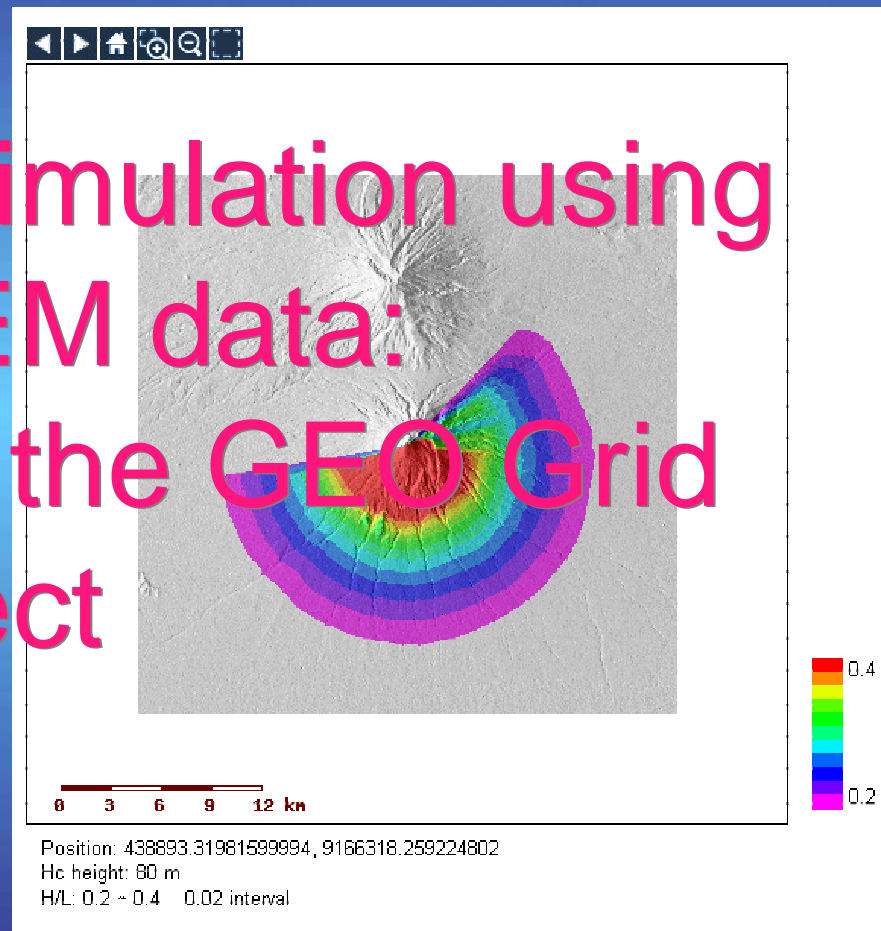


Volcanic hazard simulation using ASTER DEM data: an application of the GEO Grid Project

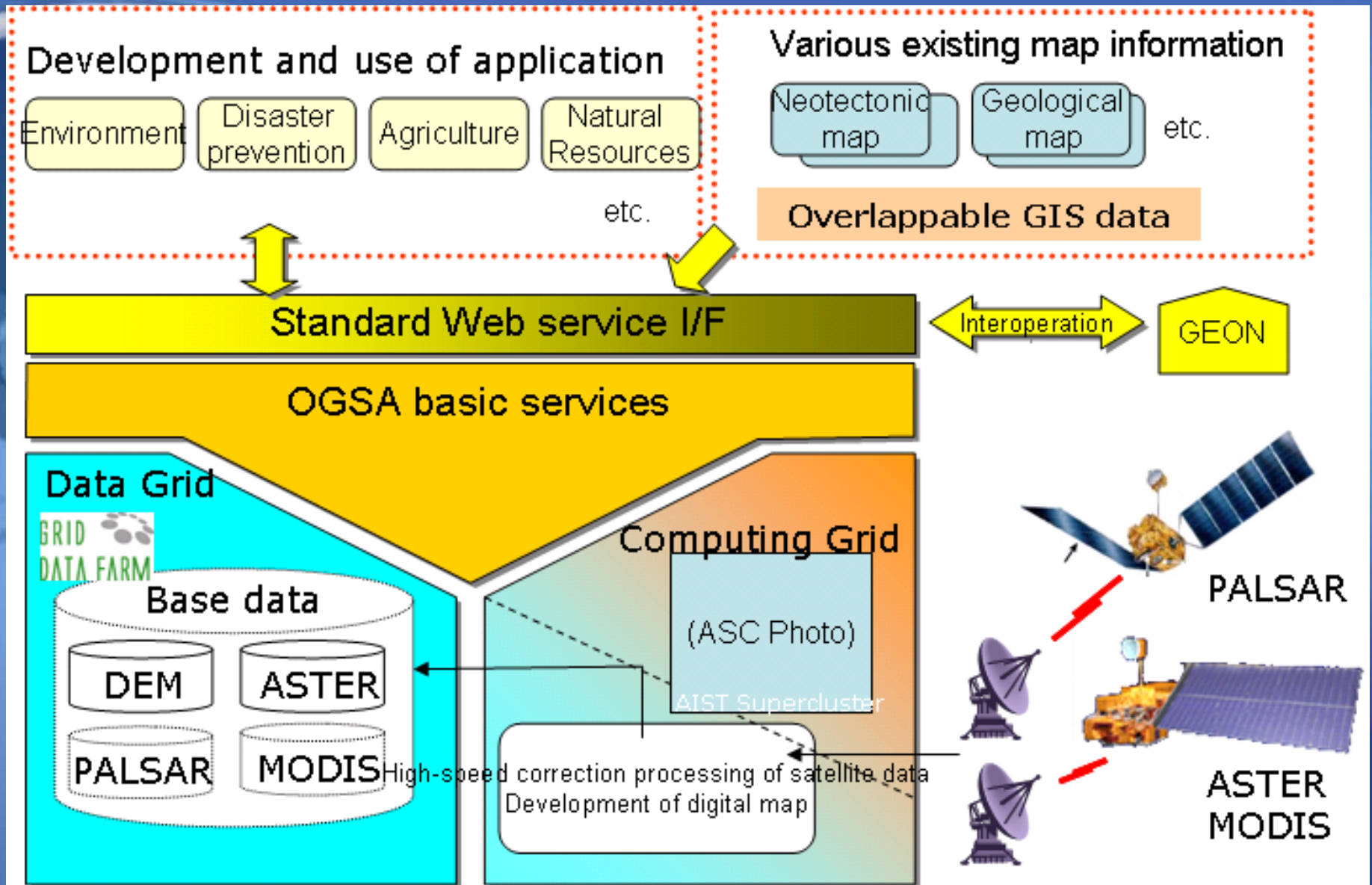


Shinji Takarada
Geological Survey of Japan
AIST

Contents

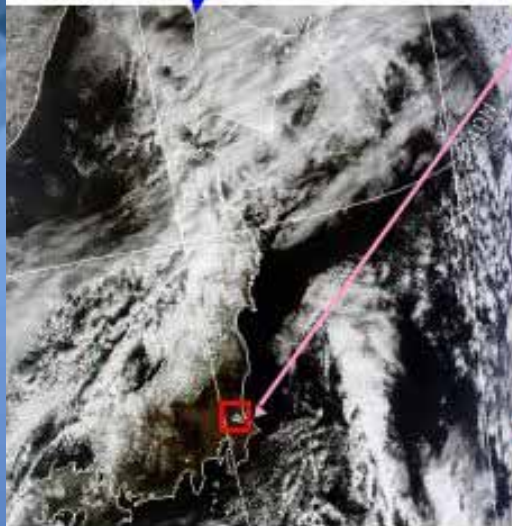
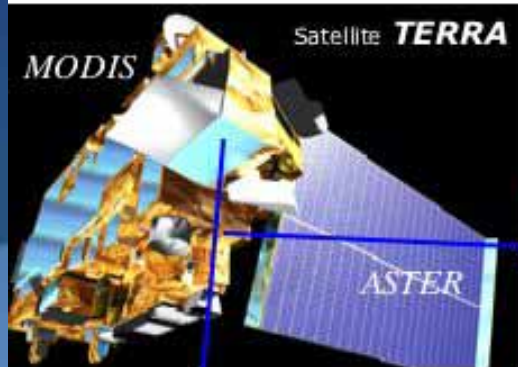
- 1 . GEO Grid Project
2. 1991-95 Unzen Pyroclastic Flows
- 3 . Next Generation Volcanic Hazard Map
- 4 . Volcanic Gravity Flow Simulation
using ASTER DEM data

GEO Grid (Global Earth Observation) Project

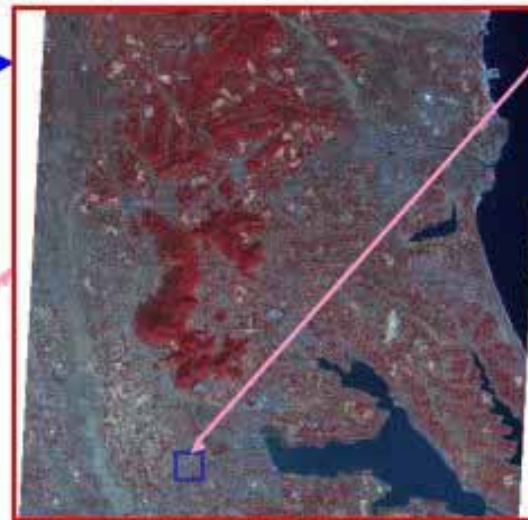


GEO Grid (Global Earth Observation) Project

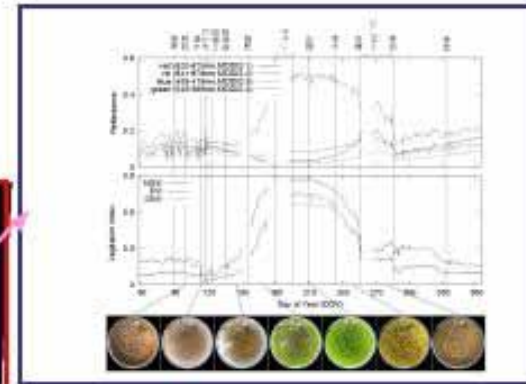
Environment monitoring



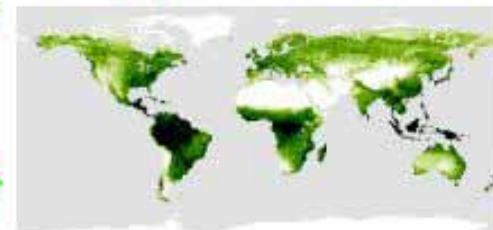
Daily Global observation
by MODIS



Link through ASTER
high resolution images



In-situ data for
validation/assimilation



Modeled Net Primary Production

Volcanic Gravity Flow Simulation Team

Shinji Takarada (Geoinformation Center, AIST)

Ryoshuke Nakamura (Grid Technology Research Center, AIST)

Naotaka Yamamoto (Grid Technology Research Center, AIST)

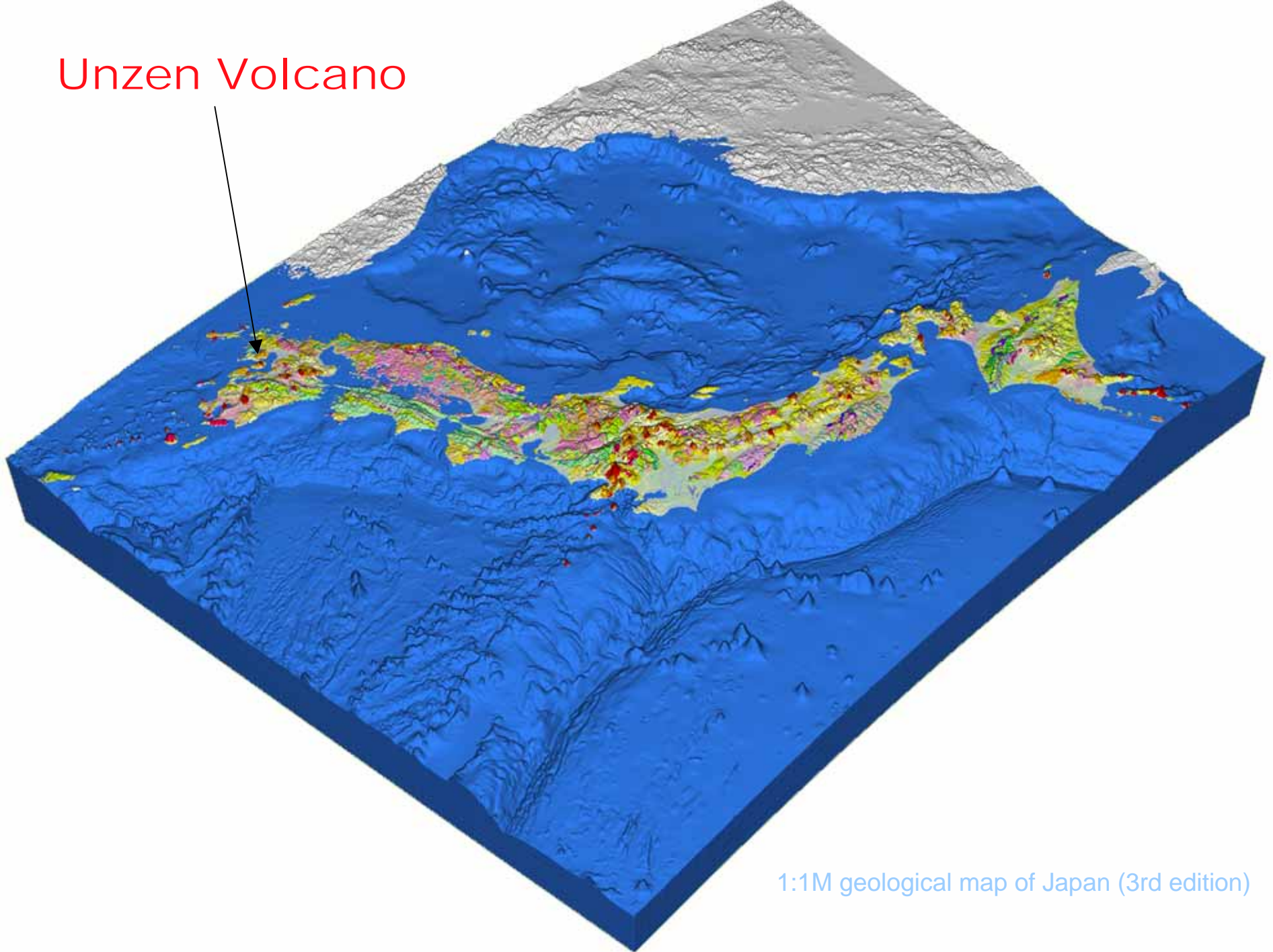
Hirokazu Yamamoto (Grid Technology Research Center, AIST)

