Terrain Interpretation Using CS 3D Map

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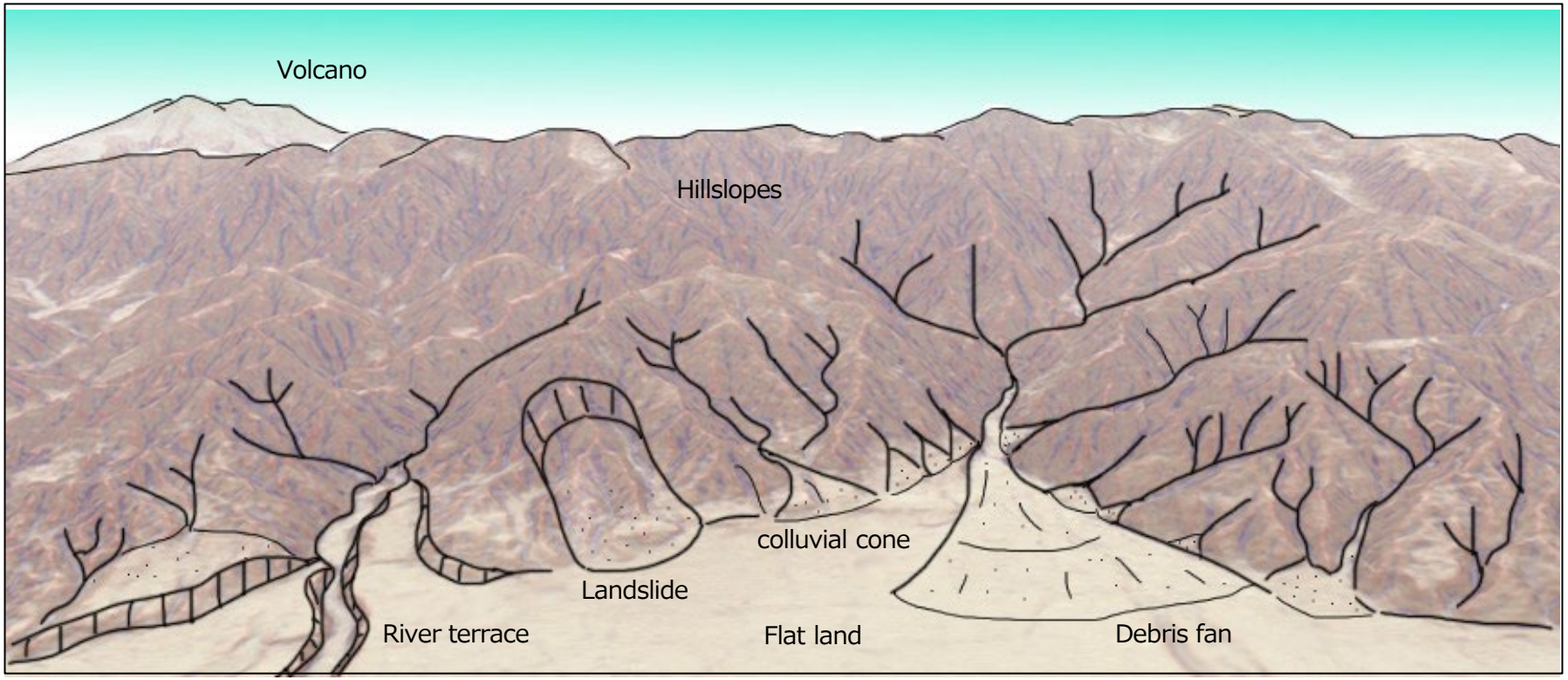
Need for Interpretation

In Japan, the terrain is very steep. There is a variety of topography in the forest area. We need to be careful of collapses and landslides when clearing forests or constructing forest roads.



Various Topography

Topographic information can be read from topographic map

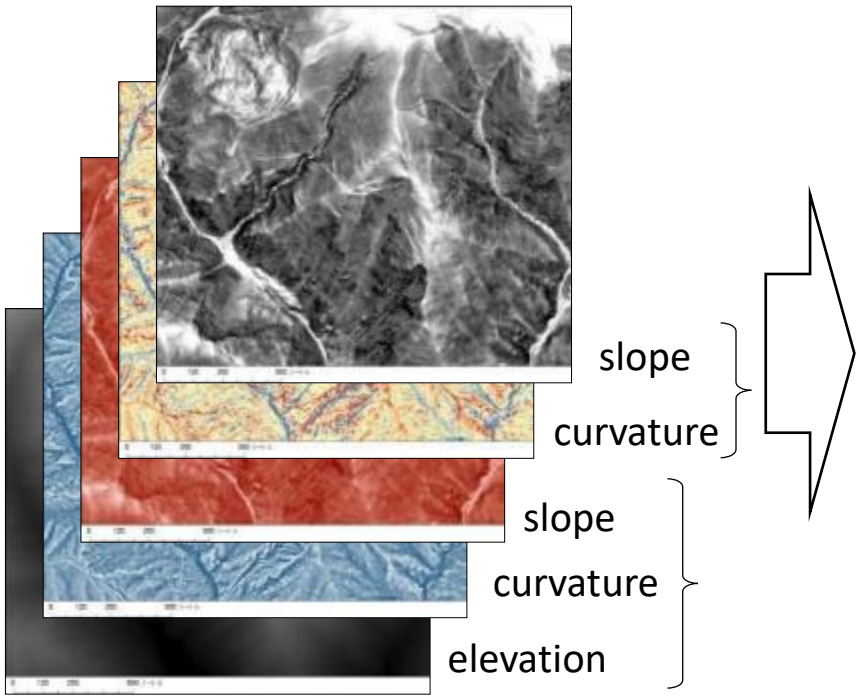
Terrain information	Outline	Example
Terrain quantification	Information (form elements) can be quantified by measurement, such as length, area, and their ratio, and if measured using the same method, the result will be the same no matter who measures it.	Elevation, slope, curvature, area, volume, direction, relief, etc.
Terrain type	A part of the landform that has morphological characteristics formed by specific factors. Different terrain interpreters may make different judgments about the same terrain.	Debris fans, talus, landslide head scarp, landslide side cliffs, etc.

