

Flood Extent Detection in Paddy Area and Future Plan of Disaster Information Sharing Platform in Rural Areas

YAMADA Yasuharu^a

^aNational Agriculture and Food Research Organization, 2-1-6, Kannondai, Tsukuba, Ibaraki, 305-8609 Japan - yamaday@affrc.go.jp

ABSTRACT-The ALOS/PALSAR data are the L -band SAR, which can easily detect a flood extent. But as in paddy areas, there are usually inundated water surfaces, it is rather difficult to distinguish a flood inundated area from an ordinary ponding water surface. Usually two or more data, which observed in different times, are used for such a distinction. The author tried to use the mathematical morphology and the Hough transform method using only once observed satellite data. The author also tried to make a disaster information sharing platform, 'GeoWeb', using open source software and the ISO or OGC standards. The cost of making and maintaining the GeoWeb may become lower than the conventional method. This is very important to the agricultural organizations, such as irrigation districts and developing countries. The author plans to do some GeoWeb experiments for the practical use in a rural area in Japan.

KEYWORDS flood, PALSAR, morphology, Hough transform, GeoWeb, irrigation district

1. INTRODUCTION

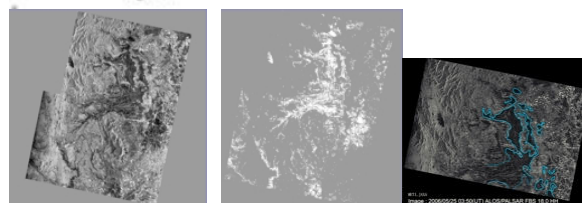
Flood inundated area detection using SAR data requests usually two or more data, which observed in different times, before and during flood. But for the purpose of disaster management, decision makers and local residents should want to know the quick understand of flood condition. The author developed another method using only one shot data at the disaster. As compared with the author proposed method, the conventional method of SAR analysis takes more time for preparing the data before flood disaster. But as usually the paddy rice growing areas have ordinary ponding water surface, it is rather difficult to distinguish flood inundated areas from such ordinary ponding water in paddy fields.

The second concern, after getting disaster conditions from satellite data, is how to hand it to the local people. The ISO(International Organization for Standardization) set up several new standards for geographic information., such as ISO19136(Geography Markup Language), ISO19128(Web map server interface), ISO19142(Geographic information-Web Feature Service). Using these new standards, we can make 'GeoWeb', a kind of World wide web of which data are related to the geographic coordinates. If the local people or local organizations which might have their own data make the GeoWeb and open to the public through the Internet respectively, the end-user of the information can browse such kind original data combined with global maps or the other data on the Internet as WMS layers at the client's PC. It will become a disaster information sharing platforms. The author tried to make the Geoweb using Open source and free ware software and set up the actual vector data of irrigation canals as a Web Map Service layer, the point data of precipitation graph as the data of background database, 'POSTGIS'. And he also wrote a

manual book and CD-ROM how to make GeoWeb for the irrigation engineers.

2. FLOOD EXTENT DETECTION

Figure 1 shows the flood area of northern part of Thailand in May,2006, ALOS/PALSAR data, morphological operated image and the JAXA announced flood region. The procedure of morphological operation is the followings.



@METI/JAXA

Figure1. Thailand flood map(upper figure), ALOS/PALSAR data of May 25th,2006(lower left figure), morphological operated image(lower center figure) and JAXA announced flood region(lower right figure)

(1) Water surface is determined by the threshold method under DN=2200. (2) Applied in twice dilation operation of 3 by 3 size filter (3) Affected open operation of 12 by 12 size filter.

The white color of the image means flood likely areas and we can find that it is similar to the JAXA announced image. Thailand case is good, but as for Japanese PALSAR data, this kind morphological filtering method doesn't result in success.



