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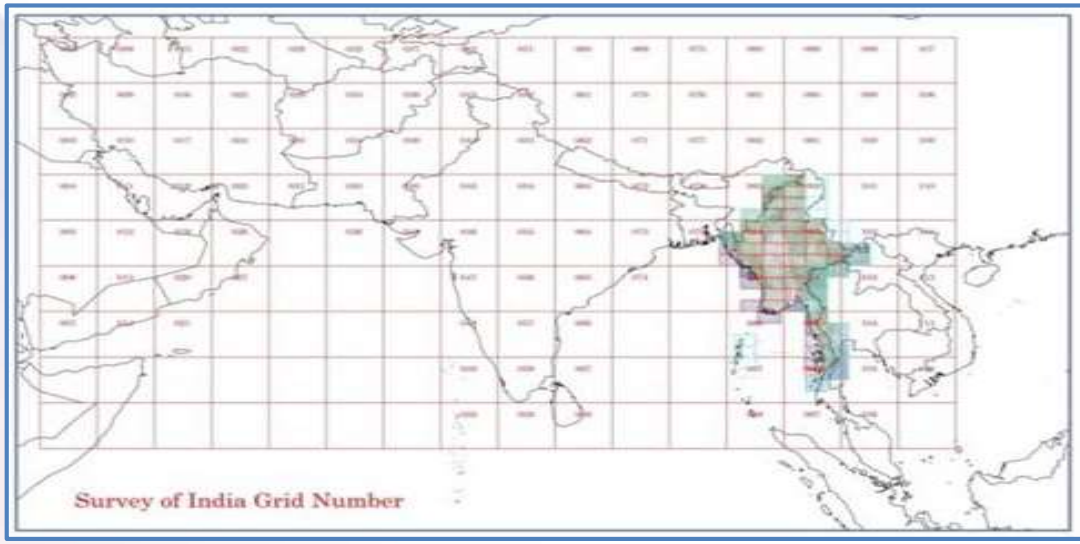
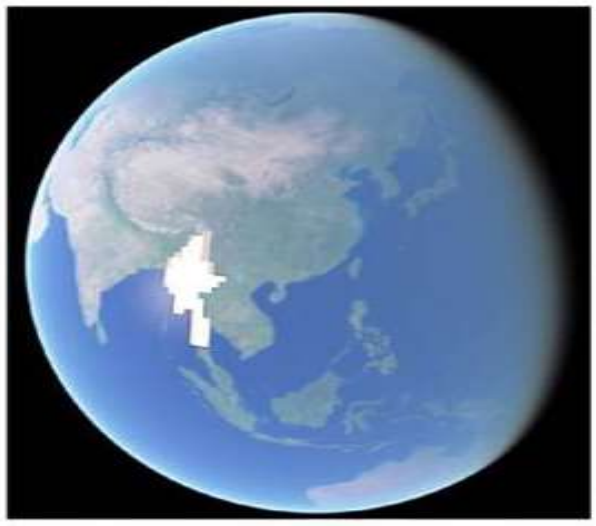
EMBRACING OUR SMART WORLD WHERE THE CONTINENTS CONNECT:

ENHANCING THE GEOSPATIAL MATURITY OF SOCIETIES

Social Tenure Domain Model and 3D modeling by UAV photogrammetry (9633)

Hiroyuki HASEGAWA, Japan GeoNet, Inc.





1) Social Tenure Domain Model on 3D-diorama
2) 3D-Landscape for residential consensus
3) Drone, UAV, Helicopter and Satellite photogrammetry on 3D CAD system

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1. Consensus making approach of social tenure domain model

1.1 Land Administration Domain Model vs. Social Tenure Domain Model

* Christiaan Lemmen of the University of Twente says " **Land Administration Systems (LASs)** provide the infrastructure for implementation of land polices and land management strategies in support of sustainable development.

* This infrastructure includes a legal framework, institutional arrangements, processes, standards, land information, management and dissemination systems, and technologies required to support the allocation, markets, valuation, control of use and development of interests in land.

*Moreover, it can be observed that existing land administration systems have limitations because of the fact that informal and customary tenures cannot be included in these registrations.

- Existing land administration systems require to include **all existing types of social tenures**, on which most of register rights and claims are based , and different from individual free hold.

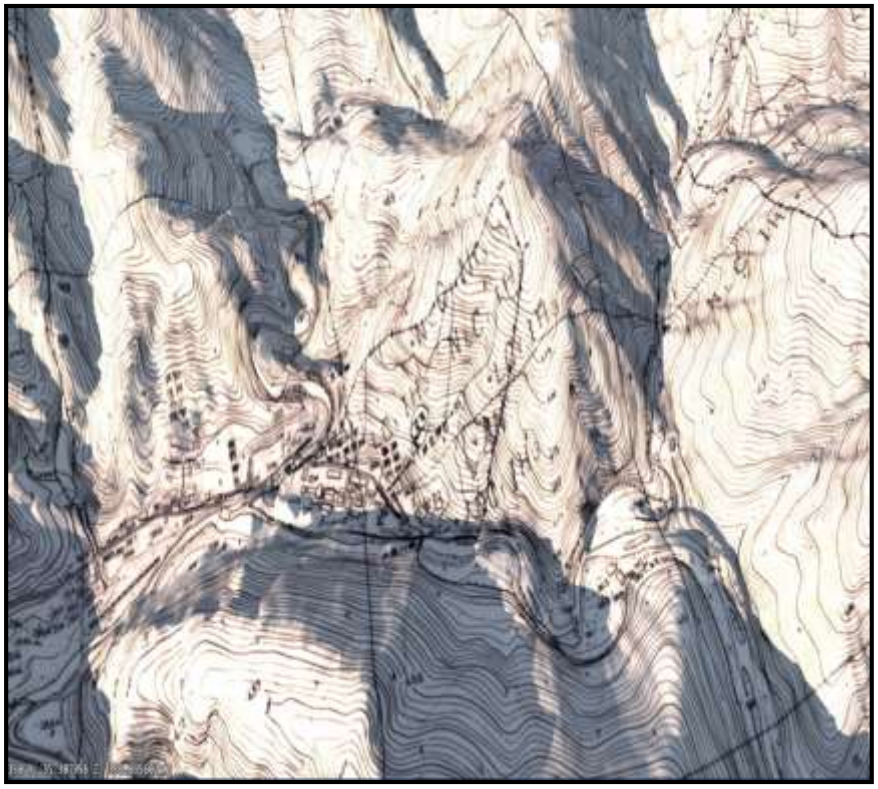
⇒ **Consensus making approaches from technological point of views**