CS 3D map is developed with the aim of lowering the hurdle of terrain type decipherment as much as possible.

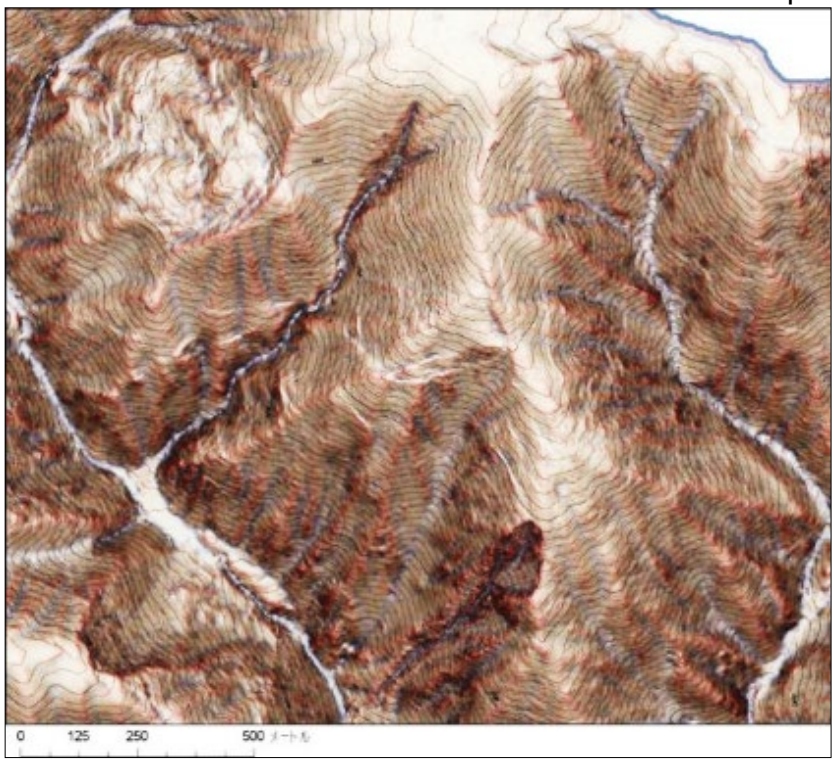
About CS 3D Map

CS 3D map is created by coloring as elevation, slope, and curvature, in different tones and overlapping them .

(Nagano Prefecture Forestry Research Center , 2012)