@METI/JAXA

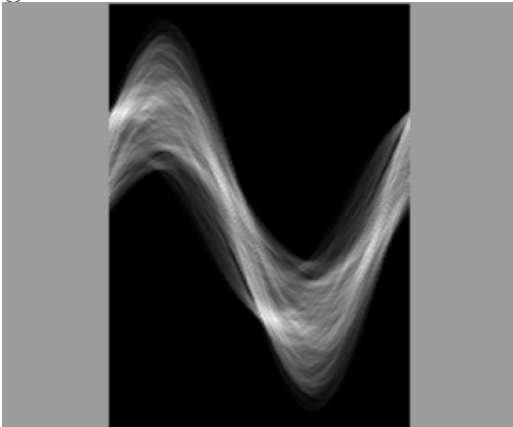


Figure2. PALSAR FBD level 1.5 image on June 21, 2007 and Hough transformed image

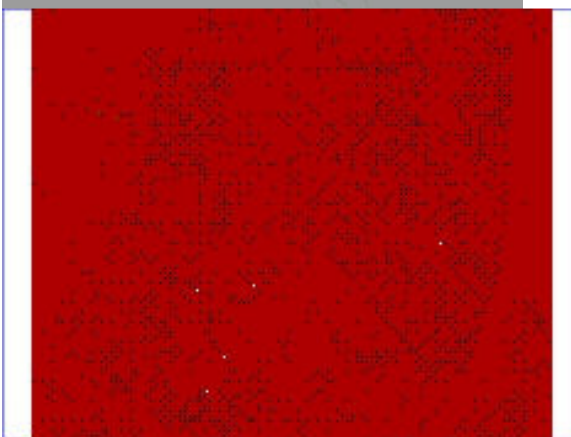
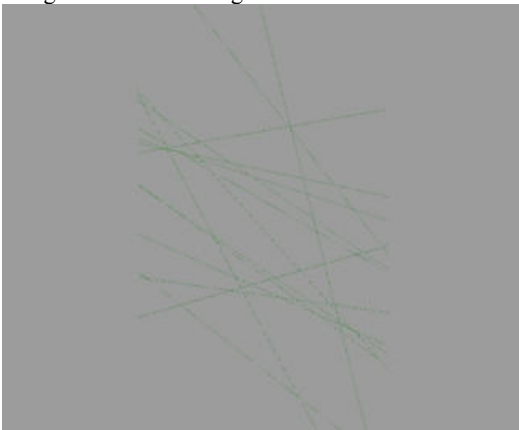


Figure 3. The inverse Hough transformed image and super imposed to the thin lined image derived from original image

Figure 2 indicates PALSAR image on June 21, 2007 in reclamation area of Hachirogata Lagoon, Japan and Hough transformed image. Figure 3 shows the inverse Hough transformed image. But the Hough transformation method is not good for the paddy levee detection. Because the Hough transformed image has too many crossing points in it.

3. GEOWEB IMPLEMENTATION

The author designed GeoWeb (geographic web) using a group of open source software for the purpose of handing over the analysed satellite data to the end-users. The designed GeoWeb system consists of Linux (CentOS5.4), Apache (web server), MapServer (web GIS), OpenLayers (JAVAscript environment), PostgreSQL (background database), postGIS (add-on DB GIS function), GDAL/OGR (projection transformation). Figure 4 shows the GeoWeb concept and its application to an irrigation district. An irrigation district needs integrating thunderstorm data upper the irrigation canals and the drainage gate condition for preventing flood. Because such open channel irrigation canals might catch surface flow of torrential rains by thunderstorm. If the meteorological station uses the GeoWeb opening to the public for the precipitation data, the staff of the irrigation district can overlay it to the route data of irrigation canals at the client's browser. If each organization uses GeoWeb in order to put their information on view, the communication will be easier than before.

Figure 5 shows the implemented GeoWeb using actual irrigation district map and its canals as a WMS (web map service) layer. The super-user of the system can add some point data represented as the blue color flag in the frame. The client can browse these data on his WMS browser at the appropriate position.

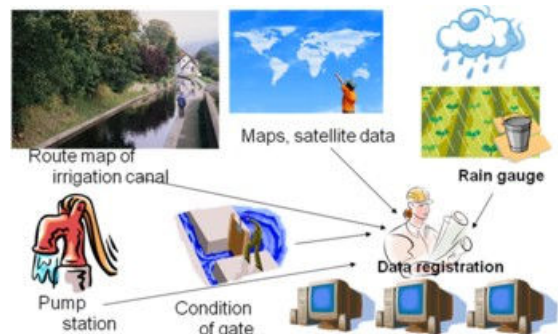
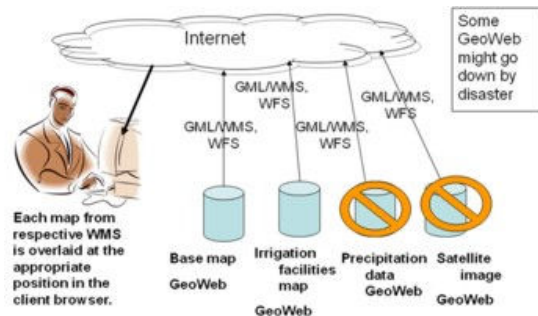


Figure 4. The GeoWeb concept (upper figure) and its applicable idea to an irrigation district (lower figure)

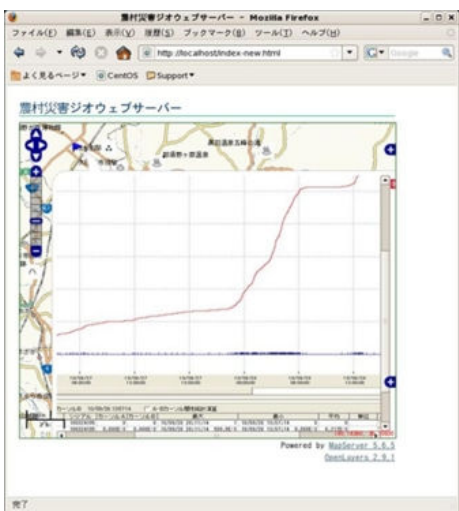
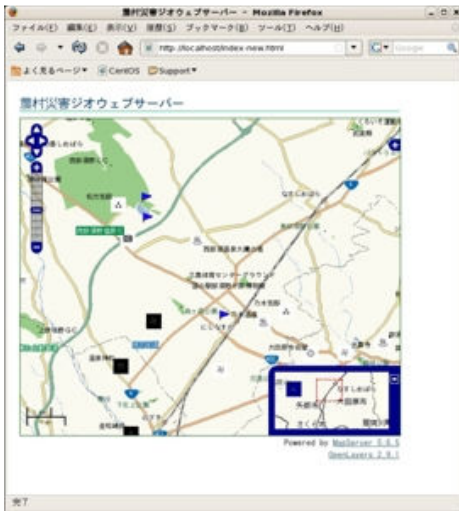


