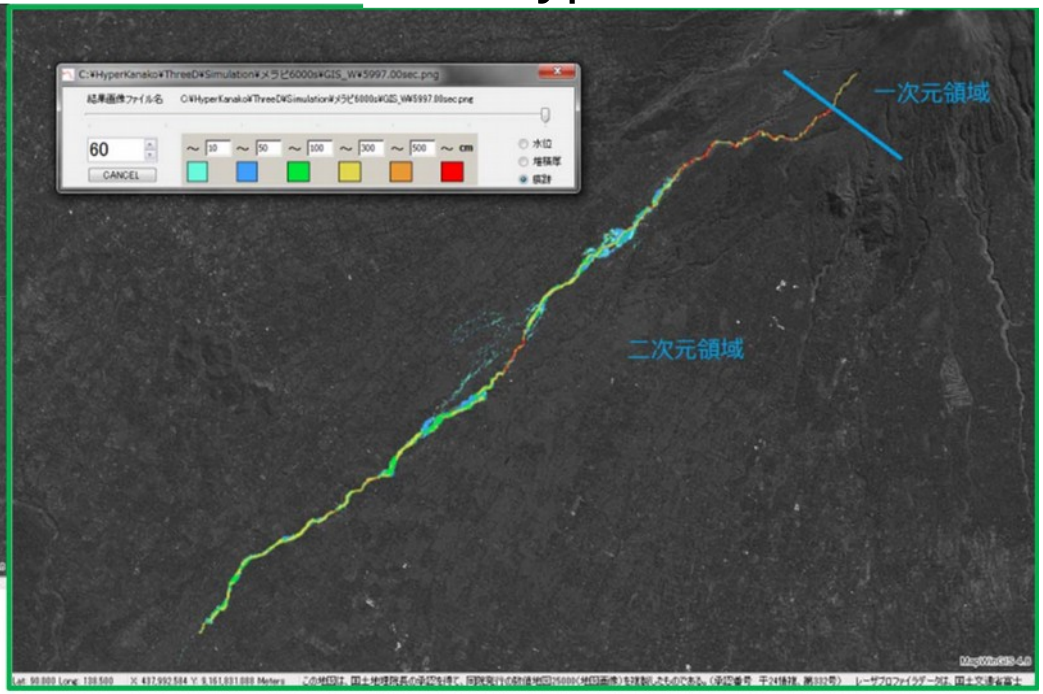
Development MSD Simulation programs
Applied Stony Debris Flow model to volcanic terrain

Hyper KANAKO



Mt. Merapi





Calculation domain (Krasak river)