Shinsuke Kodama (Grid Technology Research Center, AIST)

Mai Arioka (Institute of Geology and Geoinformation, AIST)

Tsukasa Nakano (Institute of Geology and Geoinformation, AIST)

Unzen Volcano



1:1M geological map of Japan (3rd edition)

108 active volcanoes

Rank A
13 volcanoes

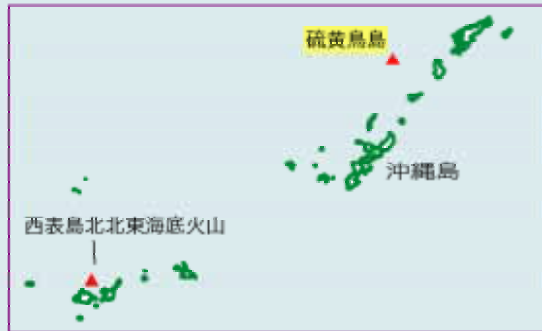
Rank B
36 volcanoes

Rank C
36 volcanoes

Aランク (13火山)

Bランク (36火山)

Cランク (36火山)



Unzen Volcano

AIST HOME

GSJ HOME

GeoMapDB Top

LIST OF DATA

HELP

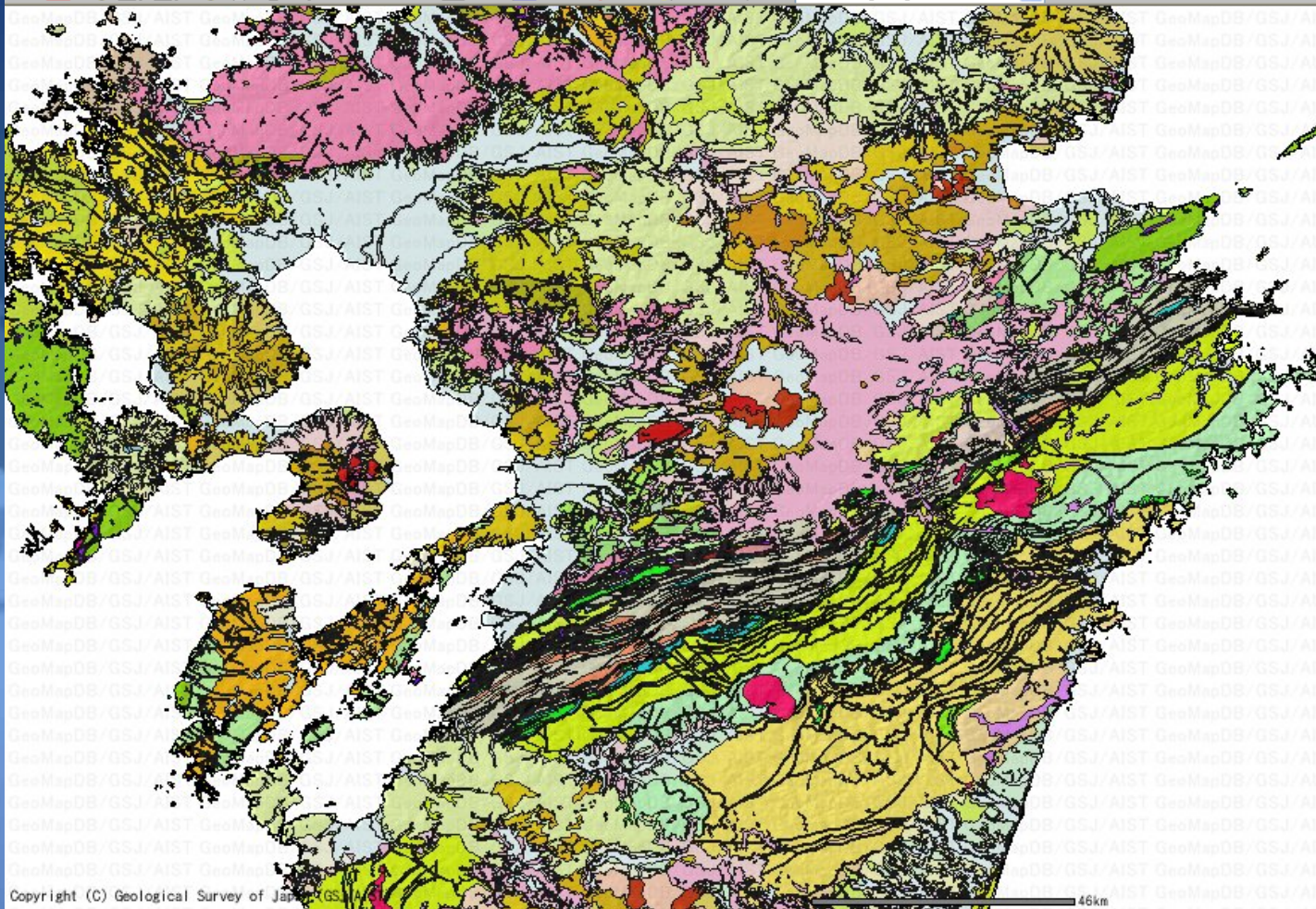
CONTACT

> AIST > GSJ > GeoMapDB Top > GeoMapDB

Search Layer 1:1,000,000 Geologic Map(Geologic)



Draw high-light selection



Map area >>

Active Layer Option

No Label Transparency 0%

Visible Active Refresh Map

- 1:25,000 Environmental Geologic Map(Raster)
- 1:50,000 Geologic Map (Easter Hokkaido and Kanto Area)(Raster)
- 1:200,000 Geologic Map (Kanto Area)(Vector)
- 1:200,000 Geologic Map (Raster)
- 1:200,000 Seamless Geologic Map(Vector,RIO-DB)
- 1:1,000,000 Geologic Map (Vector)
- 1:25,000 Topographic Map (Tsukuba Area)
- 1:50,000 Topographic Map

<http://iggis1.muse.aist.go.jp>

Seamless geological map of Japan (Kyushu island area)

1991- Heisei-
Shinzan lava
dome

1991- pyroclastic
flow deposit



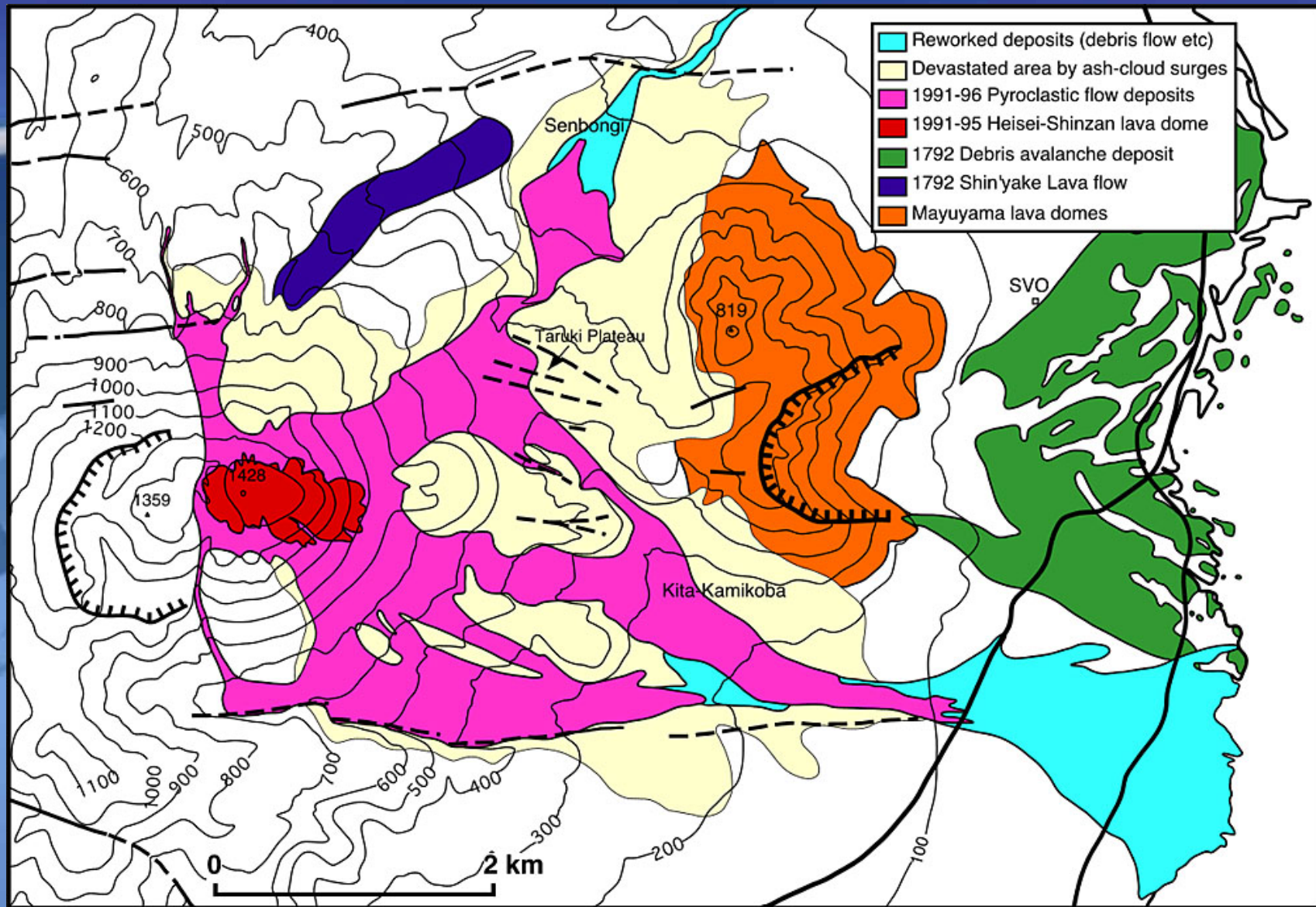
Mayuyama lava
dome

1792 amphitheater

1792 debris avalanche
deposit

Photo: Asia Air Survey

Aerial view of the Unzen Volcano



(After Watanabe and Hoshizumi, 1995)

Distribution of recent eruption products



1991 new lava dome

(After Nakada, 1992)