Figure 5. The implemented GeoWeb image on the client's browser, the point data (blue color flag mark) and click and appeared precipitation graph

4. RESULTS AND DISCUSSION

The flood extent detection using once observed SAR data at the flood disaster results in success in Thailand but the Japanese case fell through. But the polarimetry or other

capability of ALOS/PALSAR data aren't tested. This is work left thing to the author.

The GeoWeb implementation goes well. But the procedure of implementation using LINUX OS is rather complicated for the beginners. Therefore the author wrote the installation manual and made a install CD-ROM including various library files. The author experienced that the Internet security and database security from leakage of personal information is key to disseminate the GeoWeb technology. Because the existing LAN facilities in local organizations often have such fragile systems. The Internet security condition improvement should need a huge cost when the GeoWeb connects to the existing LAN system. Addition to that, people who has the original data including disaster related information sometimes doesn't desire opening to the public. And the announcement of hazard map information is sometimes refused by the local residence. This kind of problem belongs to mentality of the concerned people.

5. CONCLUSIONS

Rapid flood extent detection using morphology method and Hough transformation results in success in Thailand and no good in Japan.

The ISO TC211 committee new standards for making GeoWeb has great possibility but its dissemination will bring various obstacles.

REFERENCES

- Brent Hall,G., Leahy,M., 2008 "Open Source Approaches in Spatial Data Handling". Springer, Berlin, pp.65-199
- Jansen,M., Adams,T., 2010. "OpenLayers Webentwicklung mit dynamischen Karten" und Geodaten. Open Source Press, Muenchen, pp197-336
- Kropla,B., 2005. "Beginning MapServer Open Source GIS Development", APRESS and Springer, New York, pp1-368
- Lake,R., Burggraf, D., et al., 2004. "Geography Mark-up Language(GML) Foundation for the Geo-Web". John Willey & Sons Ltd., England, pp.7, 54-64
- Li,J., Zlatanova,S. and Fabbri,A.(Eds.), 2007. "Geomatics Solutions for Disaster Management", Springer, Berlin, pp.49-60, 225-254, 305-320
- Mitchell,T.(Author), Ohtsuka,K.,etc.(Translators), 2006. "Web Mapping Illustrated (translated into Japanese)", O'Reilly Japan, Tokyo, pp.223-225
- Nayak,S. and Zlatanova,S., 2008. "Remote sensing and GIS Technologies for Monitoring and Prediction of Disasters". Springer, Berlin, pp.121-178
- Obe, R., 2010. "PostGIS". Manning Publications, chapter11 pp.1-35
- Peter van Oosterom and Zlatanova,S., 2008. "Creating Spatial Information Infrastructures Towards the Spatial Semantic Web". CRC Press, Boca Raton, pp.1-176

Scharl,A. and Tochtermann,K.(Eds.), 2007. “The Geospatial Web”, Springer, London, pp.174, 185, 254

Yamada,Y. 2010. “Web based disaster information sharing platform, “GeoWeb” using open source software and freeware for rural areas”, Int. Archives of the Photogrammetry, Remote Sensing and Spatial Information Science, Vol.XXXVIII,Part 8, Kyoto, pp.243-247

Yamada,Y.a, 2008. “Morphological Analysis of Flood Inundated Regions In Paddy Areas Using ALOS/PALSAR Data and its Distribution on the Google Earth—Design of the Future Disaster Management System(FDMS)—“. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences. Vol.XXXVII. PartB4.Beijing, pp.1117-1122

Yamada,Y.b, 2007. “Enhancement of the rural and irrigation system infrastructure to disasters with a help of IT”. Proceedings CD-ROM of 32nd ISRSE, Costa Rica, pp.1-3

Yamada, Y., Utashiro, K., Kover, M., 1998. “Painting maps and Making column charts, line graphs of International Agricultural Statistics Database on the client browser using Web based GIS tool (in Japanese)”. Proceedings of Annual meeting of GISA, Tokyo, pp297-298

Yamada,Y., Kover,M., Utashiro,K., 2000. “Data retrieval and mapping system with Global Maps for the international statistics on agriculture using Web based GIS tool”. Proceedings of Global Mapping Forum 2000, Hiroshima, Japan, pp.1-9

Zlatanova,S., Li,J., 2008. “Geospatial Information Technology for Emergency Response”, Taylor & Francis, London, pp. 1-373

ACKNOWLEDGEMENT

The ‘GeoWeb’ experiment research budget is sponsored by the MEXT research promotion program for space technology application. ALOS/PALSAR, AVIR-2 data are provided by JAXA for the joint research program of ALOS satellite.