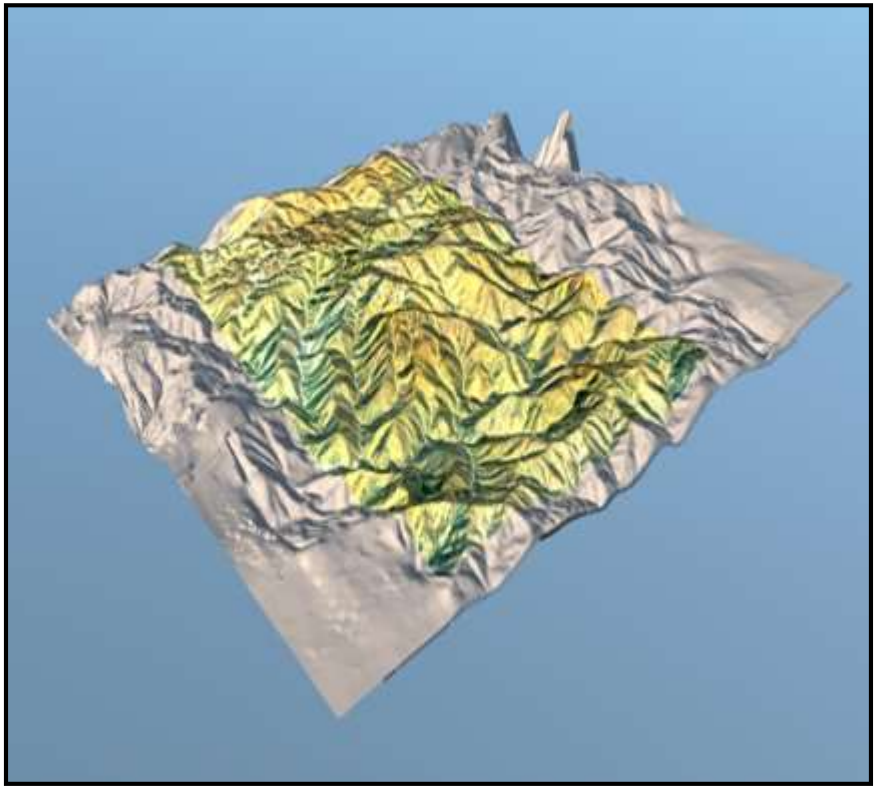
⇒ **Social tenure domain model oriented 3D/ 4D landscape mappings**

⇒ **Google Map/ Earth like approaches on 3D-CAD viewing display**

1.2 Cadastral 3D mapping for consensus making approach

rural area and social tenure area : Boundary Survey on 3D diorama





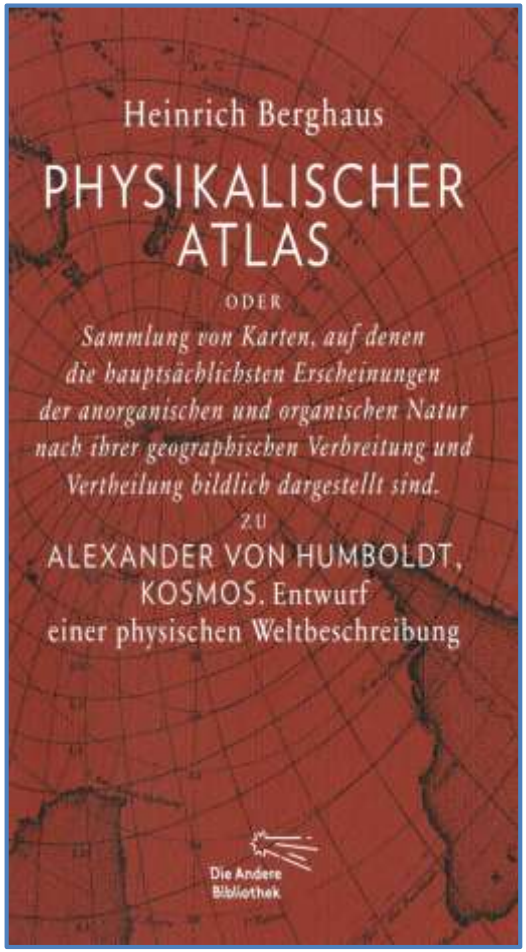
In 3D image modeling, social tenure area is also large size area for mapping, and the products, 3D map, 3D-diorama and 3D models on 3D-CAD system are administrative tools for cadastral survey.