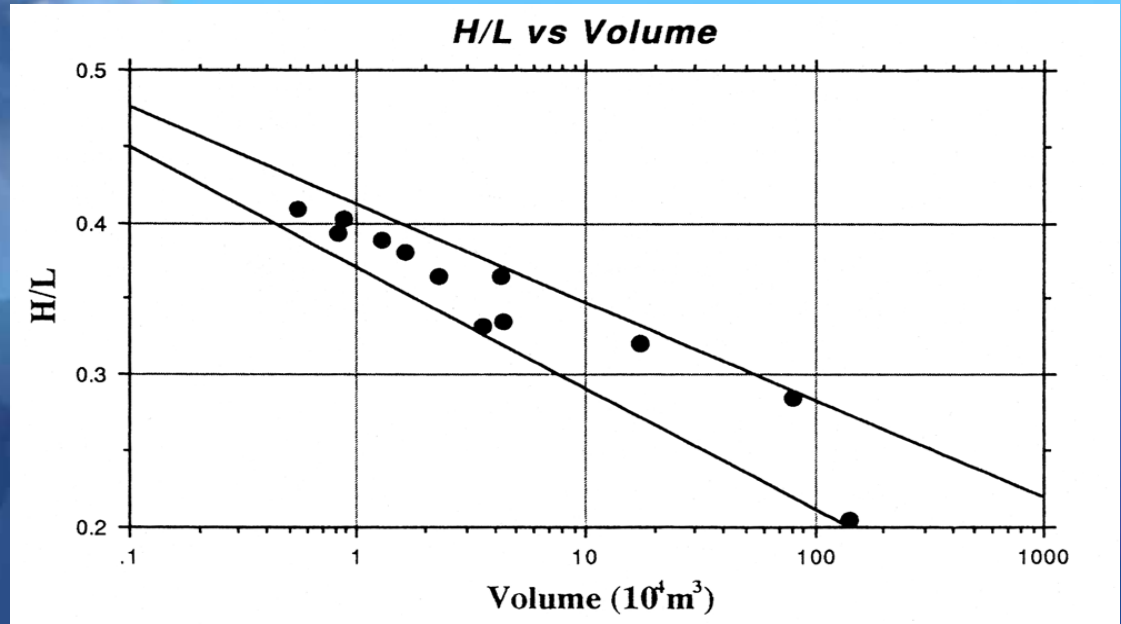
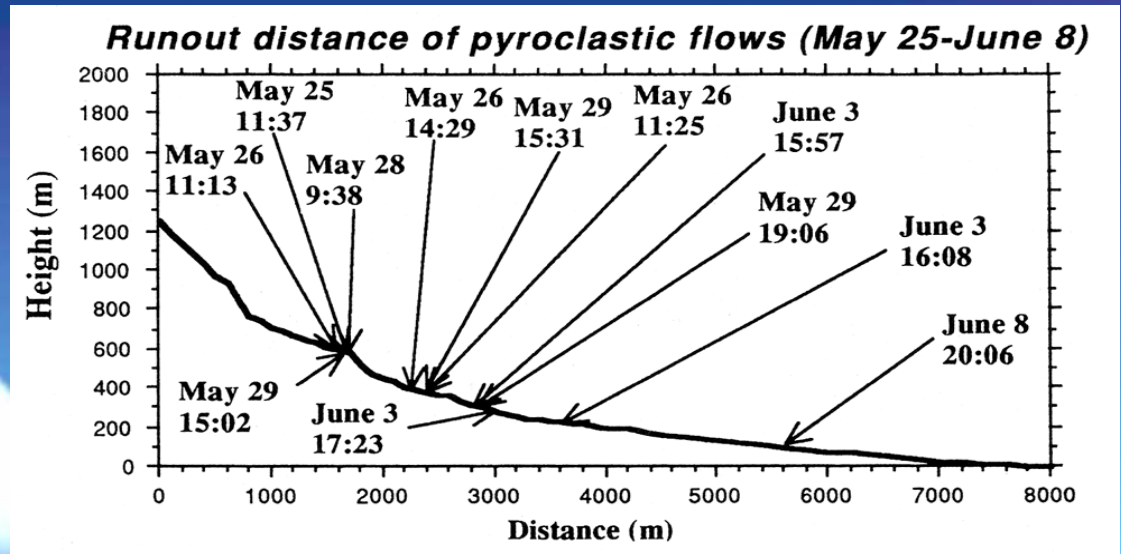


Dome-collapse type pyroclastic flow (June 24, 1993)



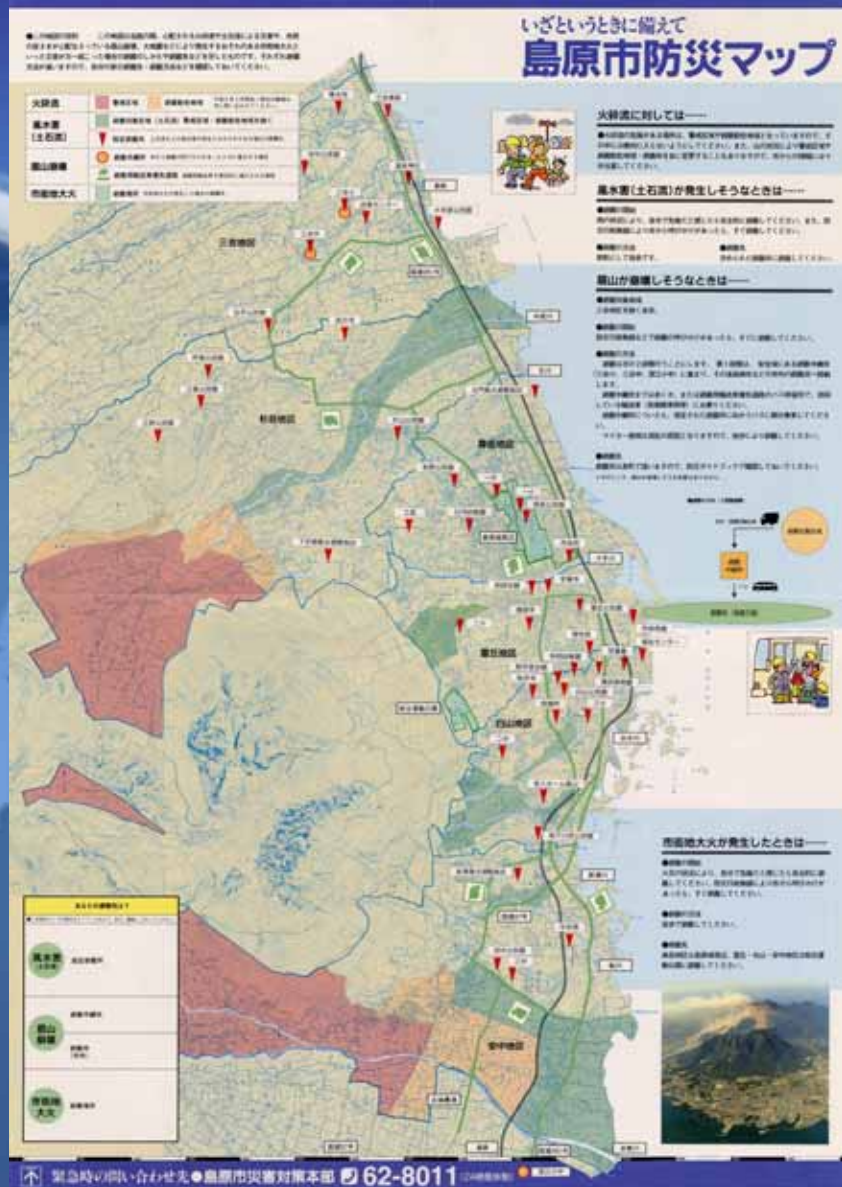
(After Nakada, 1992)

Devastation area attacked by an ash-cloud surge (June 3, 1991)



(after Takarada et al., 1993)

Runout distance and H/L-Volume relations of Unzen pyroclastic flows

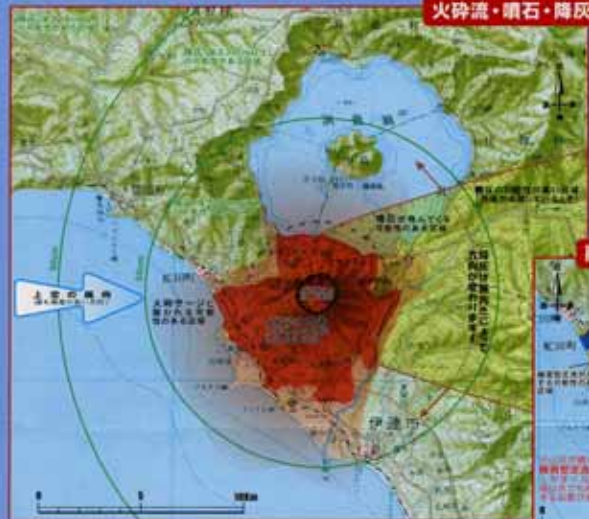


Volcanic disaster prevention map of Unzen Volcano

有珠山火山防災マップ

— 新たなる備えのために —

山頂噴火の危険区域予測図



火砕流・噴石・降灰



山頂噴火の様子(1978年4月)

この予測図は、1822年(文政5年)噴火と同じ規模の山頂噴火が起きた場合に、予想される災害の範囲を示したものです。
噴火の規模や気象条件などによって危険区域の範囲は変わります。

融雪型泥流・降雨型泥流(土石流)



融雪型泥流(土石流)は、融雪による土砂の流出や、降雨による土砂の流出によって発生します。融雪型泥流は、融雪による土砂の流出によって発生します。降雨型泥流(土石流)は、降雨による土砂の流出によって発生します。

山麓噴火の危険区域予測図



火口の位置によって危険区域は変わります!

山麓噴火はある限られた領域で起きますので、この危険区域全体が同じように危険だということを示しているわけではありません。火口の位置については事前に特定することが出来ないので昭和山噴火と同じく、山麓噴火が起る可能性のある範囲の全域を総合して示してあります。実際の山麓噴火では、火口の位置によってこの図の一部分が噴石や火砕流の危険区域となります。噴火が起きた場合には、火口の位置にあわせて危険区域があらためて示されます。噴火の規模などによっても、危険区域の範囲は変わります。



避難場所は、 避難所は、地図、記号で示されています。

Volcanic disaster prevention map of Usu Volcano

2003年版 浅間山火山防災マップ

～活火山・浅間山を知り、火山と共生するために～

佐久市



浅間山は、私たちに多くの恵みをもたらしてきています。一方で活火山である浅間山は、常に活動し続けています。...

このマップに関するお問い合わせ先

- 佐久市 電話 0287-62-2111 (FAX)
- 佐久市 消防センター 電話 03-3211-7902
- 佐久市 防災センター 電話 0287-65-1504

火山の危険度

火山ガス 火山ガスは、火山活動に伴って発生する有毒なガスです。...	噴石 噴石は、火山活動に伴って発生する岩石の破片です。...	火山灰 火山灰は、火山活動に伴って発生する細かい岩石の破片です。...	火山泥 火山泥は、火山活動に伴って発生する泥状の火山灰と水の混合物です。...
--	--	---	---

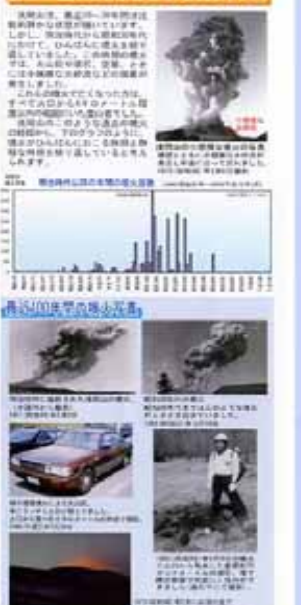


火山災害予想区域図 小～中規模噴火の場合 (火山ハザードマップ)

最近100年間に発生した規模の噴火



最近100年間の噴火の規模



Volcanic disaster prevention map of Asama Volcano

CCOP projects for volcanic hazard mitigation

1. Database of recent eruptions
(Share our knowledge and experiences during eruptions)

Make a “web-base eruption information center”

2. Next generation hazard map

What is needed for the “Next Generation Hazard Map”?