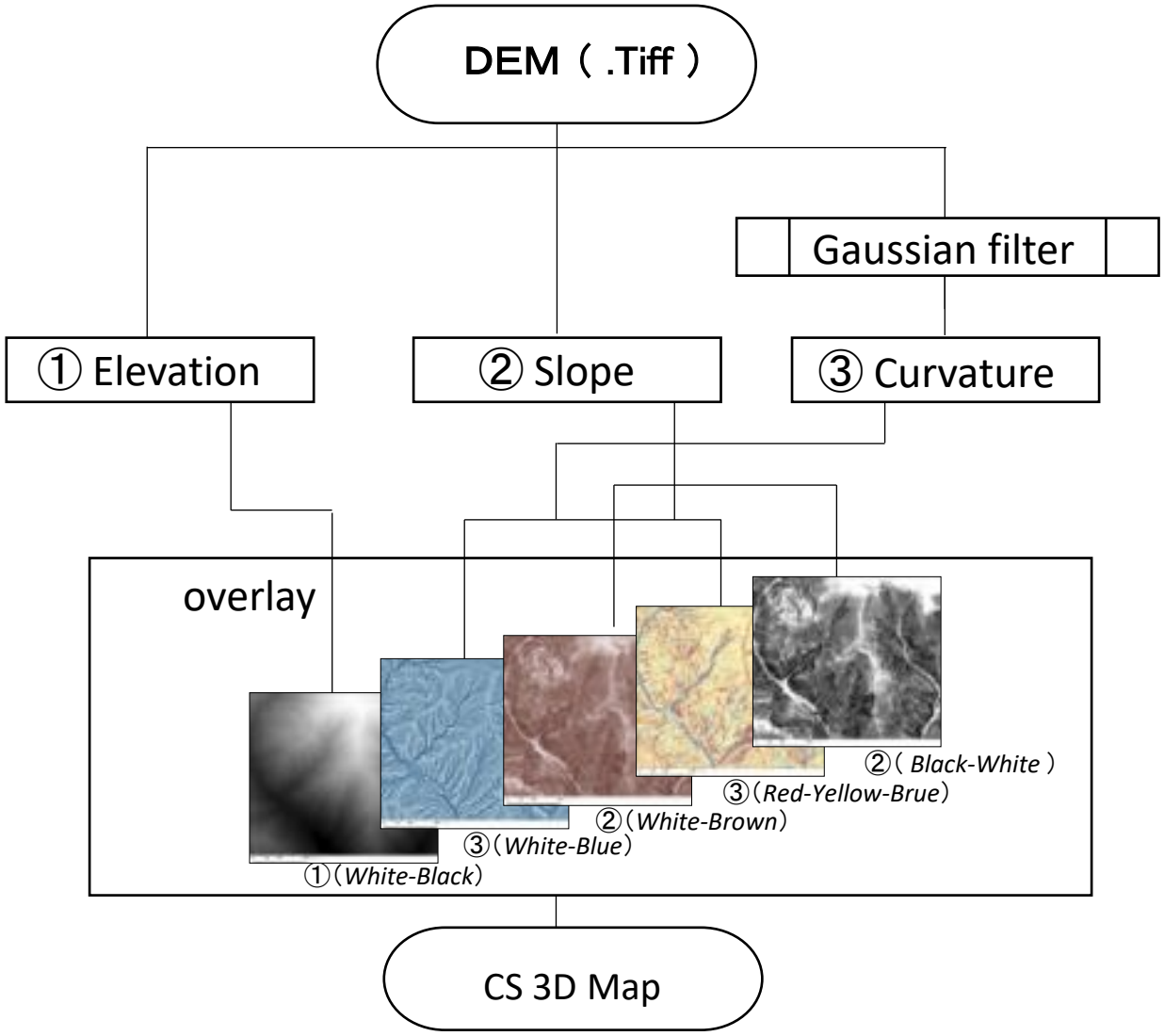


CS 3D Map



"CS" is named after the initials of Curvature and Slope.

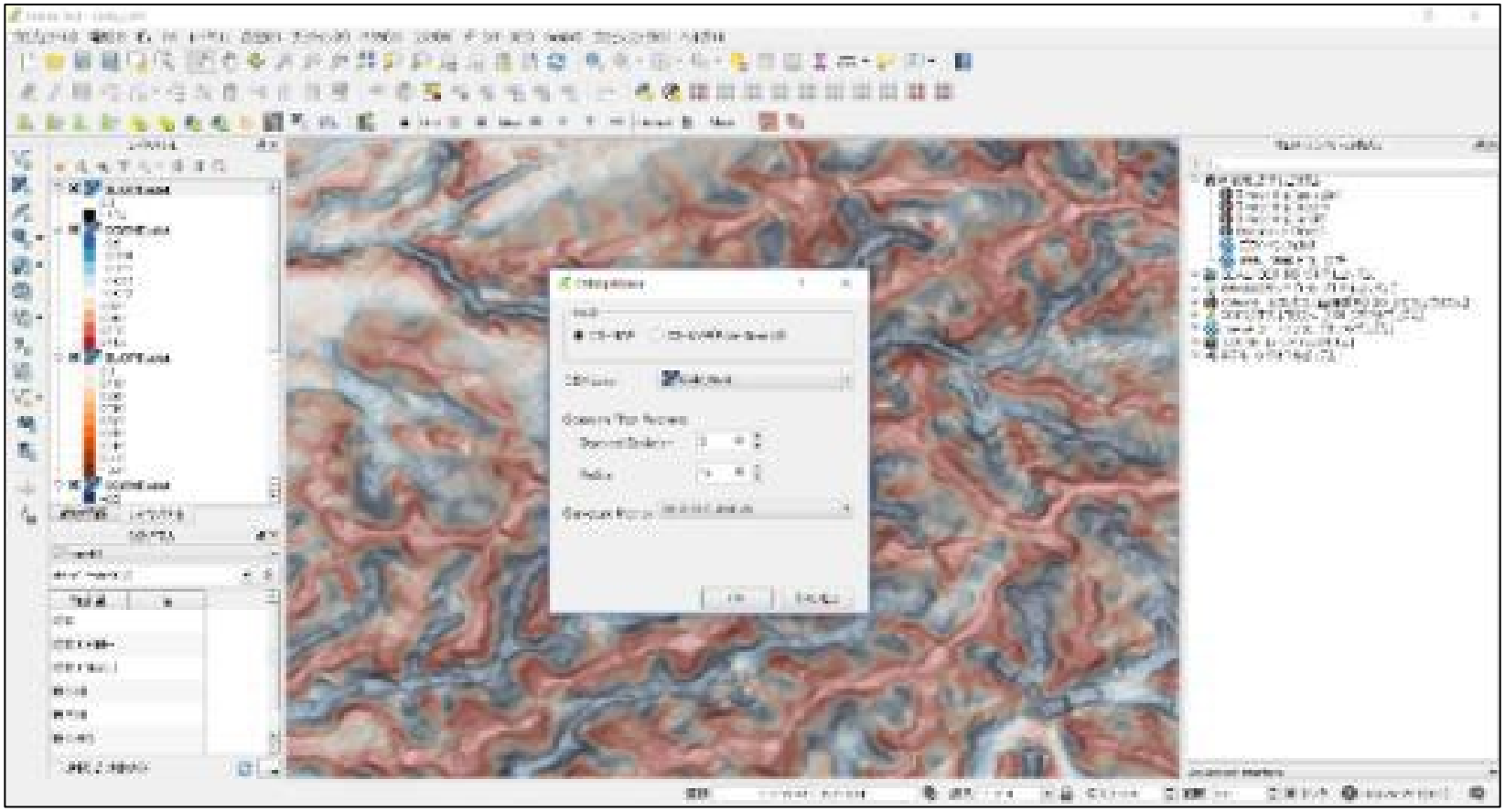
How to create a CS 3D Map



Plug-ins for QGIS

If you want to make CS 3D maps, you can use the QGIS's plugin.

Free and Open source!