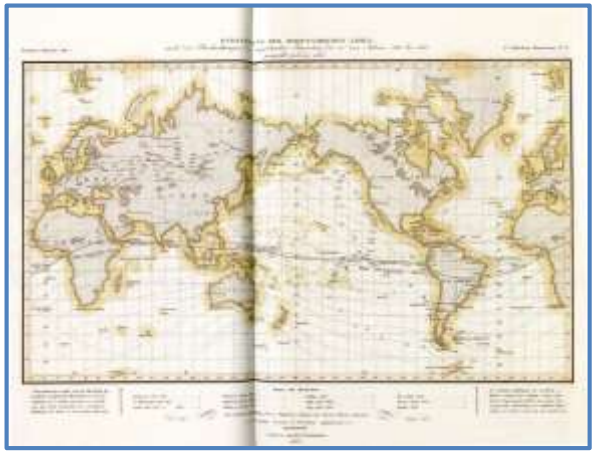
1.3 Historical Reality of land ownership Consensus making approach for Social Tenure

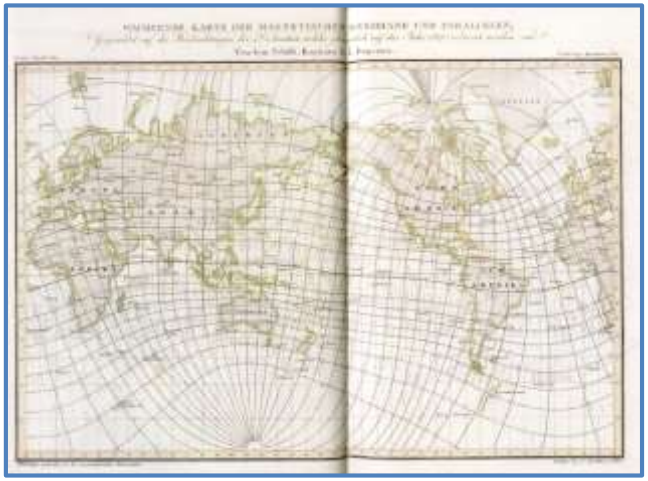
Fig. 3. 3D-displays without and with Glasses

2. 3D image modeling as Historical Reality : 4D-IMA

2.0 Physikalischer Atlas zu KOSMOS: A.v. Humboldt (1850)







“ ATLAS: Heinrich Berghaus : Physikalischer Atlas zu Alexander von Humboldt, KOSMOS, Entwurf einer physischen Weltbeschreibung”