3. Database of hazard maps

Open “hazard maps” to the public on a website

Next Generation Hazard Map

1. Using a GIS System

Overlay all historical eruption products

Overlay satellite image, resident's information

Pictures and short video footage to explain possible volcanic eruptions

How to evacuate (route, where, what to bring, etc)

2. Real Time Hazard Map

Computer simulations using a laptop computer and/or on website

Energy Cone Model, granular flow model, Bingham flow model

3. 3D Model

Using high resolution DEM, ASTER (15m mesh)

GEO Grid pyroclastic flow simulation

1. Energy Cone Simulation

Simple (less parameters, H_c , H/L only)

Evaluate potential hazard areas (good for hazard maps)

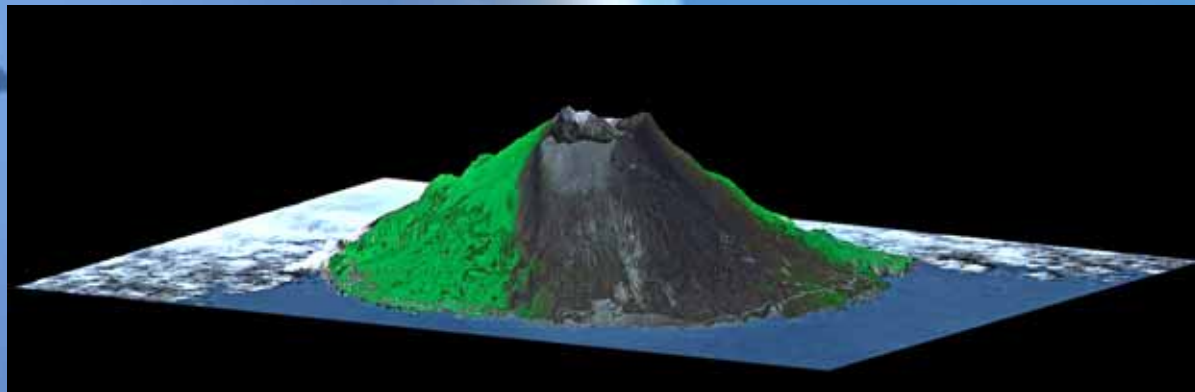
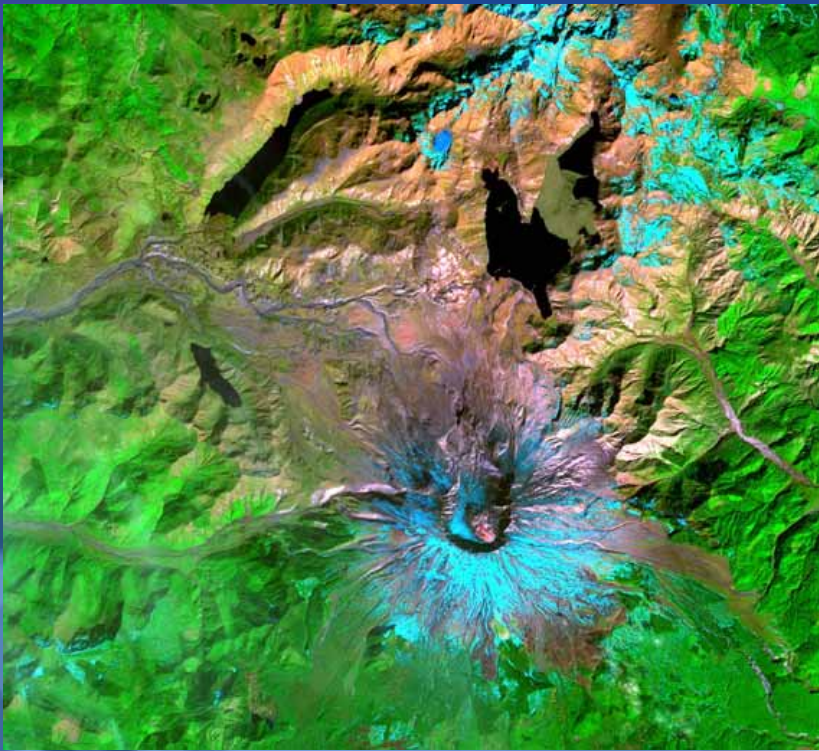
2. ASTER DEM data, Web-base Application

High resolution (15m)

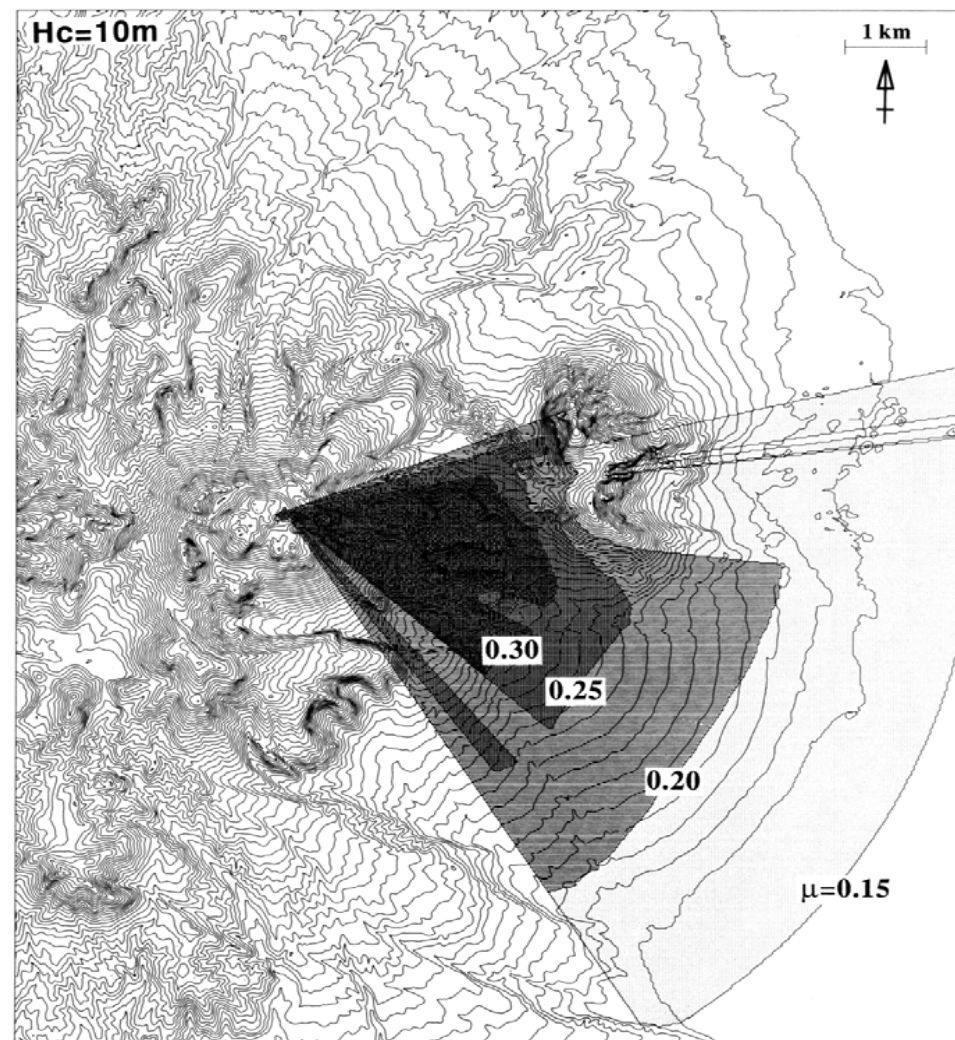
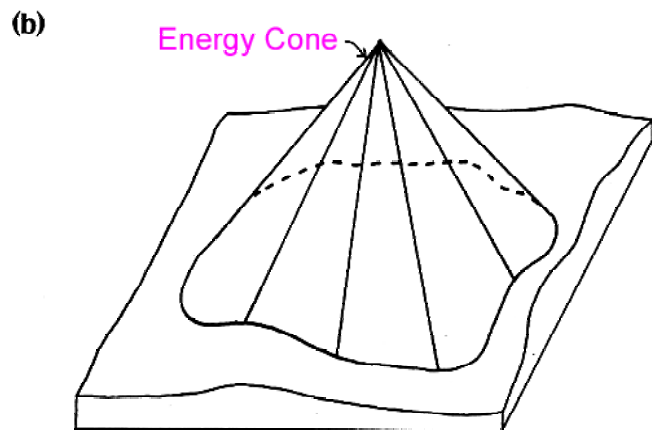
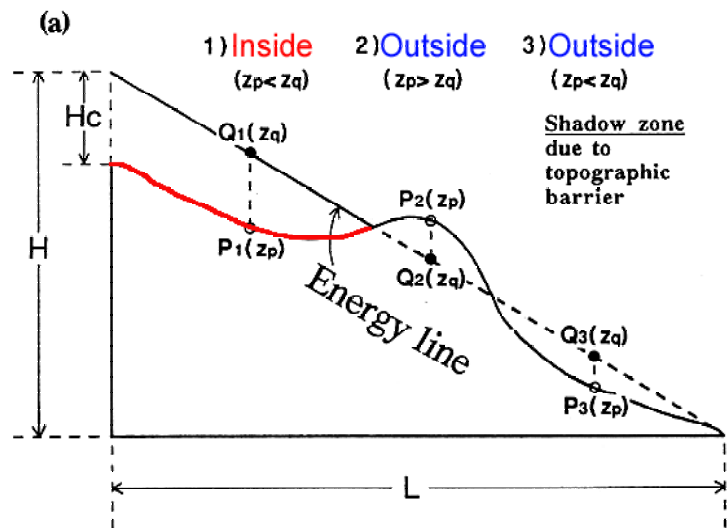
Applicable all volcanic areas in the world

Possible to use updated topography for DEM

Possible to open for all scientists in the world

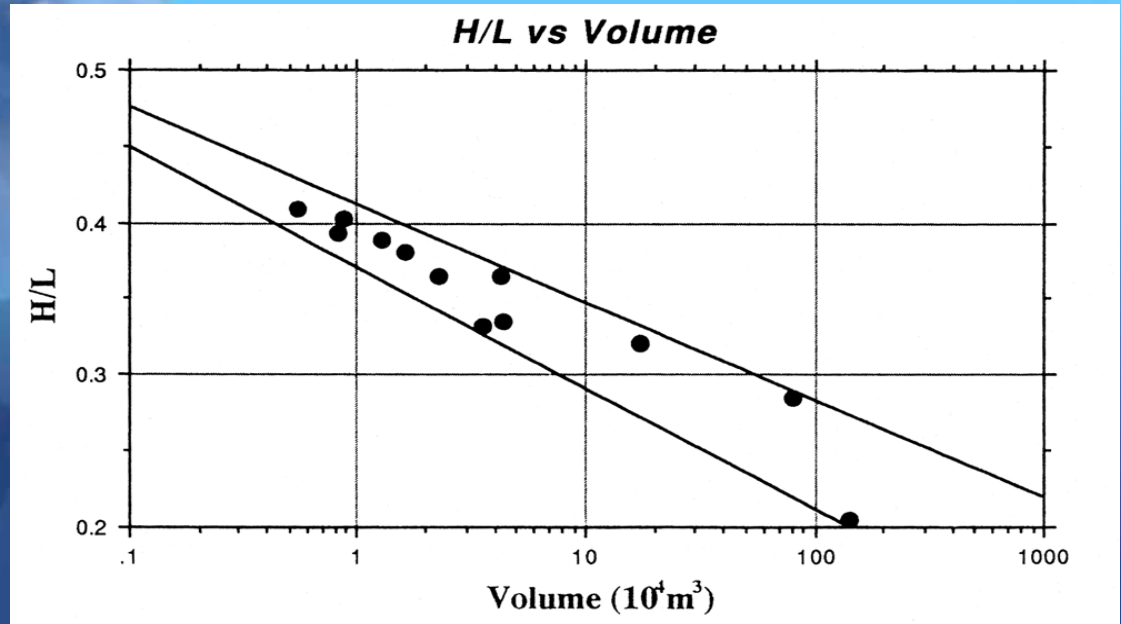
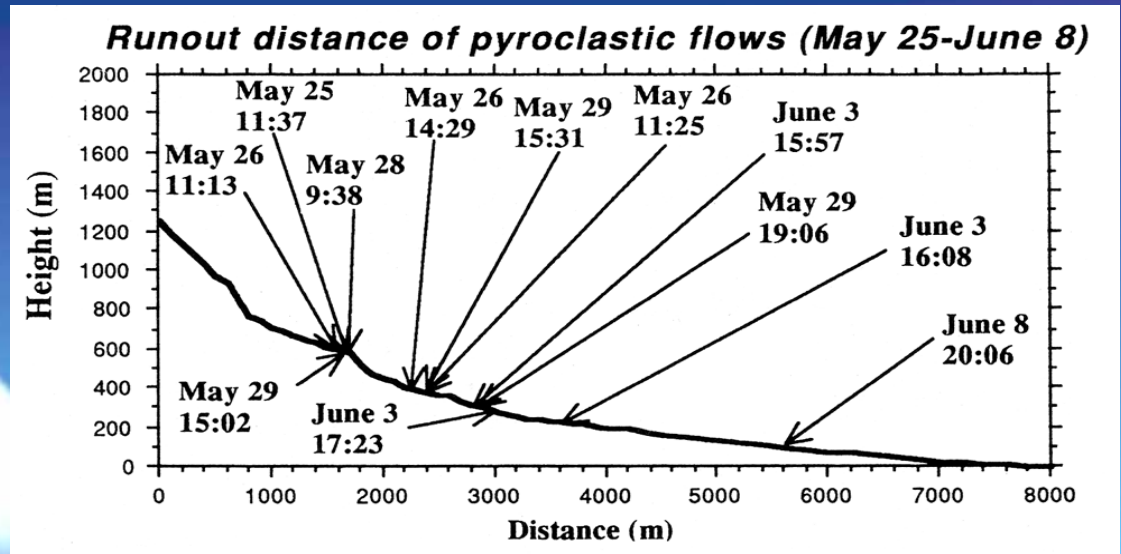


ASTER images and 3D DEM



(after Takarada et al., 1993)

Potential hazard area estimations using energy cone model



(after Takarada et al., 1993)

Runout distance and H/L-Volume relations of Unzen pyroclastic flows

GEO Grid pyroclastic flow simulation

List of Volcanoes

Merapi (Indonesia)