CSMapMaker for QGIS

Data publication

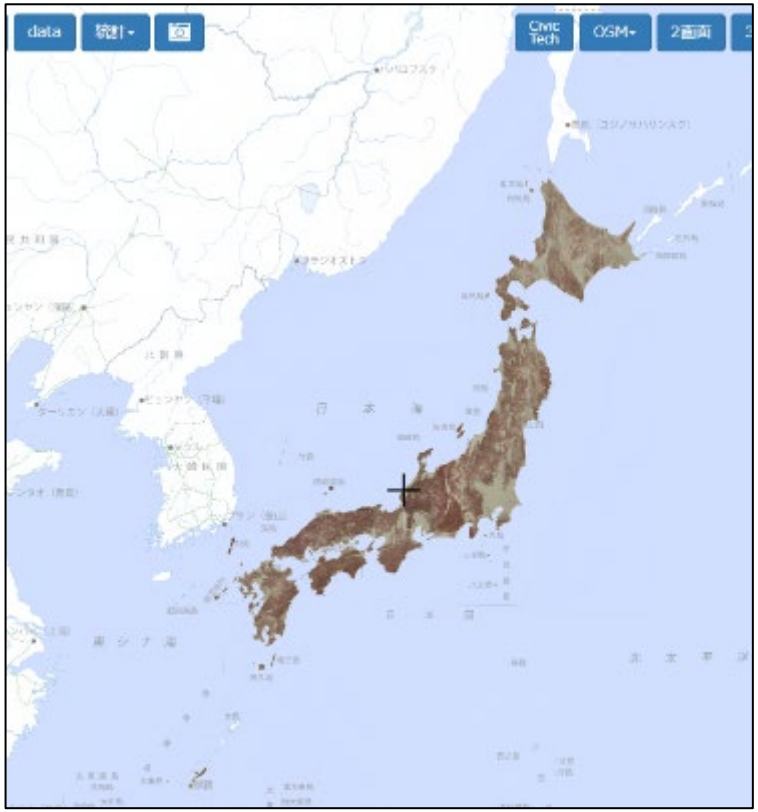
The created CS 3D map can be downloaded from the G-Spatial Information Center in Japan.

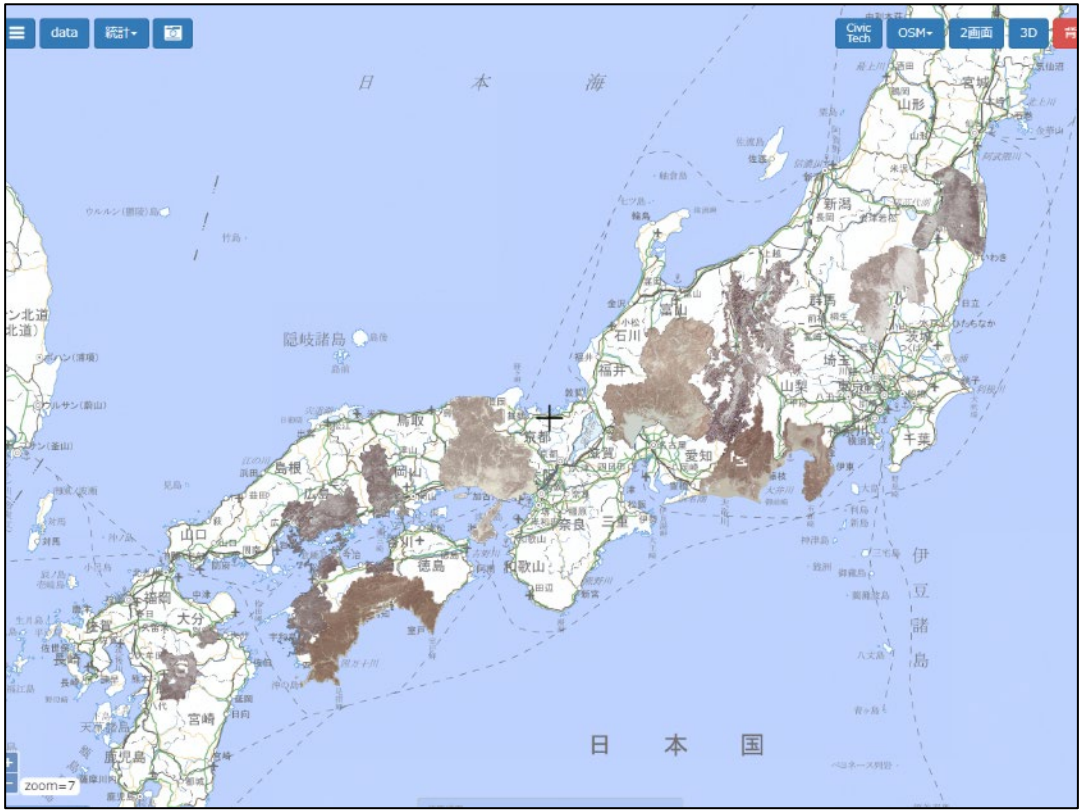
XYZ tile format can be easily displayed in QGIS or other WebGIS

Ex.) https://rinyatochigi.geospatial.jp/2023/rinya/tile/csmap/{z}/{x}/{y}.png

Published CS 3D maps

(2023.10.10)