2. 3D image modeling as Historical Reality of the land and landscape

2.1 Historical maps on the CAD-Globe

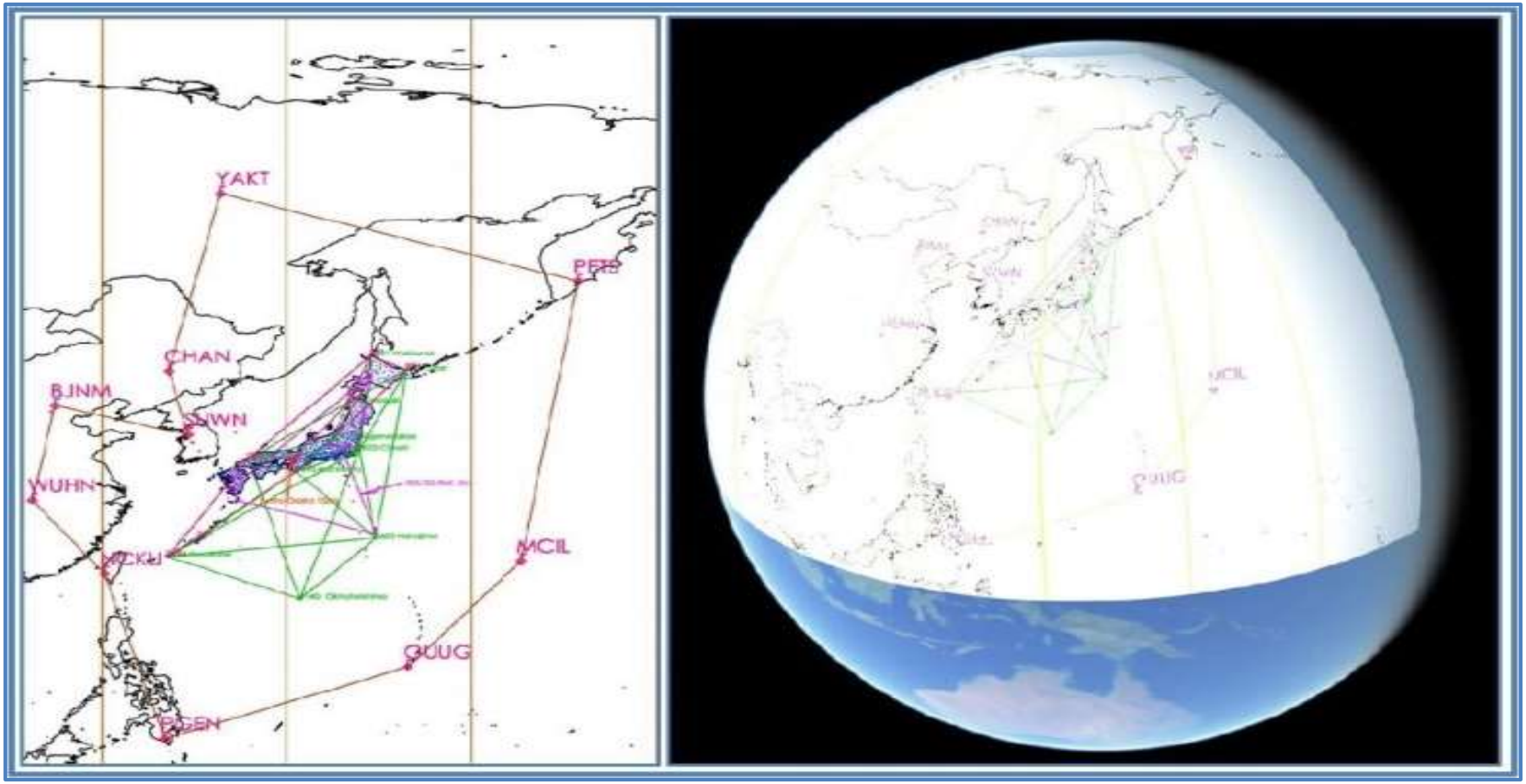
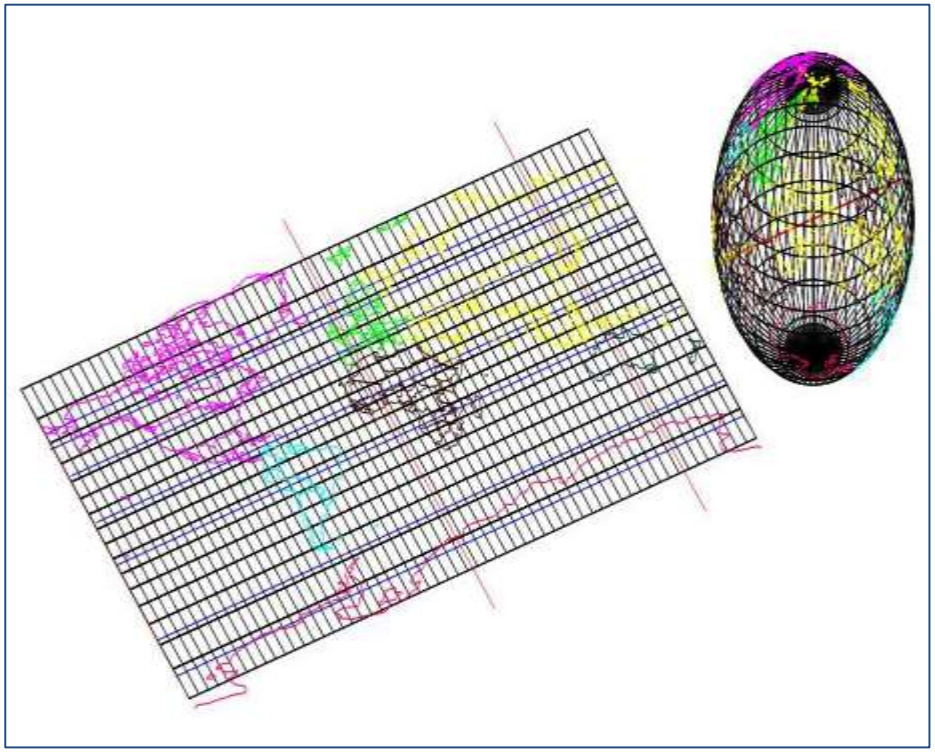


Fig.1. International GNSS Service-Japan Network on AutoCAD Infraworks

2.2 3D mapping
: Satellite Surveying (PEGASUS)