Fuji

Unzen

Kirishima

Sakurajima

Yotei

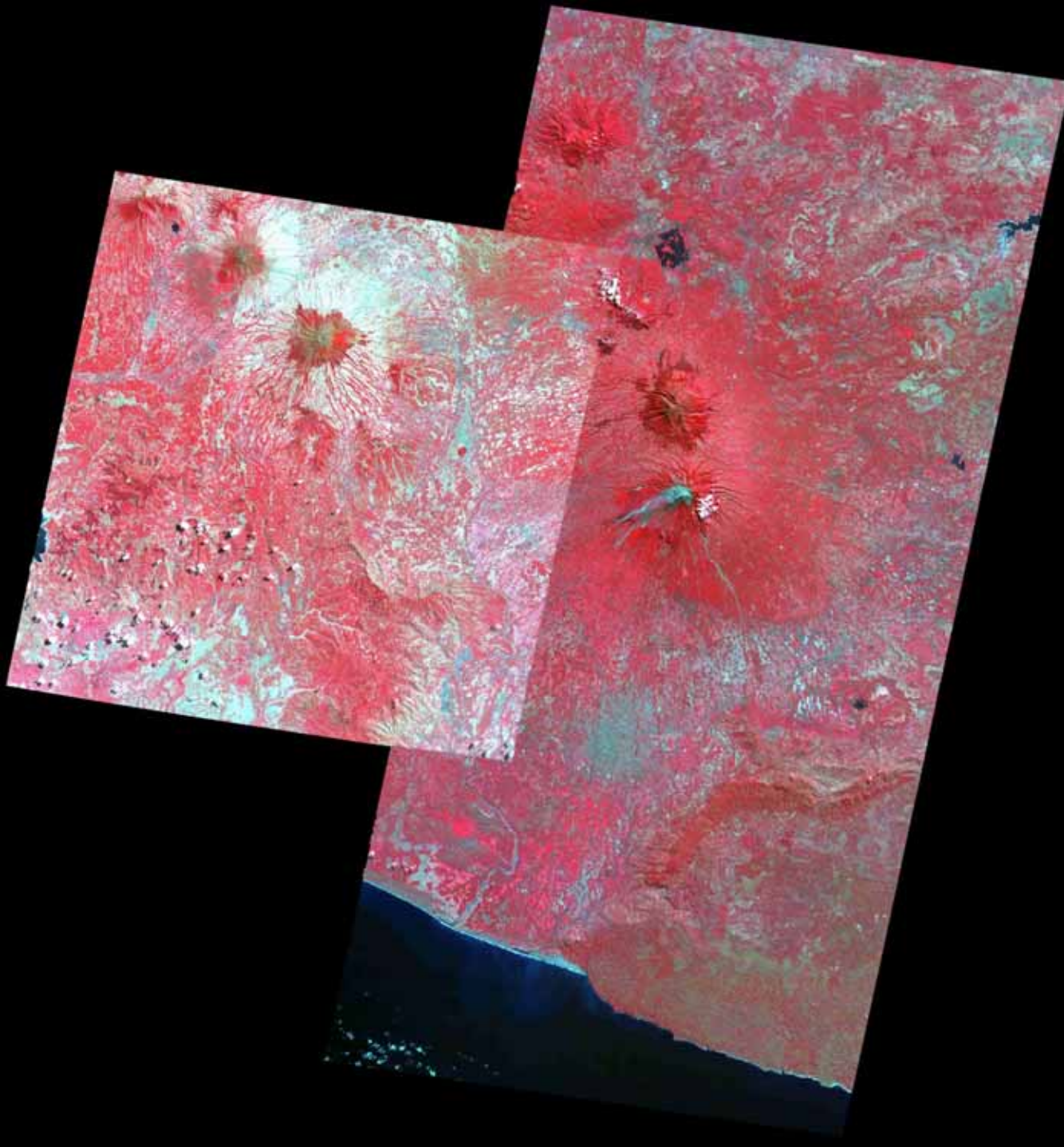
Tarumae

Usu

Bandai



Merapi Volcano



ASTER DEM
data taken on
June 30, 2003

Modified using
DEM data on
Aug. 5, 2002

GridSphere Portal - Mozilla Firefox

ファイル(F) 編集(E) 表示(V) 履歴(H) ブックマーク(B) ツール(T) ヘルプ(H)

http://www.geogrid.org/gridsphere/gridsphere?cid=72&gs_action=

Yahoo! JAPAN

GEOGrid

ログアウト
ようこそ, Shinji Takarada

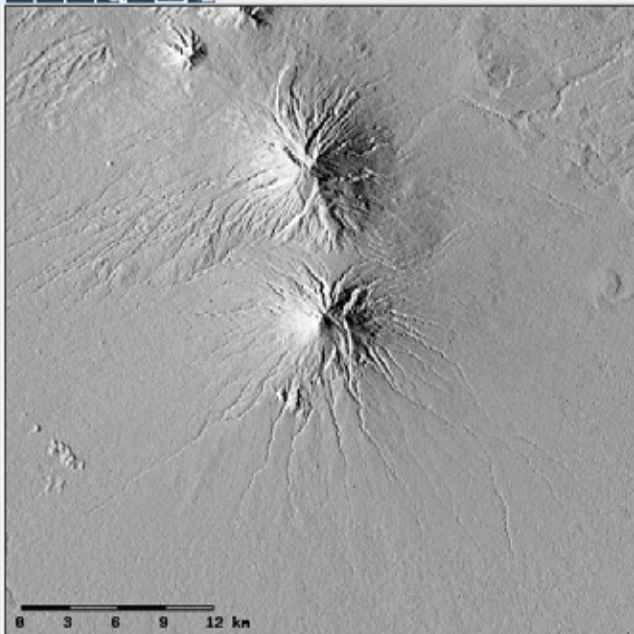
設定 Energy Cone Simulation ASTER data GEOGrid

Energy Cone Simulation

Simulation of Pyroclastic flows on volcanos

Our portal site, users can perform numerical simulations of lave and/or pyroclastic flows on volcanos for prediction and mitigation of the hazard for Merapi.

◀ ▶ ⏪ ⏩ 🏠 🔍 🔄



Position UTM(x)
 UTM(y)

Longitude

Latitude

Hc_height [m] (>=0, e.g. 10)

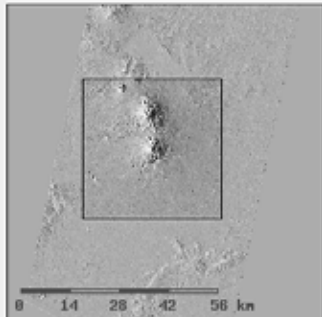
H/L min (> 0, e.g. 0.2)

H/L max (< 1; e.g. 0.4)

H/L interval (e.g. 0.02)

shadow zone

show confirm window



back to

完了

Initial view

GridSphere Portal - Mozilla Firefox

ファイル(F) 編集(E) 表示(V) 履歴(H) ブックマーク(B) ツール(T) ヘルプ(H)

http://www.geogrid.org/eridsphere/eridsphere?cid=728&_action=

Yahool JAPAN

GEOGrid

ログアウト
ようこそ, Shinji Takarada

設定 Energy Cone Simulation ASTER data GEOGrid

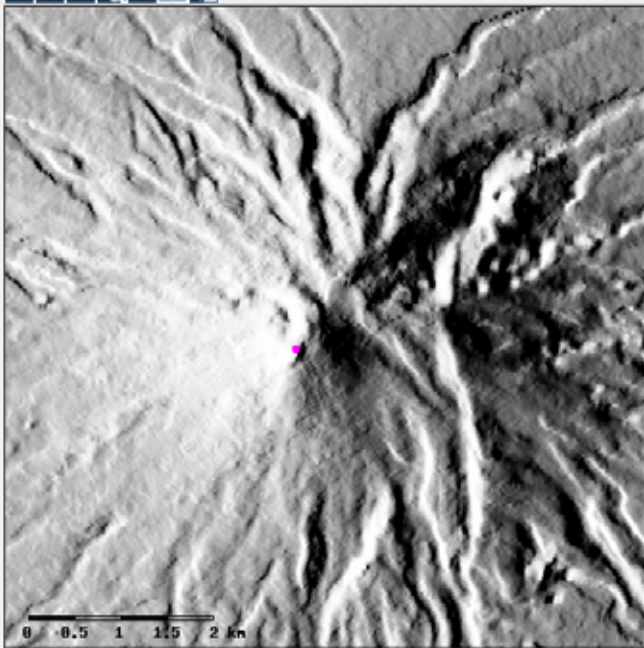
Energy Cone Simulation

Energy Cone Simulation

Simulation of Pyroclastic flows on volcanos

Our portal site, users can perform numerical simulations of lave and/or pyroclastic flows on volcanos for prediction and mitigation of the hazard for Merapi.

Navigation icons: back, forward, home, search, refresh, zoom in, zoom out, full screen



Position: 438806 UTM(x)
9166335 UTM(y)

Longitude: 110 26 43

Latitude: -7 32 30

Hc_height: 10 [m] (>=0; e.g. 10)

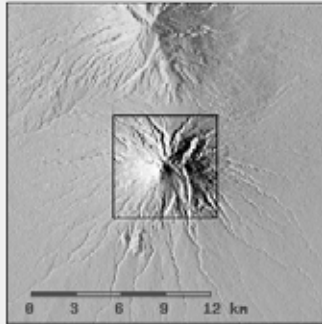
H/L min: 0.2 (> 0; e.g. 0.2)

H/L max: 0.4 (< 1; e.g. 0.4)

H/L interval: 0.02 (e.g. 0.02)

shadow zone

show confirm window

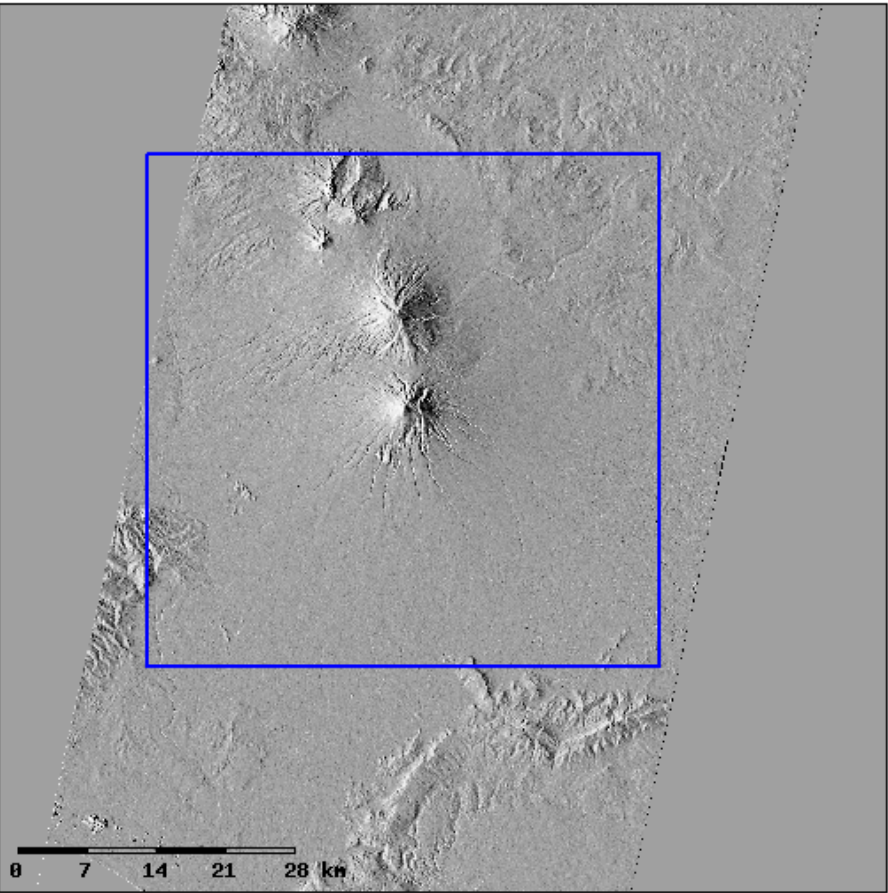


back to

完了

Input parameters

http://www.geogrid.org - Energy Cone Simulation - Mozilla Firefox



Navigation icons: back, forward, home, search, zoom in, zoom out, refresh.