10m mesh version

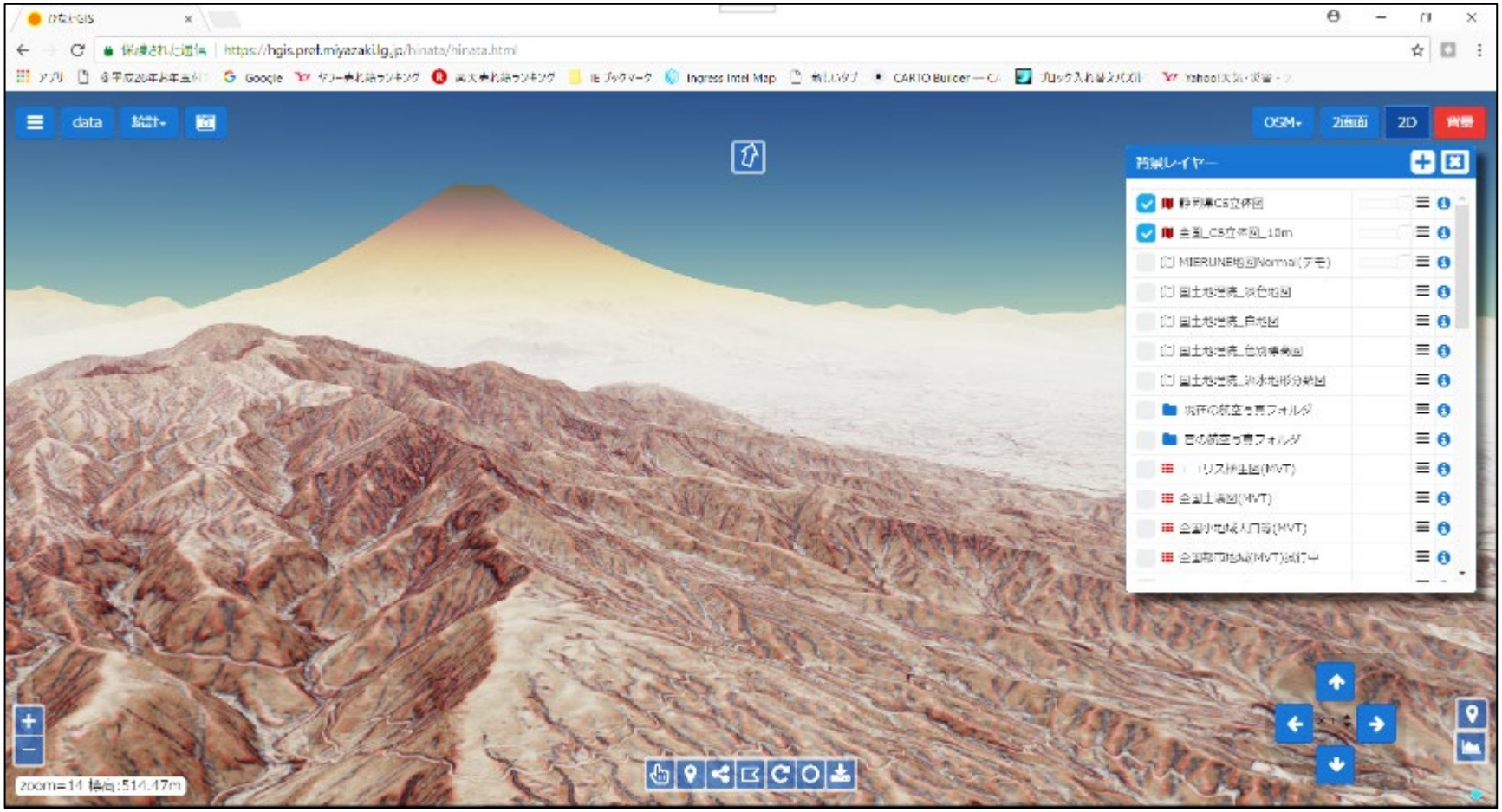
all over Japan

High-resolution (1m mesh) version

Nagano , Gifu , Shizuoka , Hyogo , Fukushima , Okayama , Hiroshima , Kochi , Ehime , Oita , Fukuoka , Tochigi　(12 prefectures)

“Hinata GIS” (Miyazaki Prefecture‘s website)