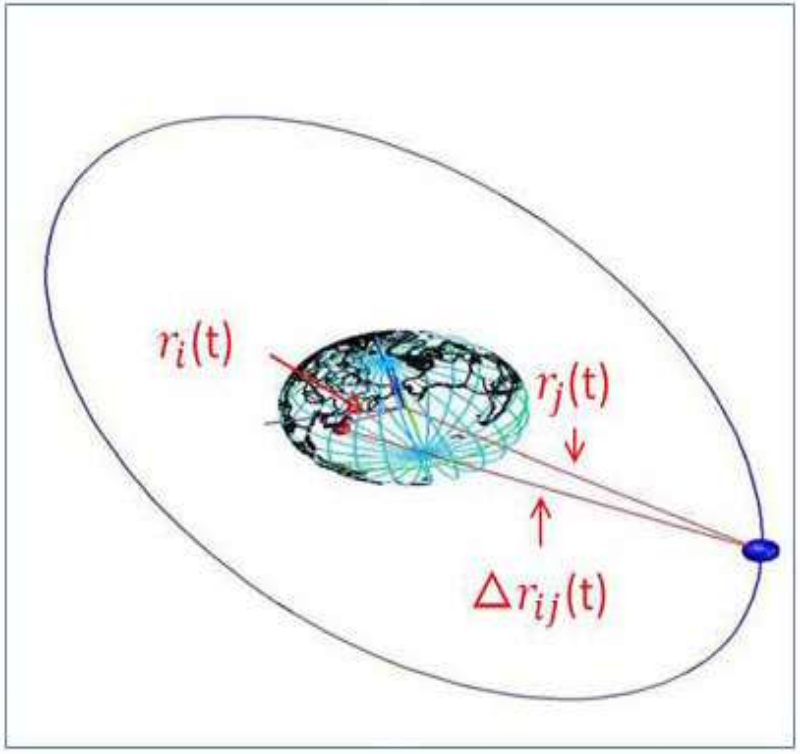


Fig. Map projection and Satellite Surveying

2.3 Historical aerial photos and 3D Image Modeling on 3D-CAD system

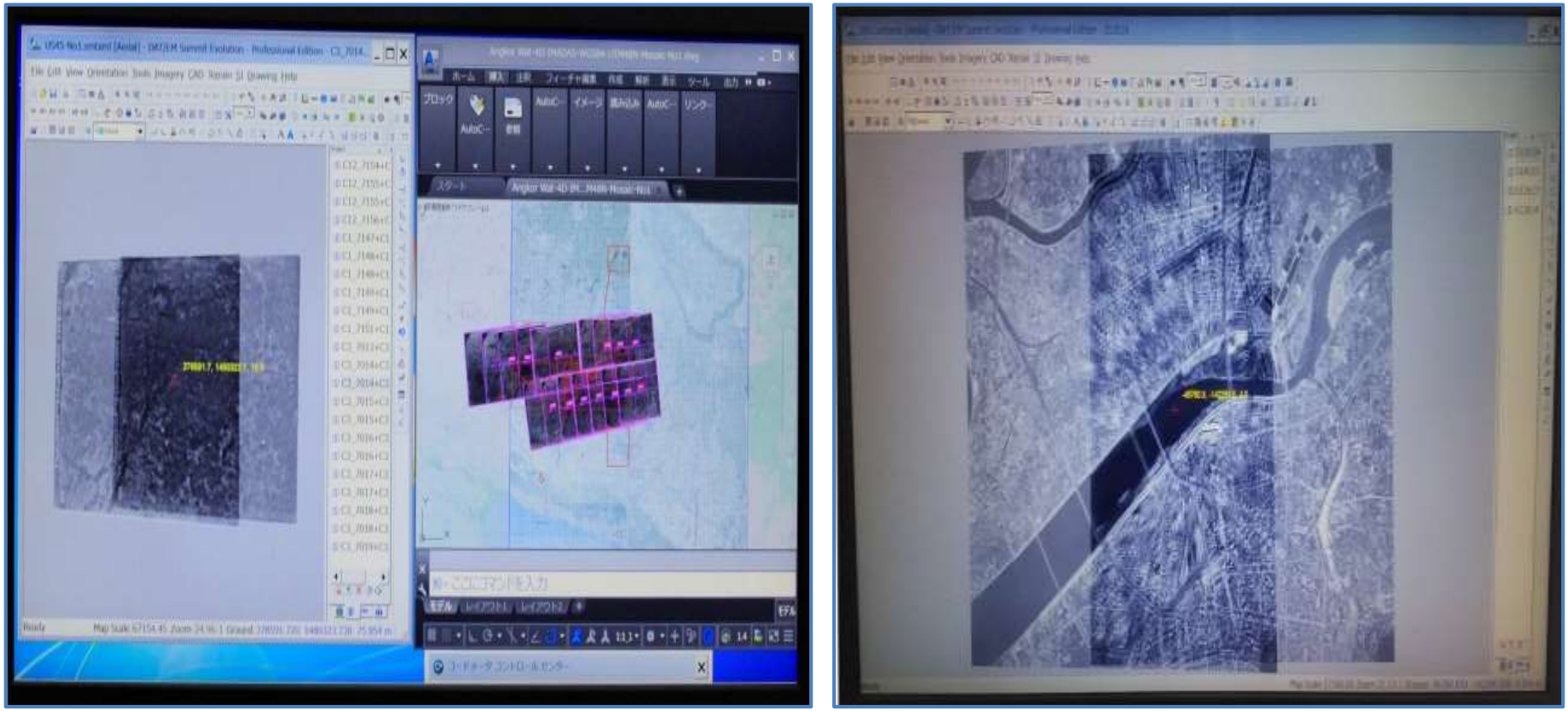


Fig. 2. Summit - Civil3D model : Angkor Wat 1945 and Osaka 1971

2.4 Satellite Photogrammetry

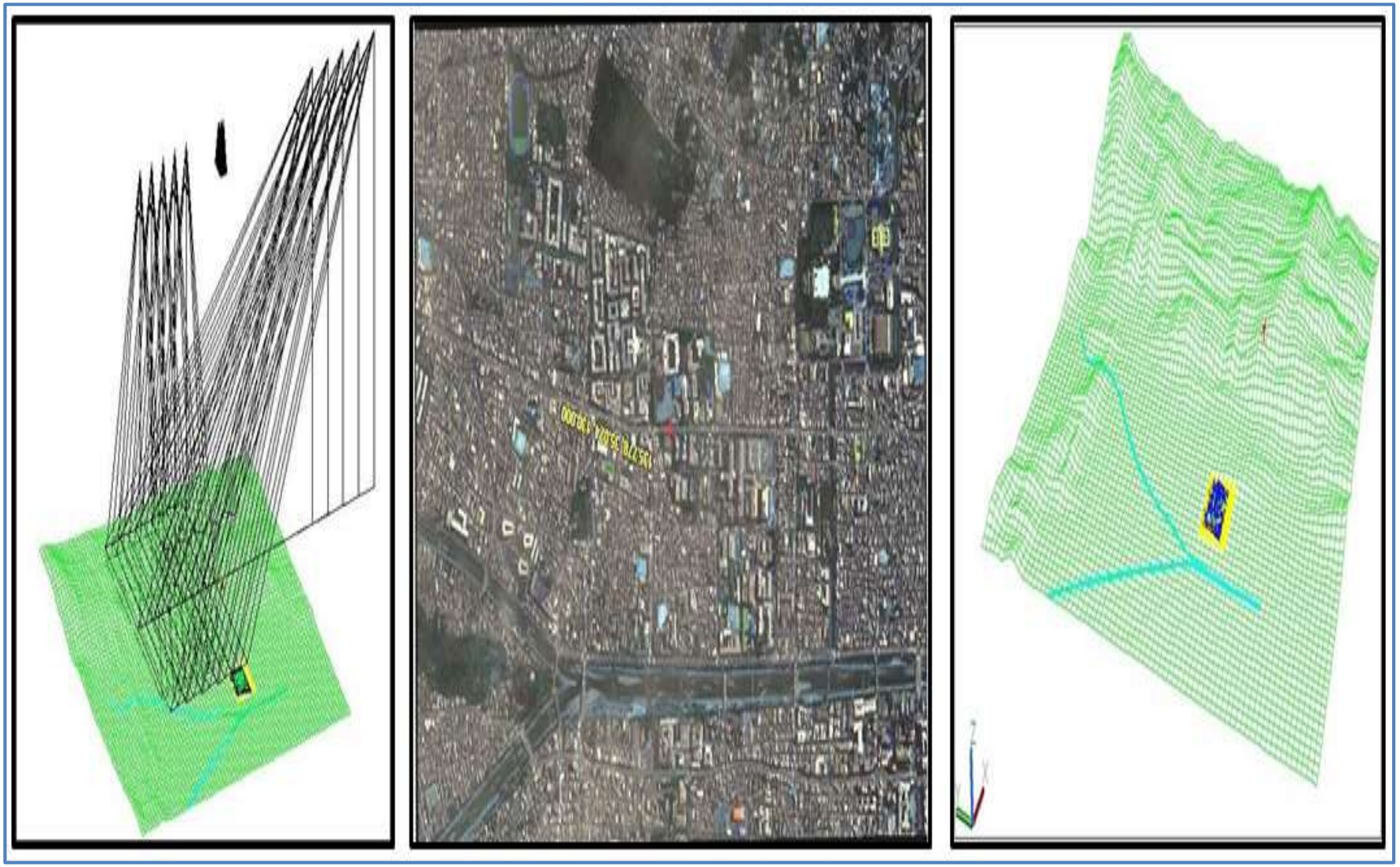


Fig. 7 Satellite Photogrammetry

2.5 Drone Photogrammetry
Kalimantan, Indonesia (2018)

Fig.4 Kalimantan/ Indonesia DJI Phantom 4 /
Flight control Drone tutorial course / Boat yard/ Start flying/ during flight

2.6 3D mapping
: One step parcel cadastral mapping for Real Property Registration Act based Maps