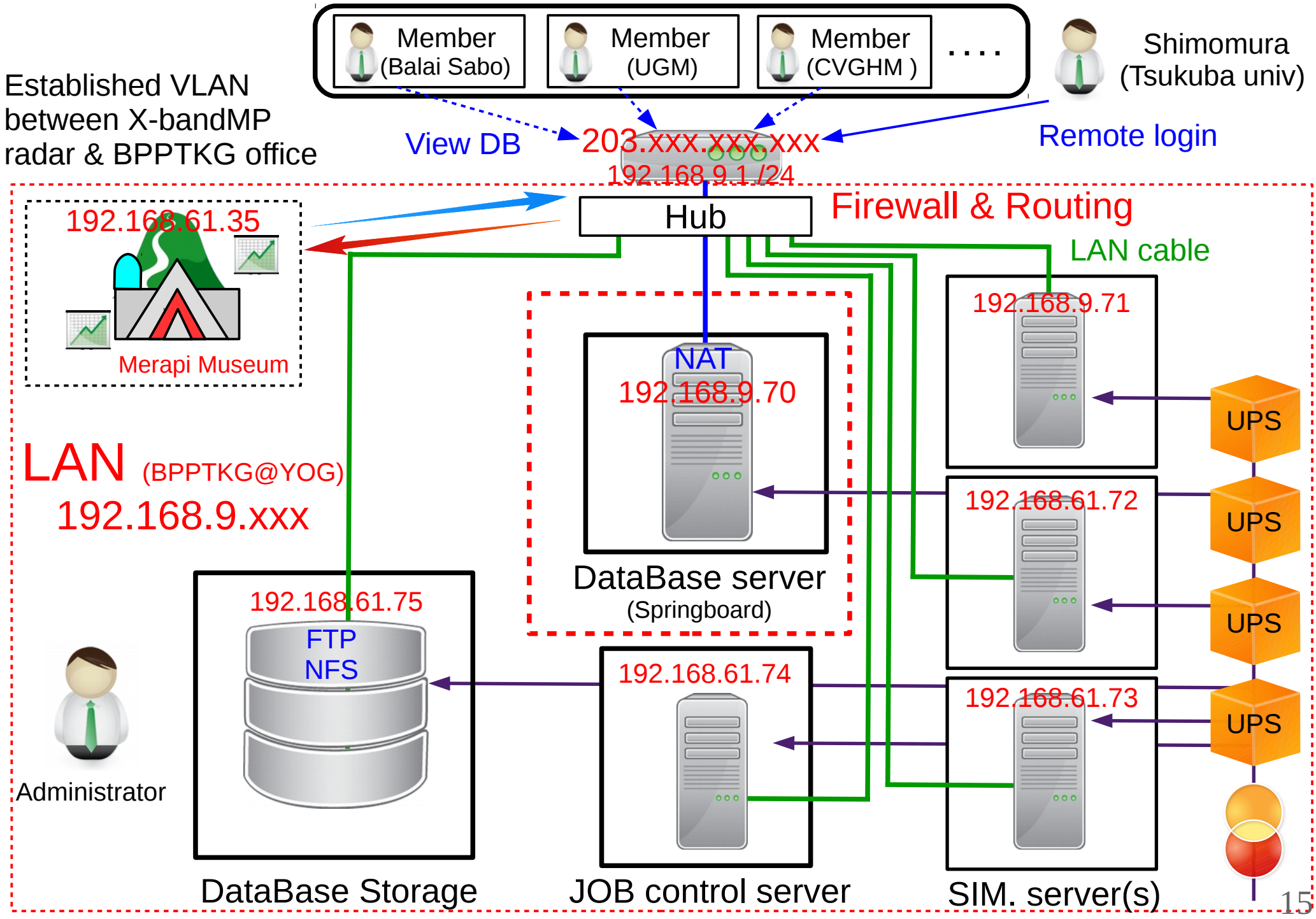
Parameters

Calculation term : 6000 sec

Grain size (d) : 20 cm

Flow Density (ρ) : 1000 kg/m^3, 1200kg/m^3

Hardware & network of GIS-MSD simulator (BPPTKG)



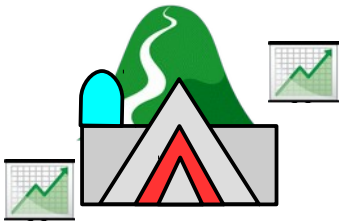
Key persons for handling GIS-MSD simulator

Mr. Akhyar Musthofa (Balai Sabo)

Prof. Adam Pamudji Rabardjo (UGM)

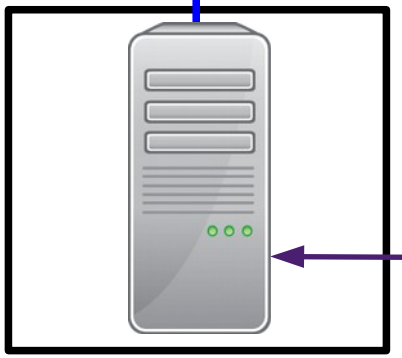
Shimomura (Tsukuba Univ)

Hub

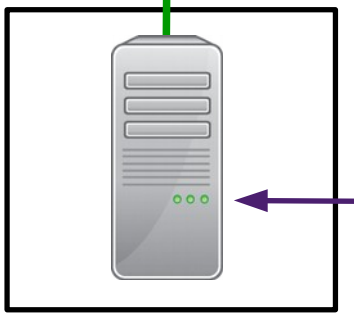


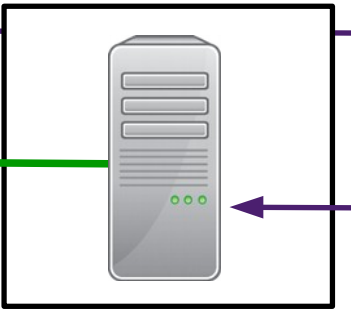
X-band MP radar

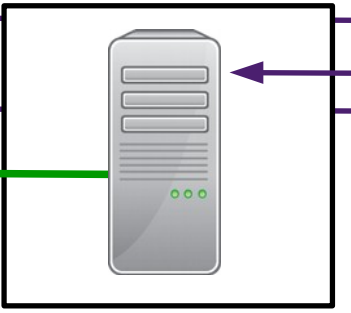
LAN



DB server (Springboard)







UPS

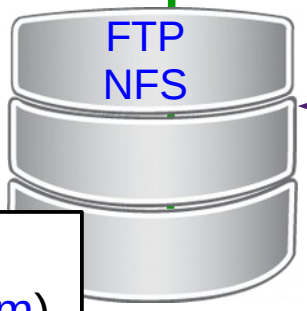
UPS

UPS

UPS

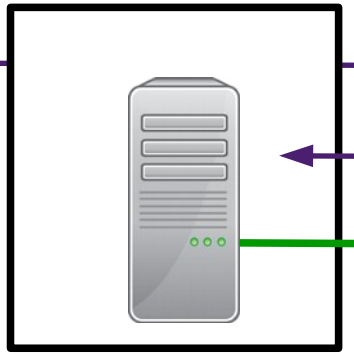
Mr. Anton Susilo (BPPTKG)

Mr. Cipta (CVGHM system)



FTP
NFS

DataBase Storage



JOB control server

SIM. server(s)