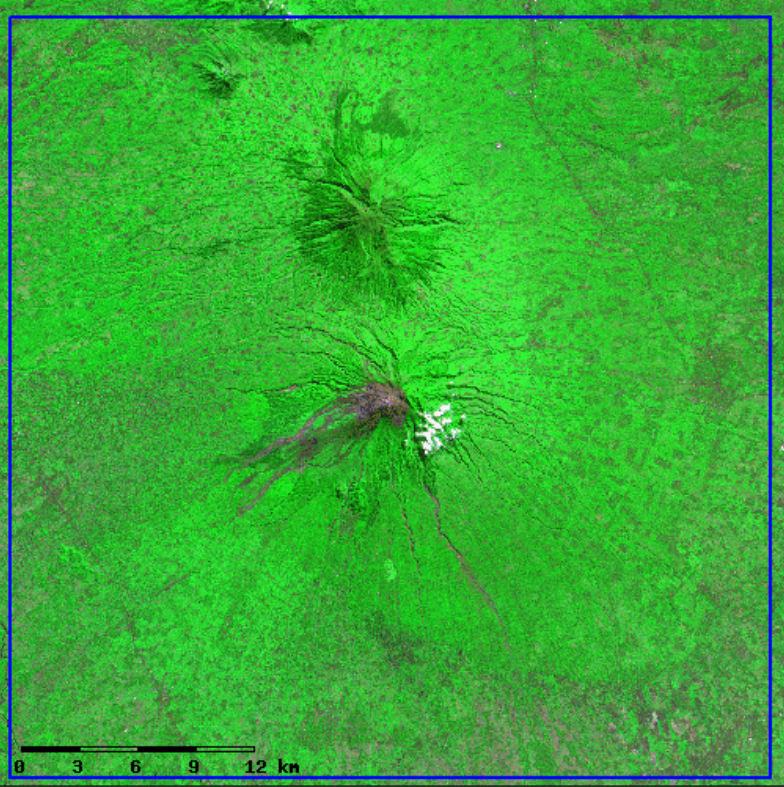
Scale bar: 0 7 14 21 28 km

Position: 438806.007000000004, 9166335.5235
Expectation processing time: 88.2 sec.
Hc height: 10 m
H/L: 0.2 ~ 0.4 0.02 interval

完了

Confirmation view

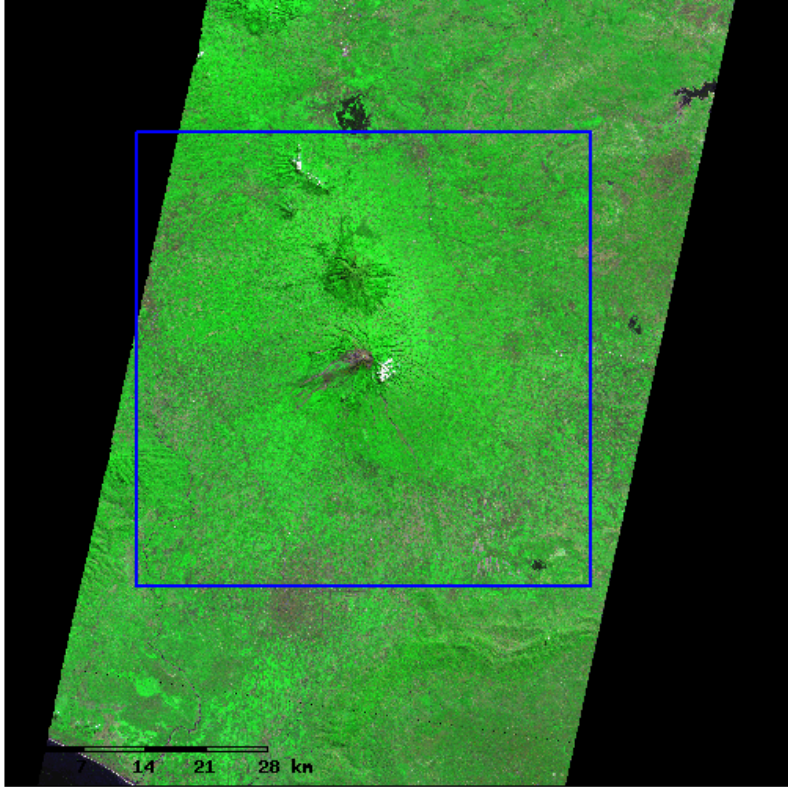
http://www.geogrid.org - Energy Cone Simulation - Mozilla Firefox



Position: 438971.24700000003, 9166666.0035 Expectation processing time: 91 sec.
Hc height: 40 m
H/L: 0.2 ~ 0.4 0.02 interval

完了

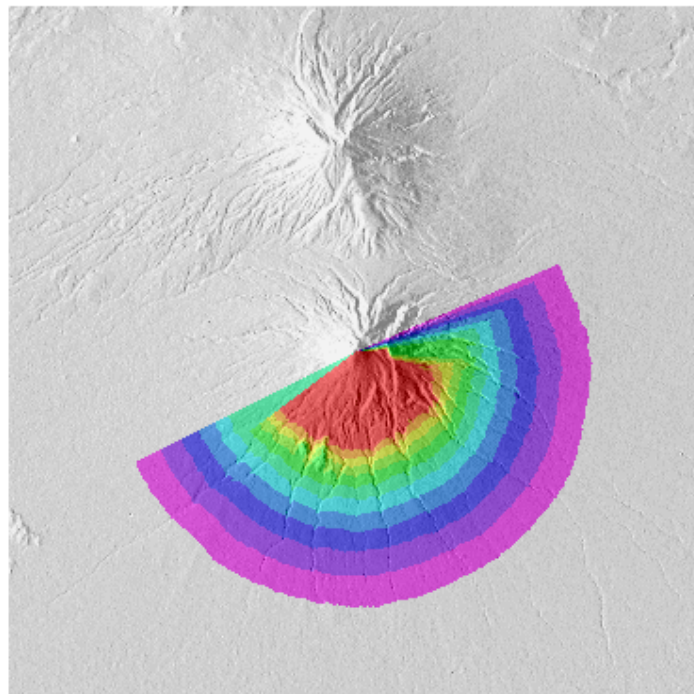
http://www.geogrid.org - Energy Cone Simulation - Mozilla Firefox



Position: 438847.31700000004, 9166376.8335 Expectation processing time: 91 sec.
Hc height: 40 m
H/L: 0.2 ~ 0.4 0.02 interval

完了

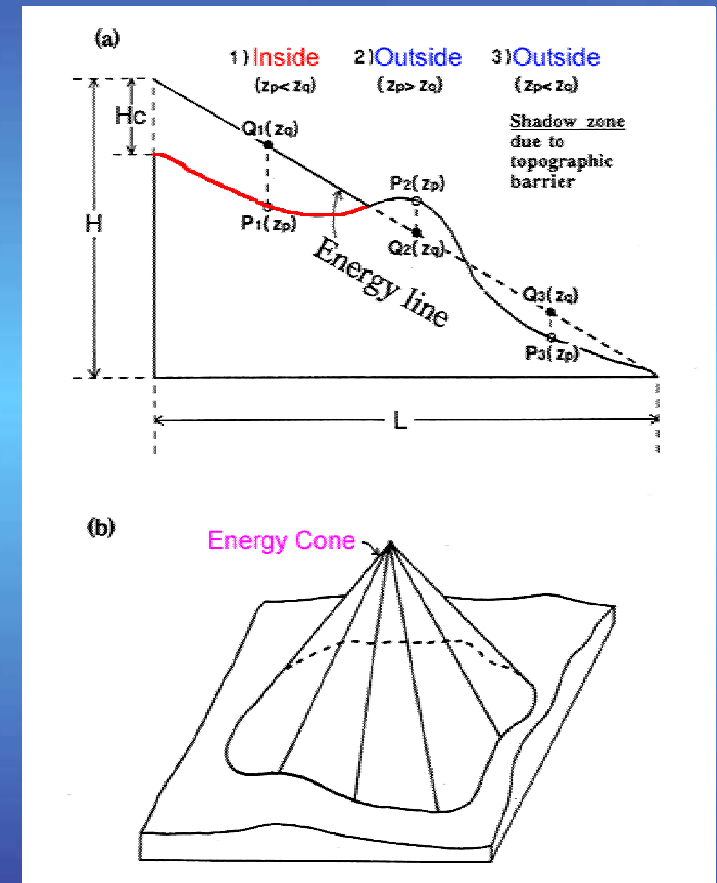
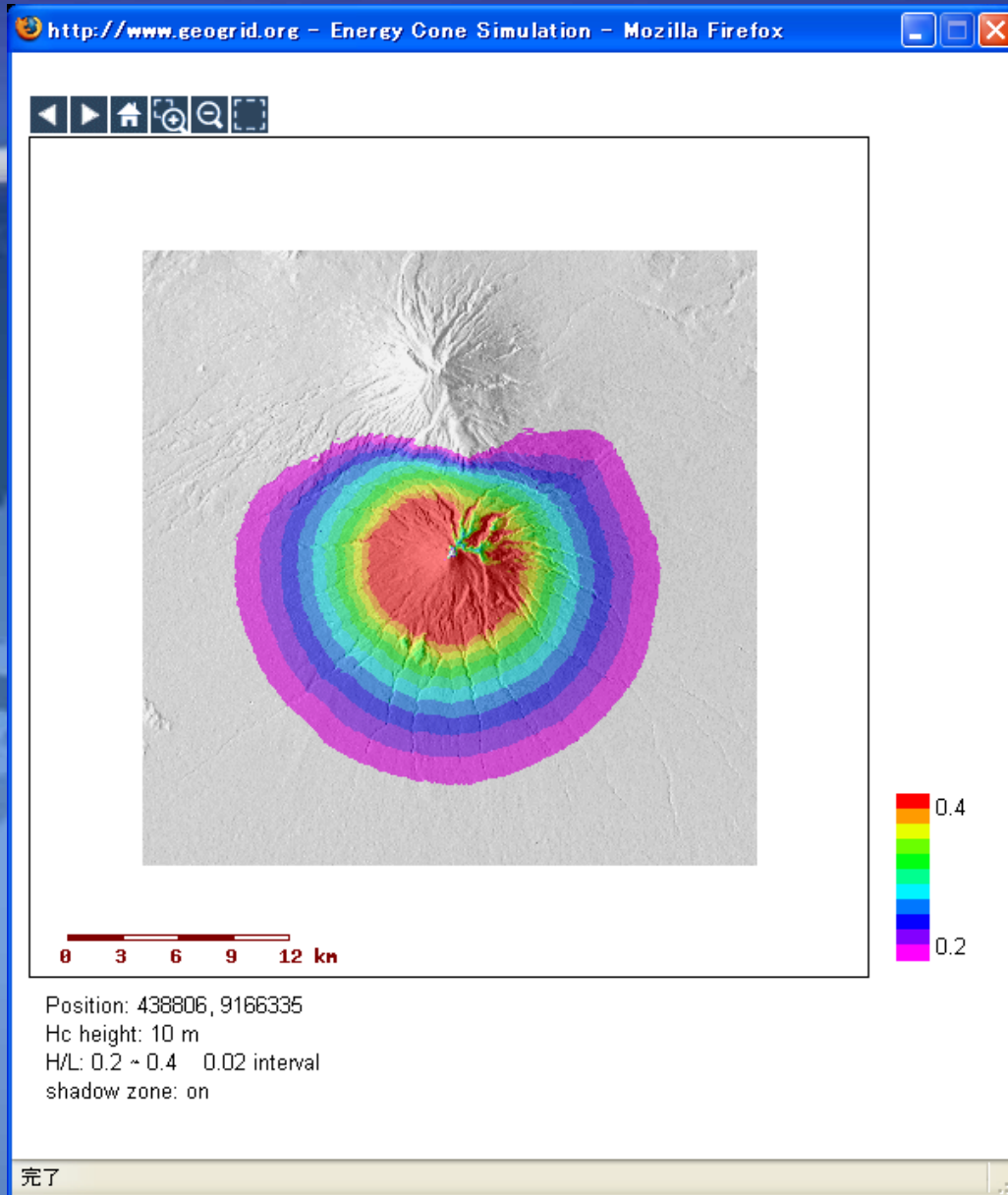
Confirmation View (Ortho Image)