PEGASUS Meister (TS and GNSS – 3D CAD system)

3. Photogrammetric 3D image modeling/ Mapping

3.1 Drone Photography and Photogrammetry

: Drone photography or UAV(Unmanned Aviation Vehicle) as leading engine of photogrammetry

Reducing the following restrictions

and Expanding the feasibilities.

1) Unmanned and auto controlled capability

, with viewing like a bird

2) Easy to learn and to go operations

for un- experienced photogrammetrist

3) Application oriented usage

, for forestry, disaster research and viewing around tourism

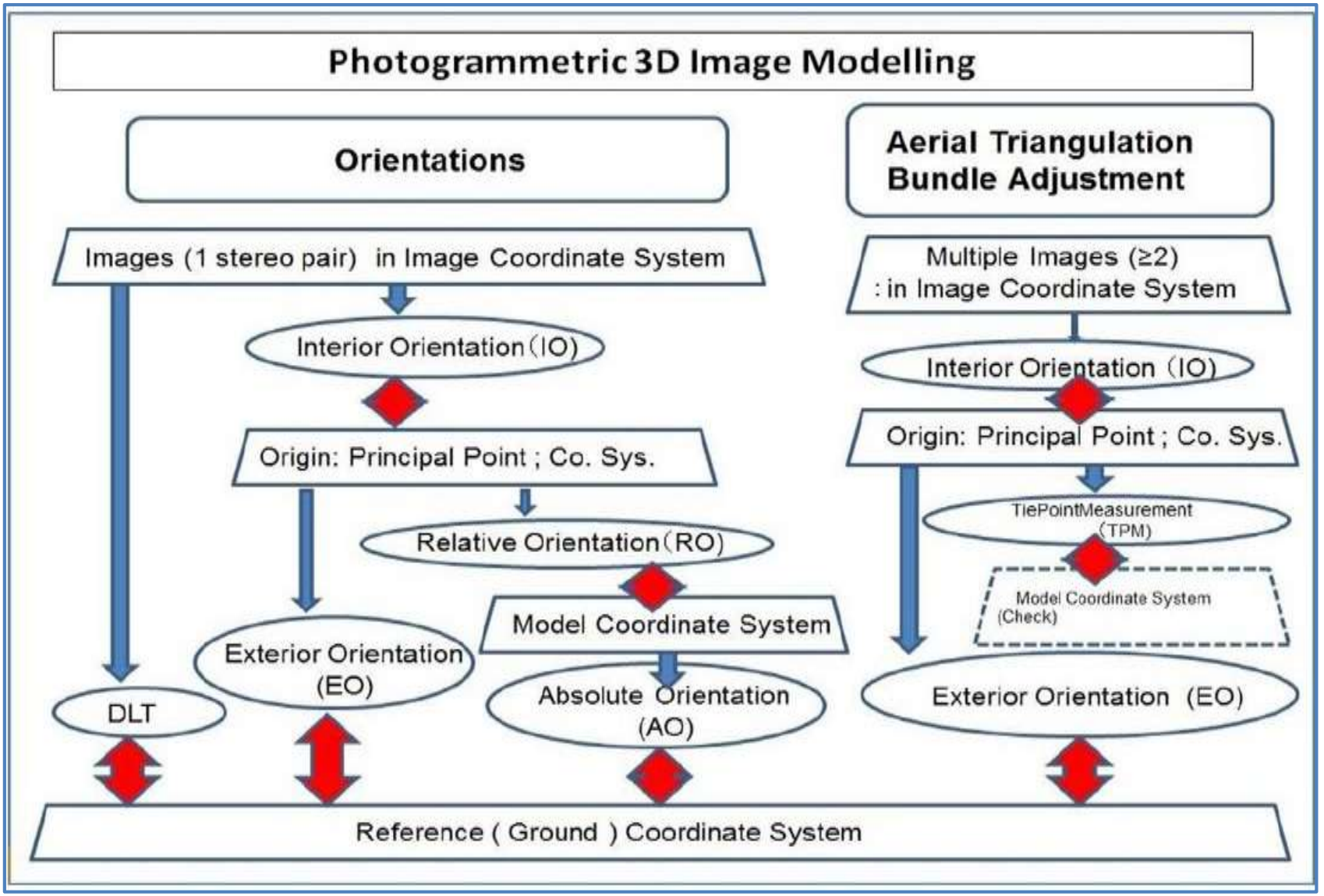
4) Smart phone/ Tablet supported image communication