SUMMARY

- Introduced the basic of the GIS-MSD simulator
  - key components are DB engine, Sim. Engine, and IF/API
- Designed the hybrid physical-logical DB system
  - Physical DB is suitable for tree structure data
  - Logical DB is suitable for large number of data
  - Hybrid physical-logical DB provides us both scalability & portability
- Developed IF/API and simulation programs
  - User can easily operate the simulator by IF/API
  - simulation programs are almost developed, it needs to develop the IF/API
- Installed hardware configuration for installing in Indonesia
  - The hardware installed in BPPTKG (YOG) and CVGHM (BDO)
  - We established network which enables a remote accessing

Terima Kasih

[Future] Operating GIS-MSD Simulator

[Decision,Order]
warning & evacuation

Government

Local Government

Local Community

Consortium Merapi

CVGHM

BPPTKG

Balai Sabo

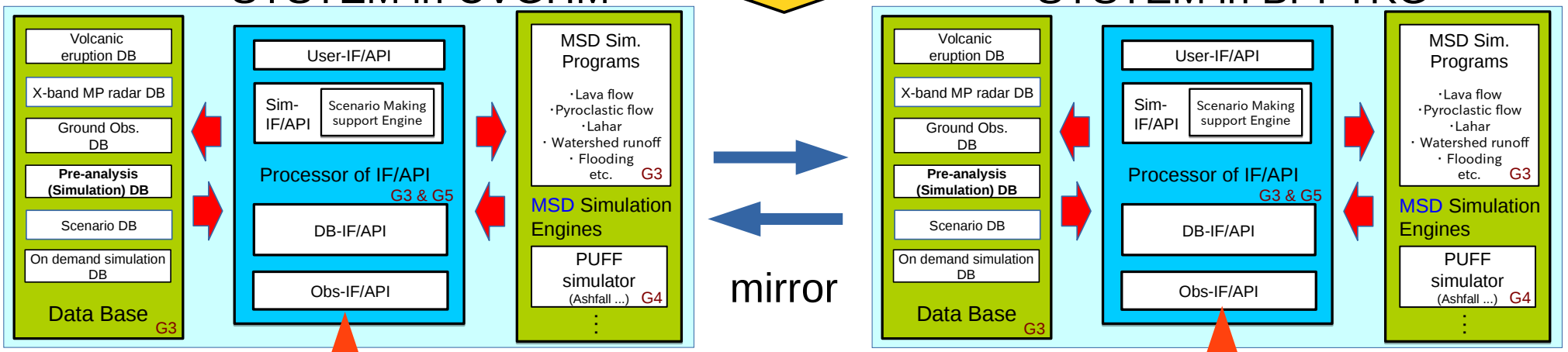
UGM

[Observation, Simulation, Analysis]

Consortium (Future?)

SYSTEM in CVGHM

SYSTEM in BPPTKG

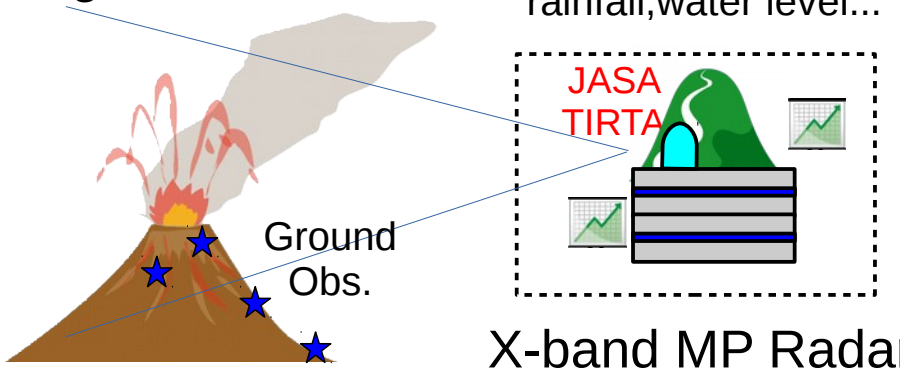


e.g. Mt. Klued

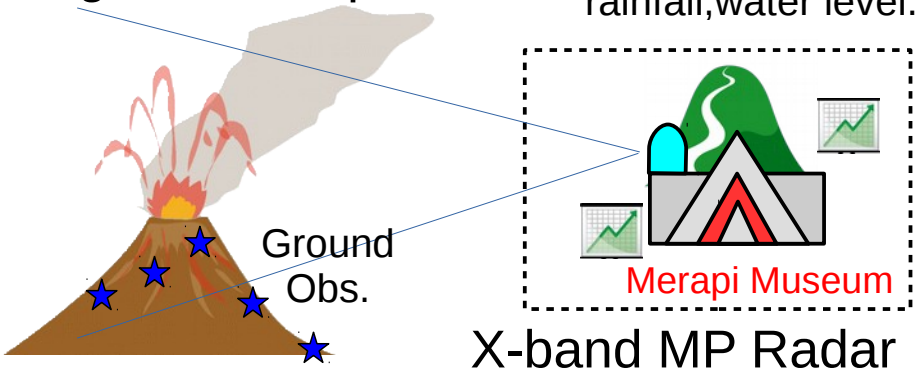
seismic,deformation,ash, rainfall,water level...

e.g. Mt. Merapi

seismic,deformation,ash, rainfall,water level...



X-band MP Radar



X-band MP Radar