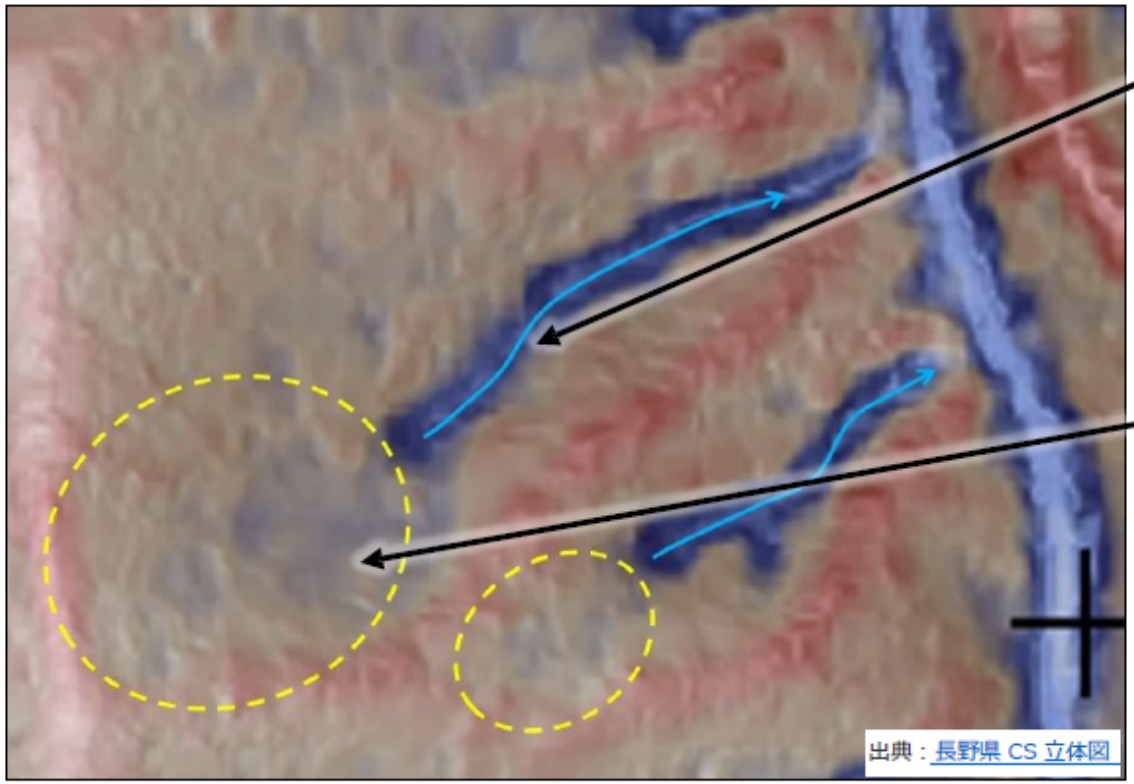
https://hgis.pref.miyalg.jp/hinata/



Hinata GIS

How to interpret hazardous terrain using CS 3D maps

Valley head - Erosion front -



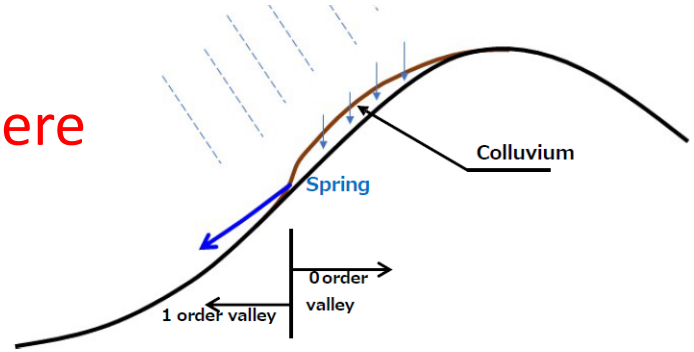
Primary valley (obvious valley)

A deep valley eroded by flowing water. There is always water, or even if there is no water normally, water flows during heavy rains, so cross drainage facilities such as culverts are required when establishing a road network.

Zero-order valley (shallow valley terrain with no regular water)

What was originally a valley terrain has been filled in by colluvial soil from the surrounding area. Erosion progresses upstream. If a road network is to be established in this location, measures such as installing road surface drainage or creating a wave-shaped vertical alignment are required to avoid changing the water collection area.

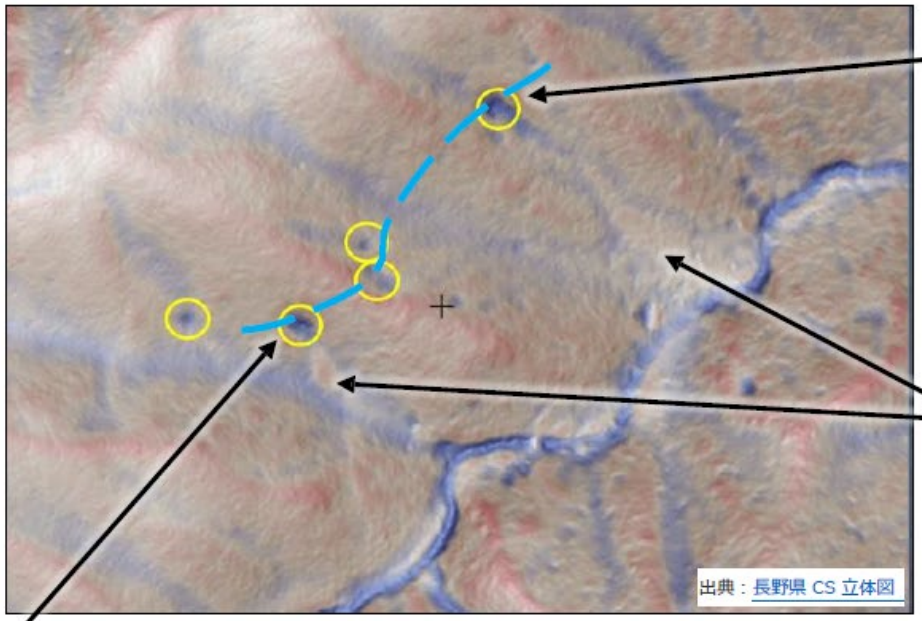
If you want to constructing a forest road here pay attention to drainage !



Valley head（Erosion front）

Schematic diagram of erosion front

Springs due to geological structure



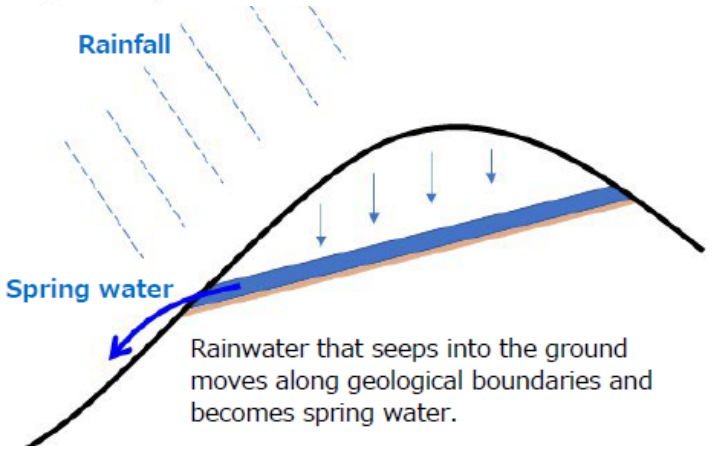
Springs arranged in rows along the terrain

Springs due to geological structure tend to line up along geological boundaries with different permeability. Spring water always comes from the same place and does not develop upstream.