in real time mode

5) We could expect further more development

with Robotics and Artificial Intelligence.

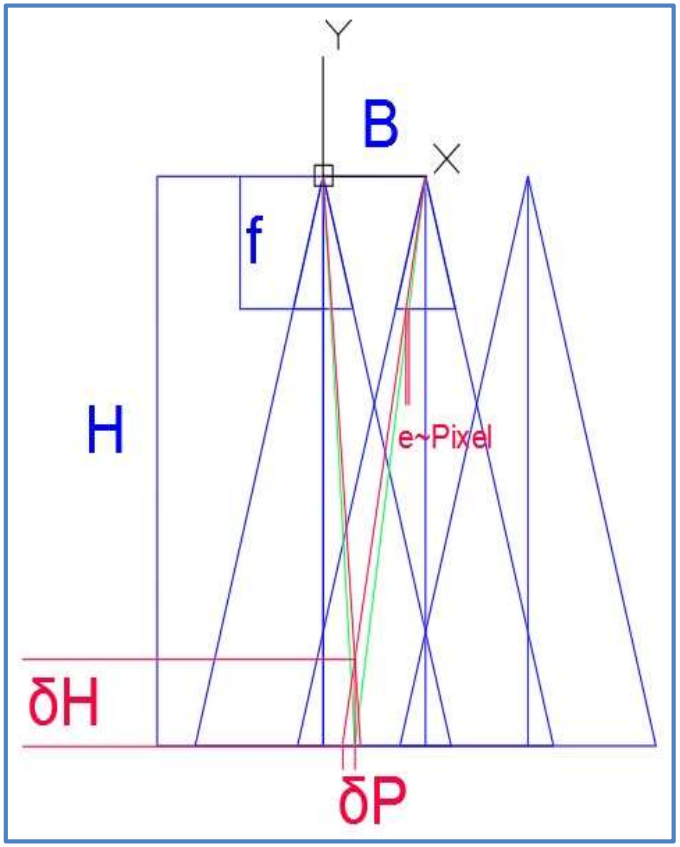
3. 2 Photogrammetric 3D Image Modelling



3.3 Drone/Helicopter Photogrammetry

Planimetric Accuracy : $\delta P = H/f * \varepsilon$ (≈ pixel size)

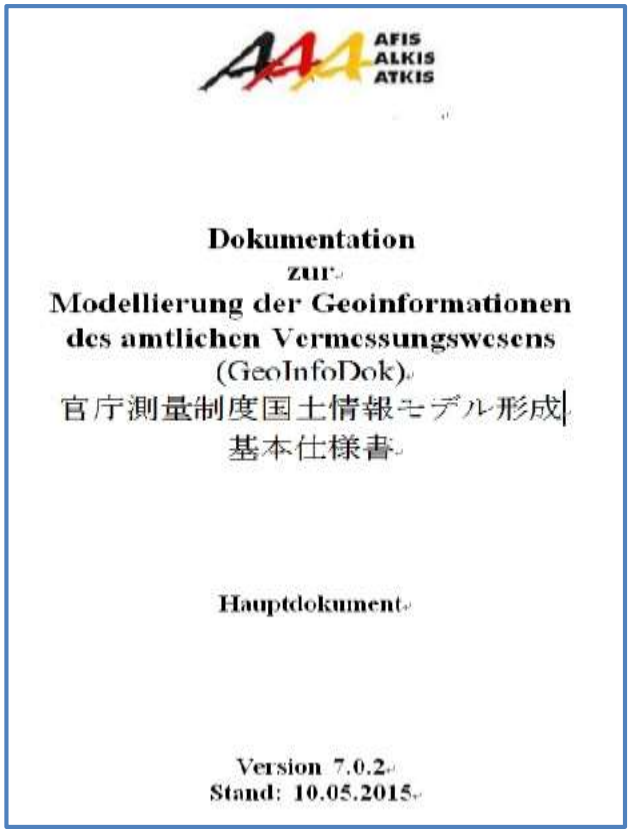
Height Accuracy : $\delta P = H/B * H/f * \varepsilon$ (≈ pixel size)



Freight Height (H)	300m	300m	Aviation regulation
Focal Length (f)	70mm	300mm	Canon zoom lens
Image Scale(f / H)	1/ 4,286	1/1,000	
Image Size (36mm x 24mm) Base (60% O.L.)	(154.3m x 102.9m) 36mm x 0.4 x Image Scale = 61.7m	(36m x 24m) 36mm x 0.4 x Image Scale = 14.4m	On the ground
H/B ratio	4.86	20.8	Sensitive on Height Accuracy
Image Pixel Size	5um	5um	
Planimetric Accuracy : δP	21mm	5mm	
Height Accuracy : δP	101mm	104mm	

Fig. 5 Accuracy calculation : Flight plan B/H ratio issue

4. Cadastral 3D mapping Standards
4.1 CADASTRE2014 : GeoInfoDok : ALKIS



Cadastral standard : “Cadastre 2014”

Land Administration Domain Model and Social Tenure Domain Model.