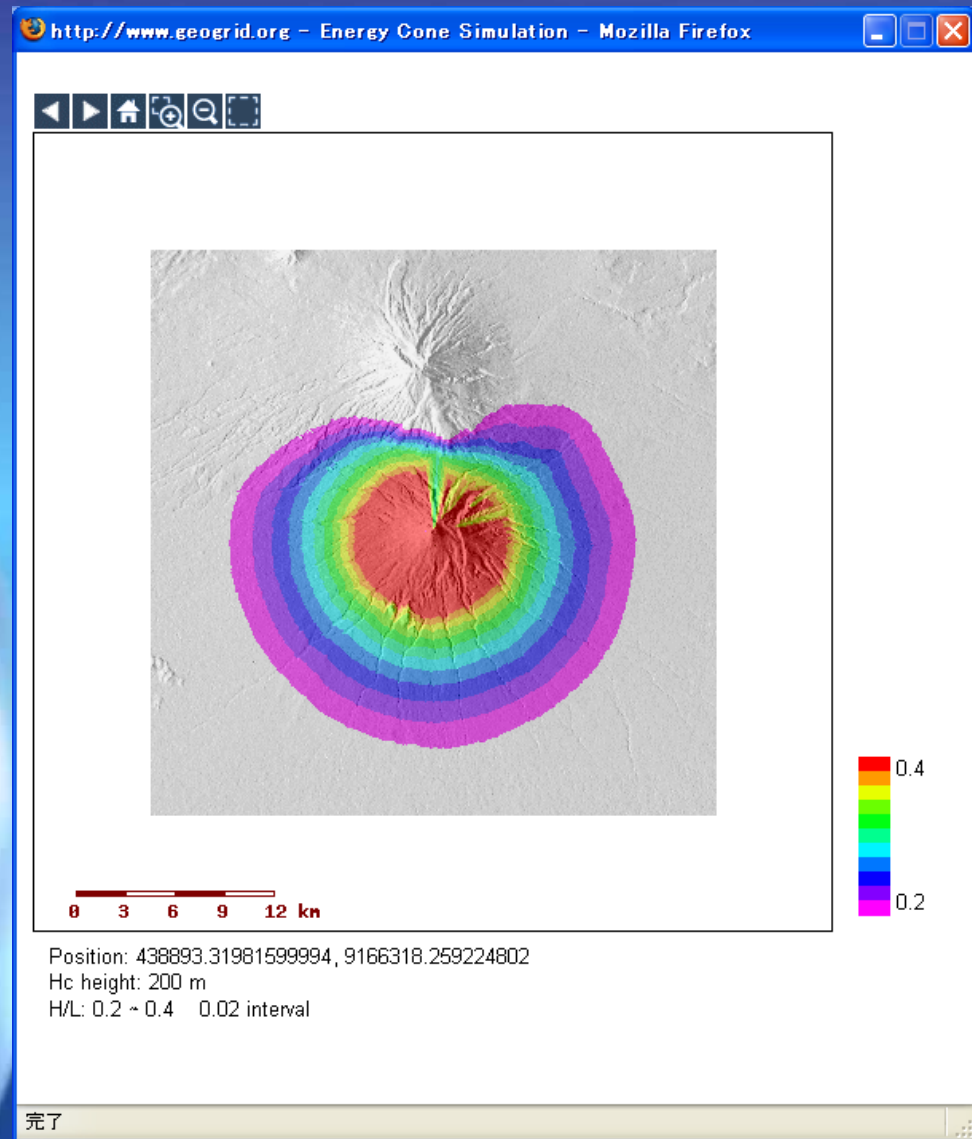
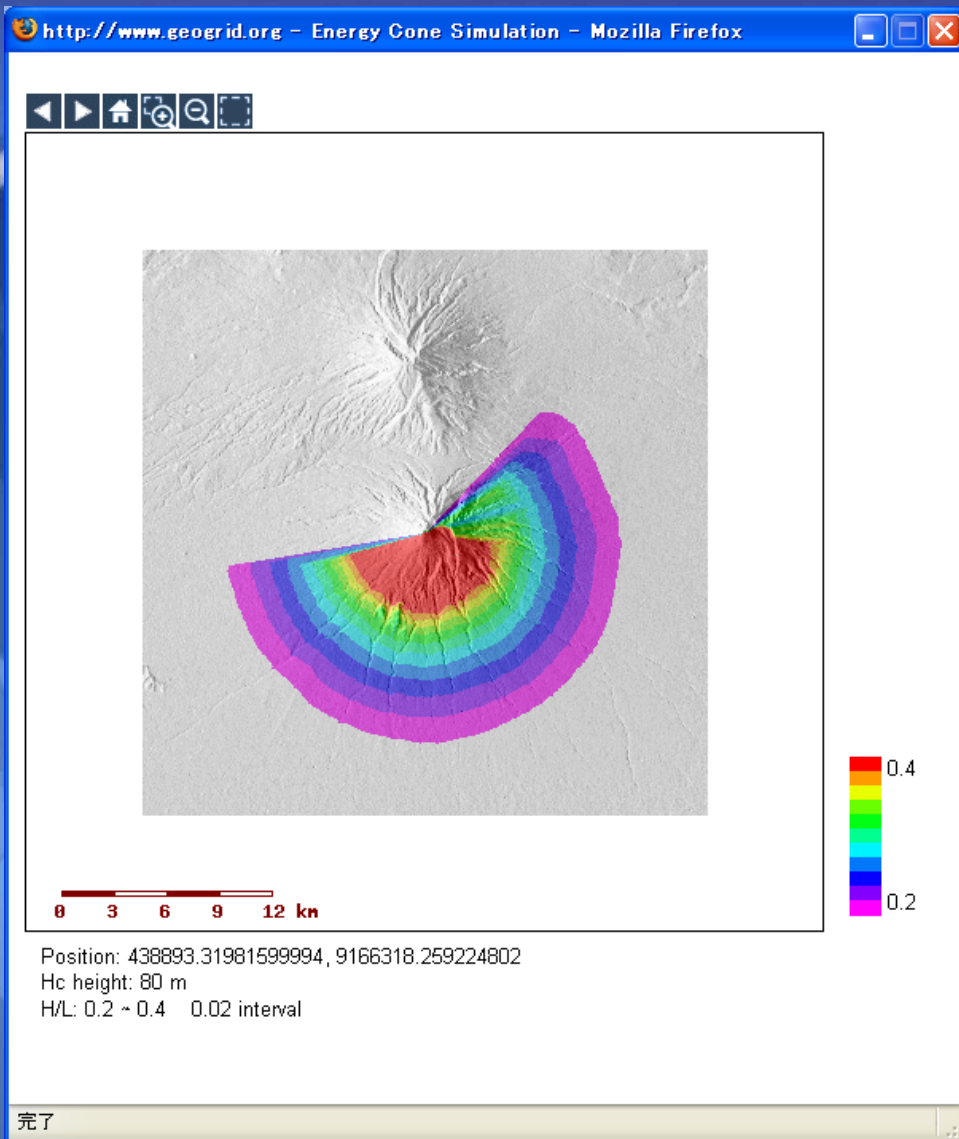
0 3 6 9 12 km



Position: 438806.007000000004, 9166335.5235
Hc height: 10 m
H/L: 0.2 ~ 0.4 0.02 interval

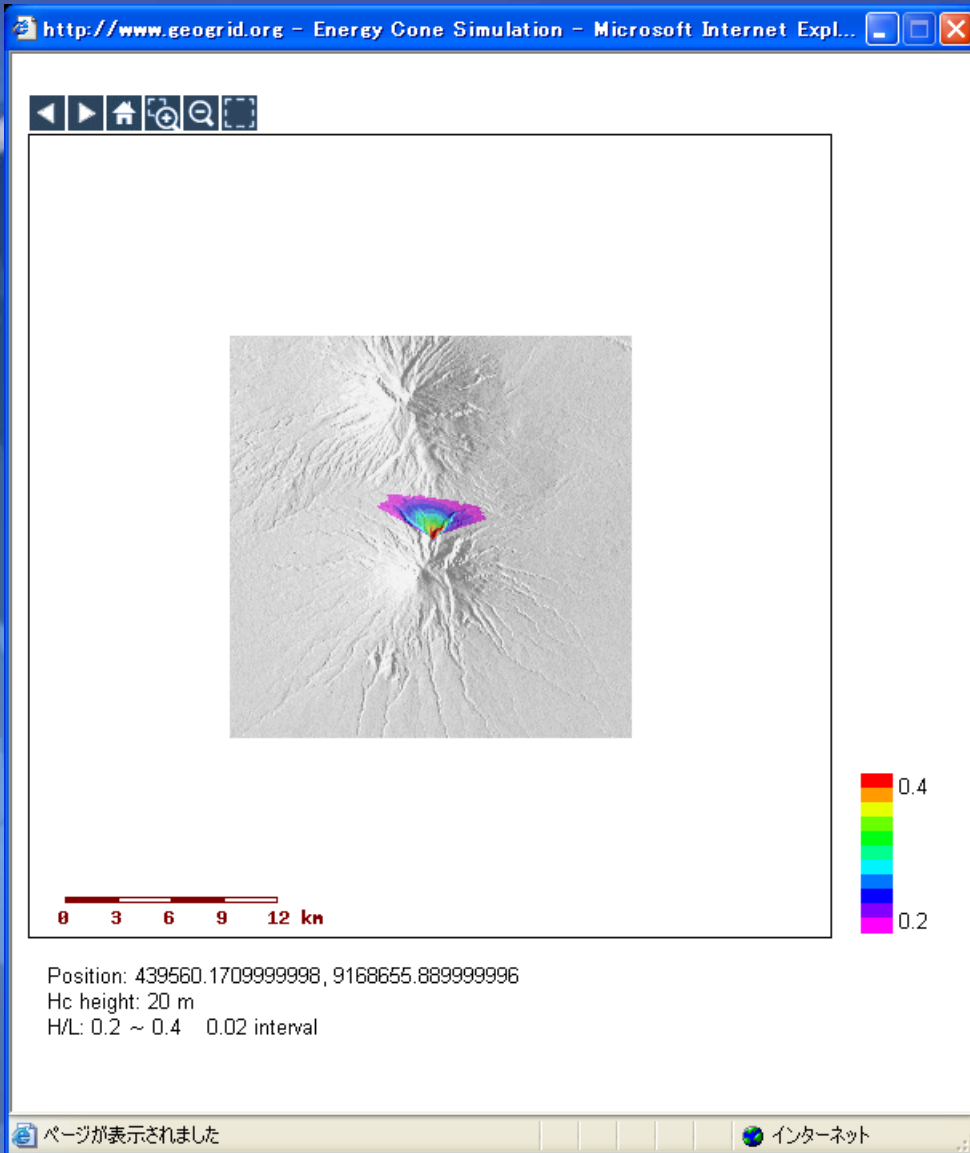


Result of Energy Cone Simulations (Shadow zone on)

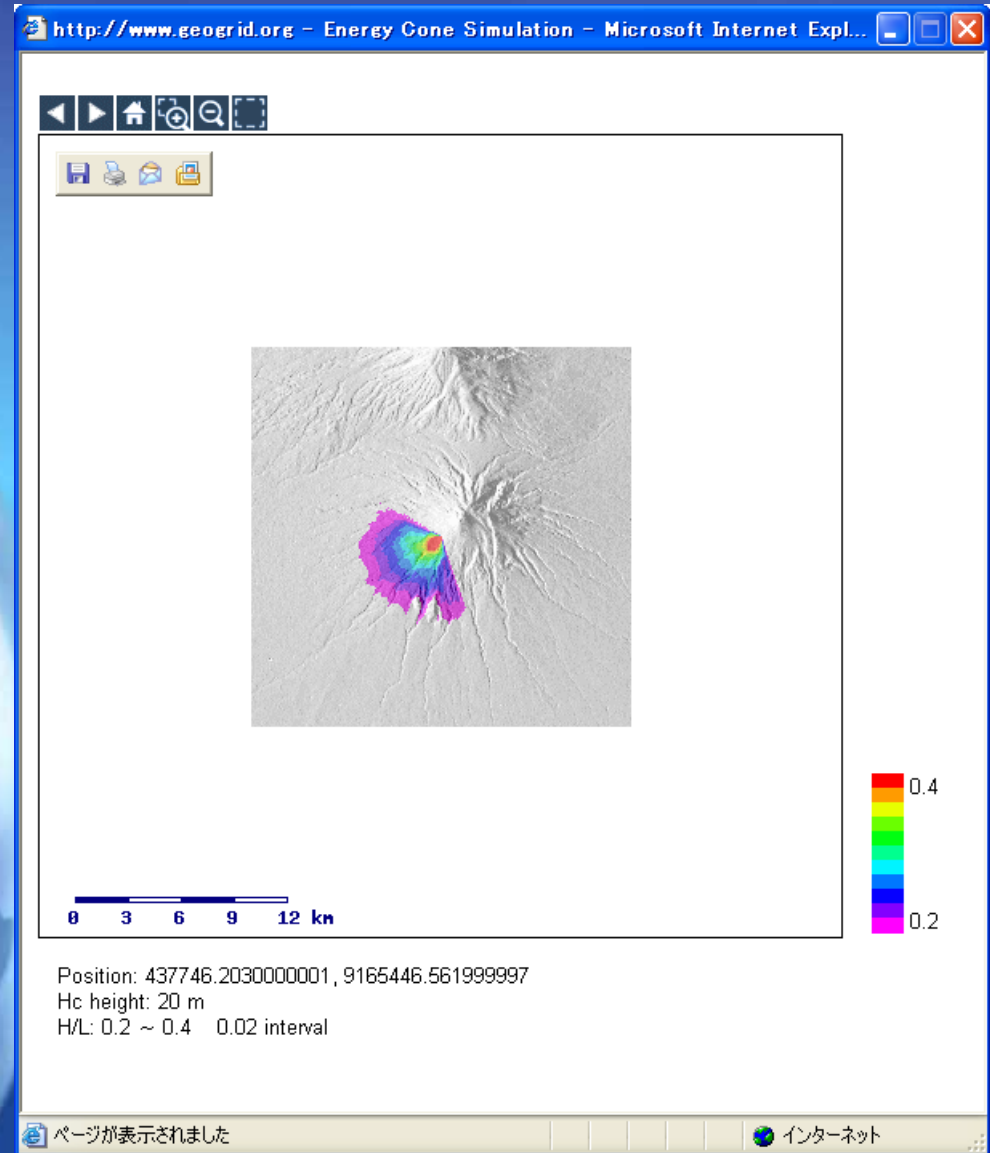


Results of Energy Cone Simulations (Hc=80m, 200m)