Colluvium

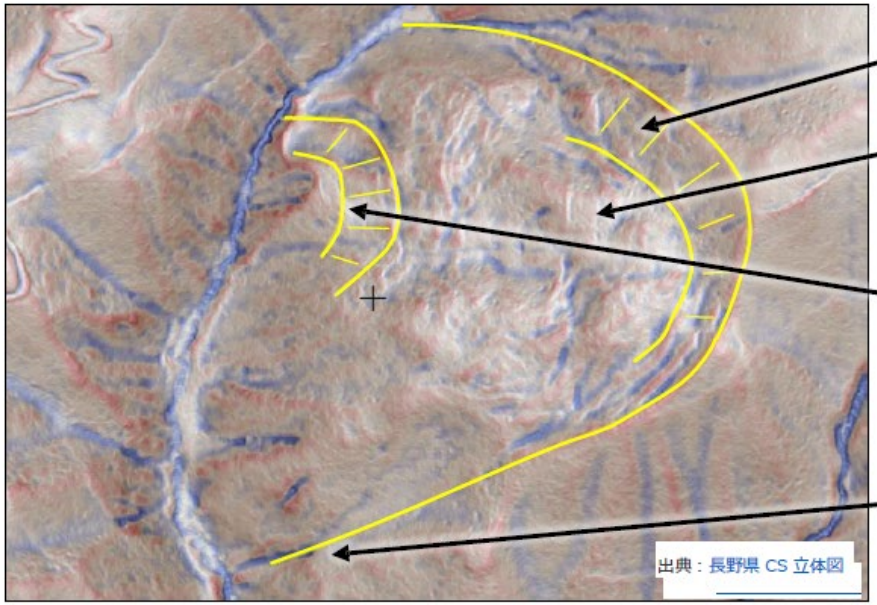
In the downstream area, the earth and sand flowing from the spring are deposited.

（写真提供：長野県林業総合センター）



If landfills are located in such places, there is a risk of landslides and debris flows.

Landslide



Main scarp

Moving mass

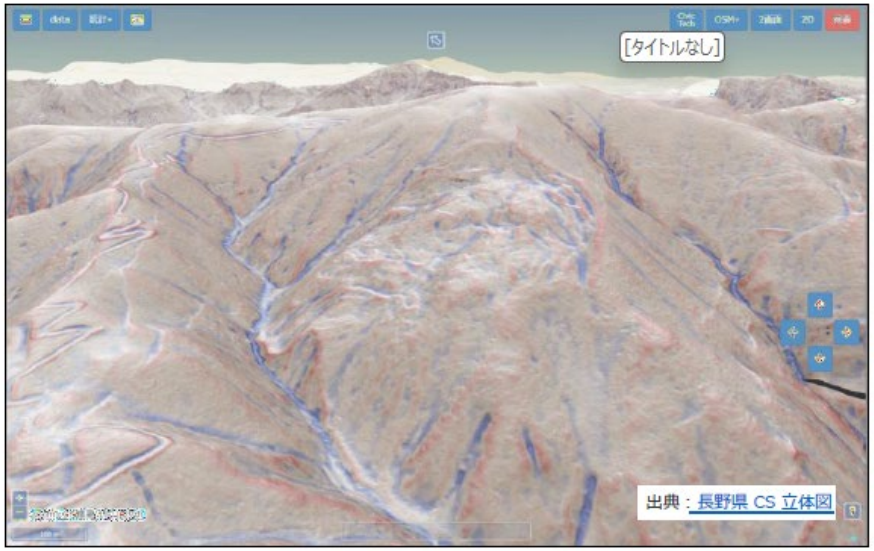
Many cracks and small ridges can be seen inside the moving body.

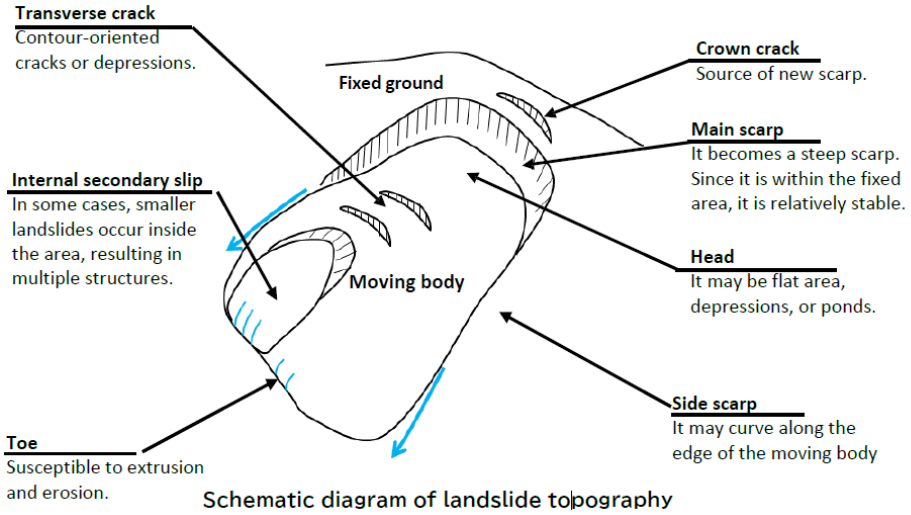
Internal secondary slip

Smaller landslides are more susceptible to artificial changes such as road network construction.

Side scarp

Erosion is actively progressing, so care must be taken when constructing the road network.

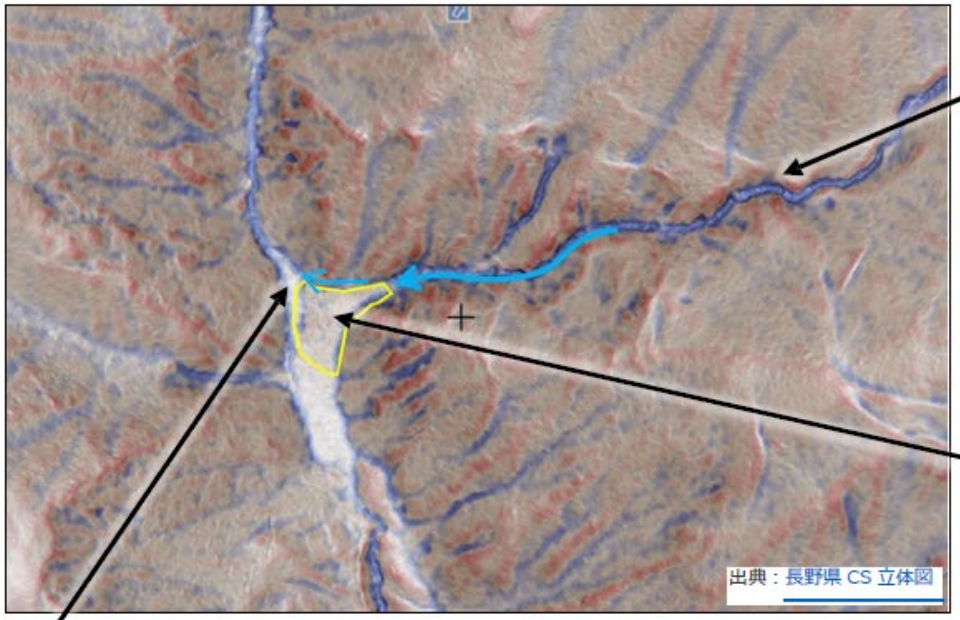




Schematic diagram of landslide topography

Landslides can be more easily deciphered.

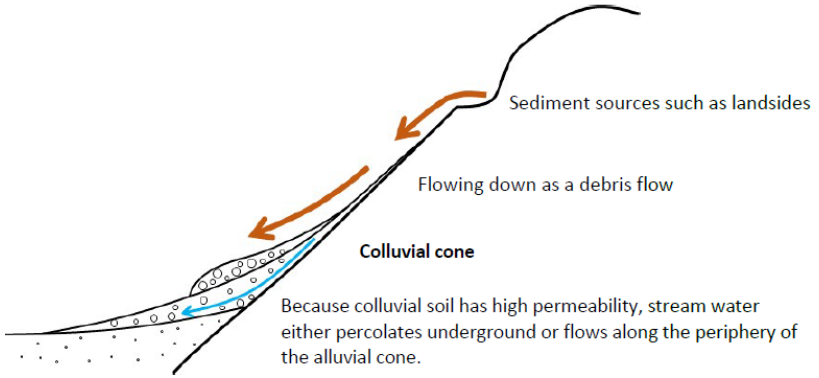
Colluvial cone



Sediment source

Even small mountain streams have alluvial cones at the outlet, indicating that there is a lot of sediment production upstream.

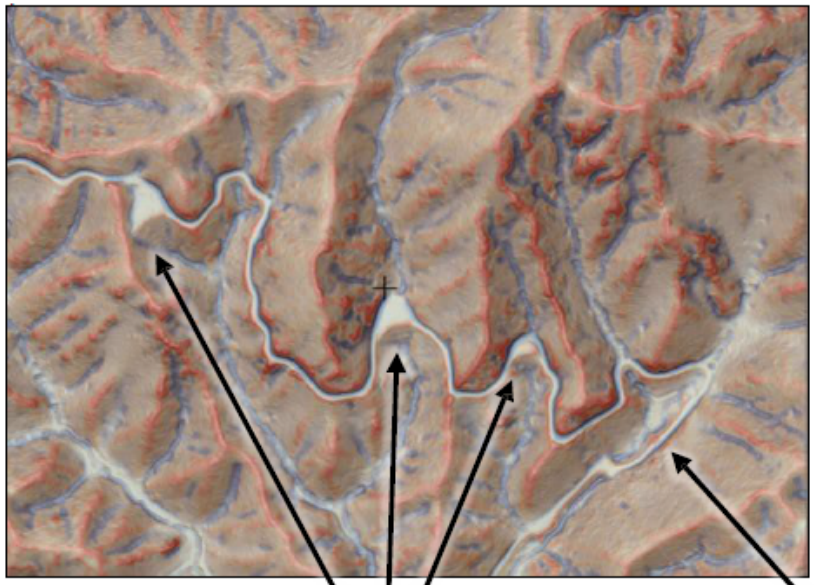
Colluvial cone



Schematic diagram of a colluvial cone

It is frequently damaged from debris flows.

Artificial modification

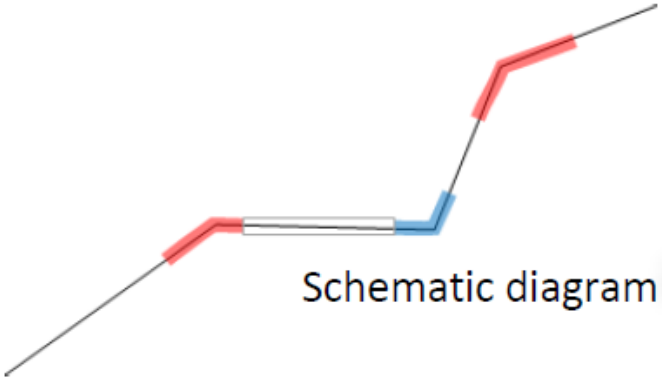


出典：岐阜県 CS 立体図

Landfills

Road network alignment

We can easily decipher the exact location of forest road networks, landfills, check dams, etc. These are not written on conventional maps ,because they are under the trees.



In CS 3D maps, convex terrain is expressed in red, concave terrain in blue, and flat terrain in white, so artificially created flat terrain is expressed in a color pattern like the one on the left.

[タイトルなし]

Schematic diagram of artificially modified landforms

Conclusion

① Before going to the site, you looked at the CS 3D map and wondered why it was shaped the way it was. What kind of geological structure? What disaster risks are there? Are there any other terrains that interest you? Please think about it.

② Please collect as many map materials other than CS 3D map as possible and compare them. Examples include aerial photographs (from the oldest to the latest), geological maps, landslide distribution maps, and hazard maps published by the government. These are published as open data.

③ It's time to go to the site and find out the answer. During the field survey, please check the CS 3D map of the current location on a mobile device such as a smartphone. If the actual situation is different from what you thought beforehand, that means you have learned something.

Let's try it !