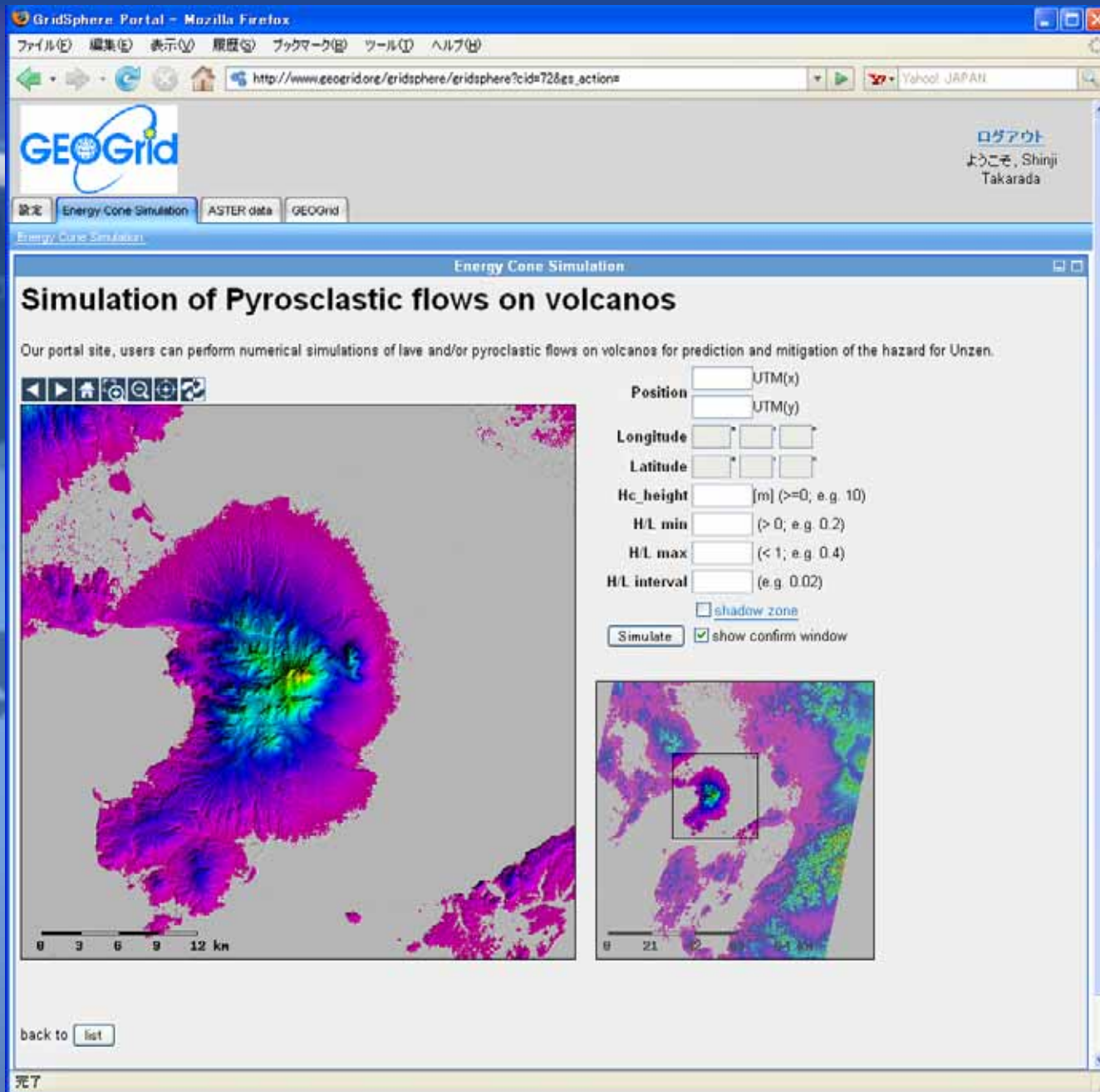
Frank Eruption (northern slope)



Frank Eruption (SW slope)



Results of Energy Cone Simulations



Result of Energy Cone Simulation (Unzen Volcano)

GridSphere Portal - Mozilla Firefox

http://www.geogrid.org/eridsphere/eridsphere?id=72&gs_action=

GEOGrid

ログアウト
ようこそ, Shinji Takarada

設定 Energy Cone Simulation ASTER data GEOGrid

Energy Cone Simulation

Simulation of Pyroclastic flows on volcanos

Our portal site, users can perform numerical simulations of lava and/or pyroclastic flows on volcanos for prediction and mitigation of the hazard for Unzen.

Position: 622148 UTM(x)
3625572 UTM(y)

Longitude: 130 18 14
Latitude: 32 45 41

Hc_height: 30 [m] (>=0; e.g. 10)
H/L min: 0.2 (> 0; e.g. 0.2)
H/L max: 0.4 (< 1; e.g. 0.4)
H/L interval: 0.02 (e.g. 0.02)

shadow zone
 show confirm window

back to [list](#)

完了

http://www.geogrid.org - Energy Cone Simulation - Mozilla Firefox

Position: 622148.2033898305, 3625572
Hc height: 30 m
H/L: 0.2 ~ 0.4 0.02 interval
shadow zone: off

完了

Result of Energy Cone Simulation (Unzen Volcano)

GridSphere Portal - Mozilla Firefox

ファイル(F) 編集(E) 表示(V) 履歴(H) フォークマーク(B) ツール(T) ヘルプ(H)

http://www.geogrid.org/eridsphere/eridsphere?cid=728&_action= Yahoo! JAPAN

GEOGrid

ログアウト
ようこそ, Shinji
Takerada

設定 Energy Cone Simulation ASTER data GEOGrid

Energy Cone Simulation

Simulation of Pyroclastic flows on volcanos

Our portal site, users can perform numerical simulations of lave and/or pyroclastic flows on volcanos for prediction and mitigation of the hazard for Fuji.

Position UTM(x)
 UTM(y)

Longitude

Latitude

Hc_height [m] (>=0, e.g. 10)

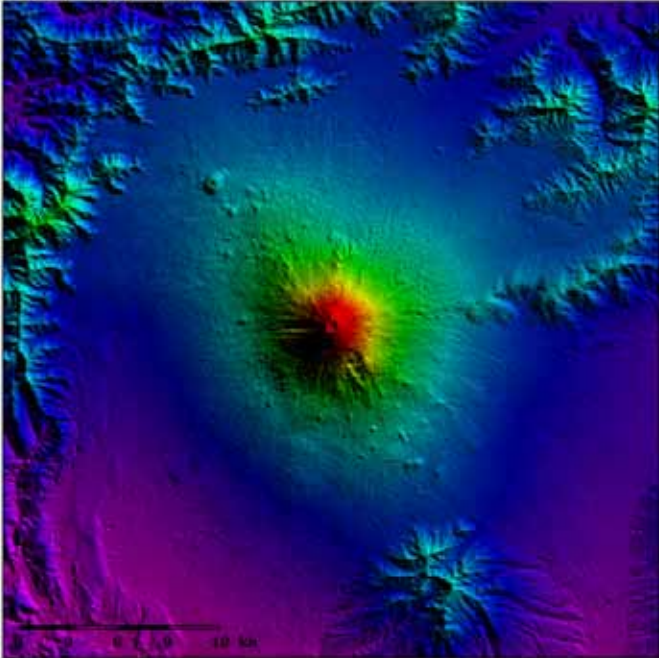
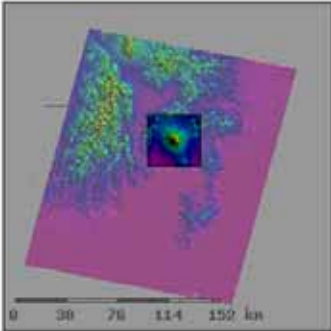
H/L min (> 0, e.g. 0.2)

H/L max (< 1, e.g. 0.4)

H/L interval (e.g. 0.02)

shadow zone

show confirm window

back to

死7

Result of Energy Cone Simulation (Fuji Volcano)

GridSphere Portal - Mozilla Firefox

http://www.geogrid.org/eridsphere/eridsphere?cid=72&es_action=

GEOGrid

設定 Energy Cone Simulation ASTER data GEOGrid

Energy Cone Simulation

Simulation of Pyroclastic flows on volcanos

Our portal site, users can perform numerical simulations of lava and/or pyroclastic flows on volcanos for prediction and mitigation of the hazard for Fuji.

Position: 293761 UTM(x)
3915098 UTM(y)

Longitude: 138 43 49

Latitude: 35 21 20

Hc_height: 100 [m] (>=0, e.g. 10)

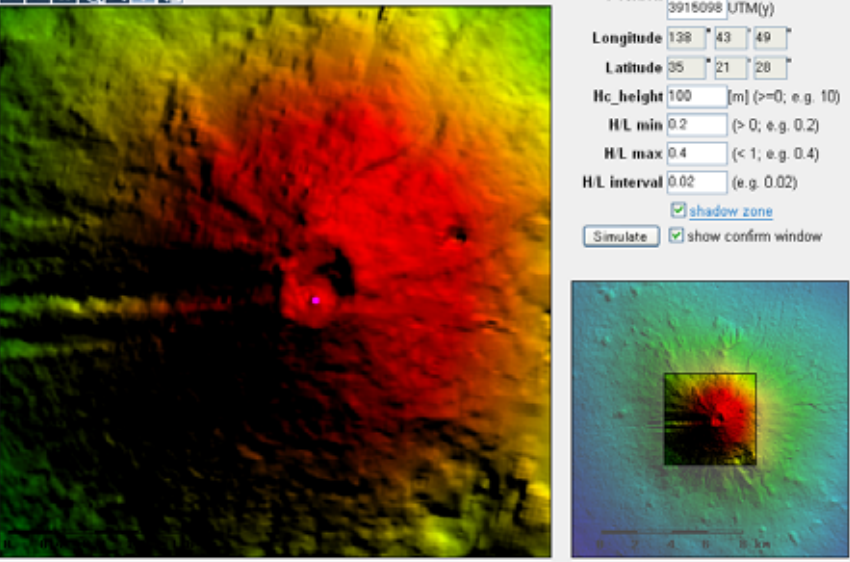
H/L min: 0.2 (> 0, e.g. 0.2)

H/L max: 0.4 (< 1, e.g. 0.4)

H/L interval: 0.02 (e.g. 0.02)

shadow zone

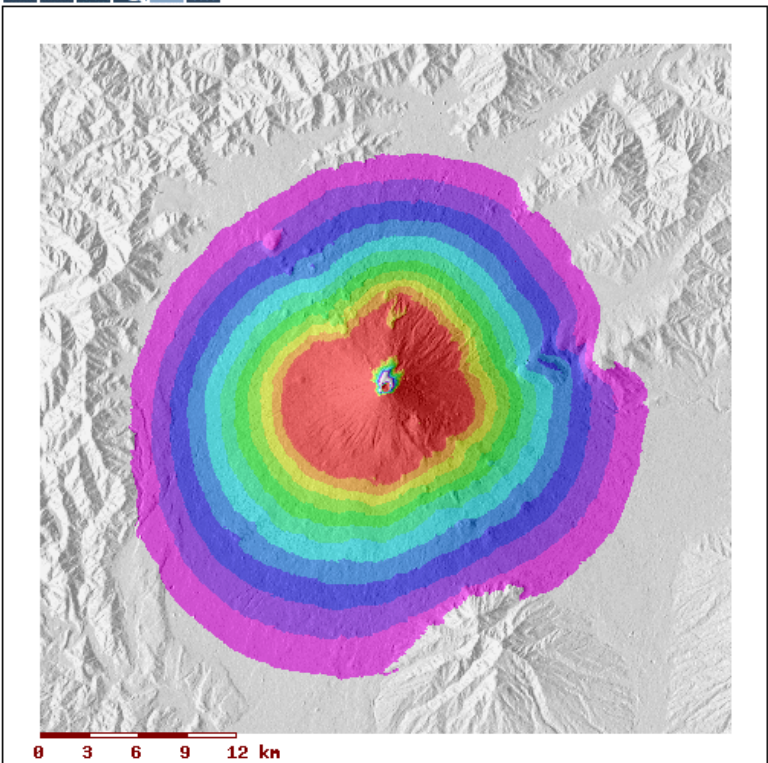
show confirm window



back to [list](#)

完了

http://www.geogrid.org - Energy Cone Simulation - Mozilla Firefox



Position: 293761.45106408925, 3915098

Hc height: 100 m

H/L: 0.2 ~ 0.4 0.02 interval

shadow zone: on

完了

Result of Energy Cone Simulation (Fuji Volcano)

Summary

1 . 1991-95 Unzen Pyroclastic Flow

High temp. and High Speed , Volume= 10^4 - 10^6 m³ , H/L=0.2-0.4

2 . Next Generation Volcanic Hazard Map

Overlapping any kinds of data sets

Real Time Hazard Map (Available on a laptop and on a website)

High resolution DEM data (ASTER 15m , Applicable for all volcanoes in the world)

3 . Volcanic Gravity Flow Simulation using ASTER DEM

Pyroclastic flow simulations using energy cone model

Possible to access all scientists in the world on a website

Possible to update DEM after changing topography due to eruptions

High-speed processing using Grid computing technology (0.1-3min)

Applicable to other natural disasters (landslides, debris avalanches)