Land ownership, land administration and land registration in Germany.

“GeoInfoDok” : ALKIS (German Official Cadastral Information System)

4.2 Cadastral 3D mapping standards; new type : topographical, land-use, soil science and geological maps

Google-Map and Google-Earth has influenced map production policies.

for topographical, land-use, soil science and geology map productions.

For Cadastral 3D Mapping, we do need new definition of map object, presentation method

and representation media for various purposes

in administrative organizations and citizenship.

Cadastral Survey / Real Property Registration like AAA in Germany

4.3 Peatland oriented topographic map and Peatland oriented cadastral map

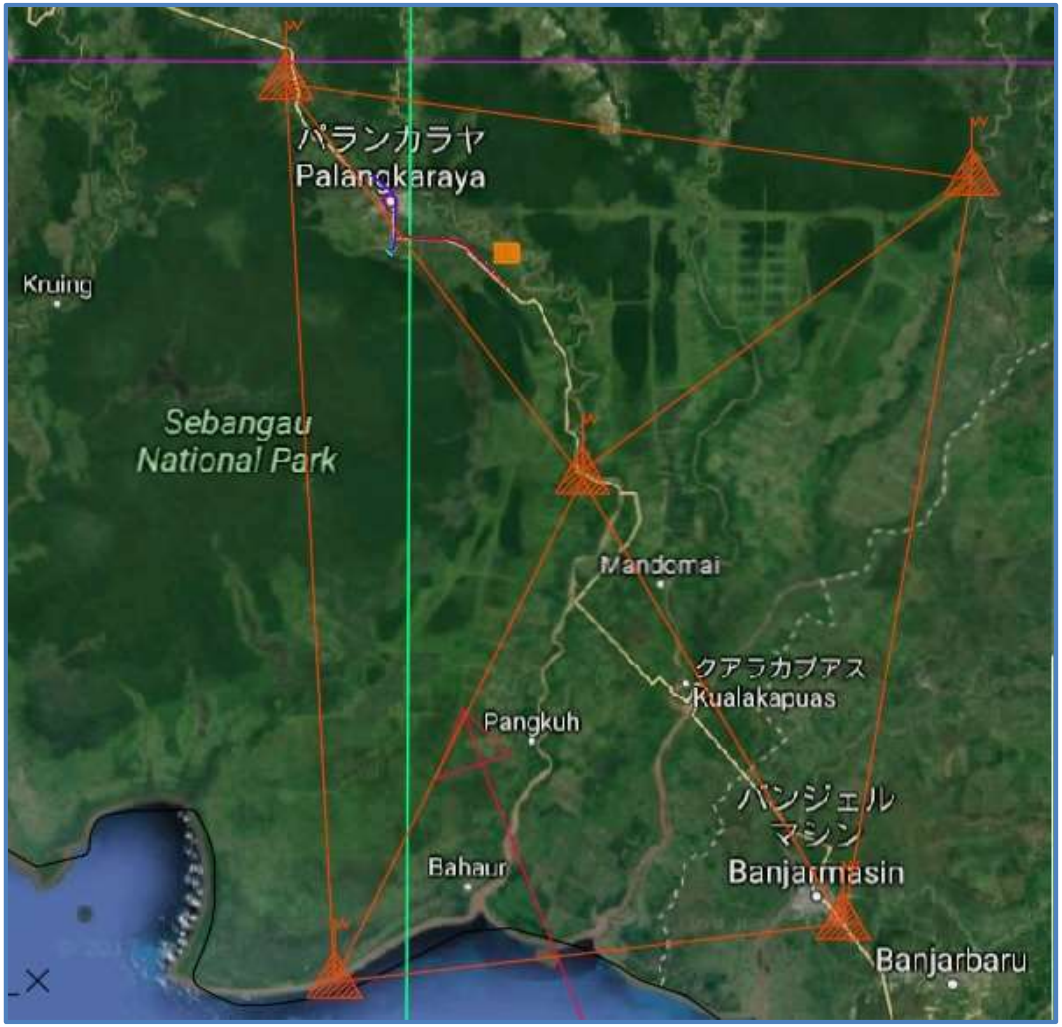
As Kalimantan Peatland area has the largest portion of the area

, so ground control, topographic mapping could be realized in defining peatland features with facility features.

As for land registration process, Peatland oriented cadastral mapping is geo-referenced

and timely representation of the area, using the above mentioned major approaches.

=>FKP 5 reference stations



4.4 Mapping (Peatland) features

DJI-PalangkaRaya (2018)

* Peatland features are derived from generation/transition/ process of each peatland.

* Mapping expressions reflect peatland features.

- Different aspects

of mapping expressions need to have specified.

- Major products;

: 3D image model

, Ortho-image

, DEM height data

: Analysis data sets.

4.5 Mapping = 3D modeling approaches

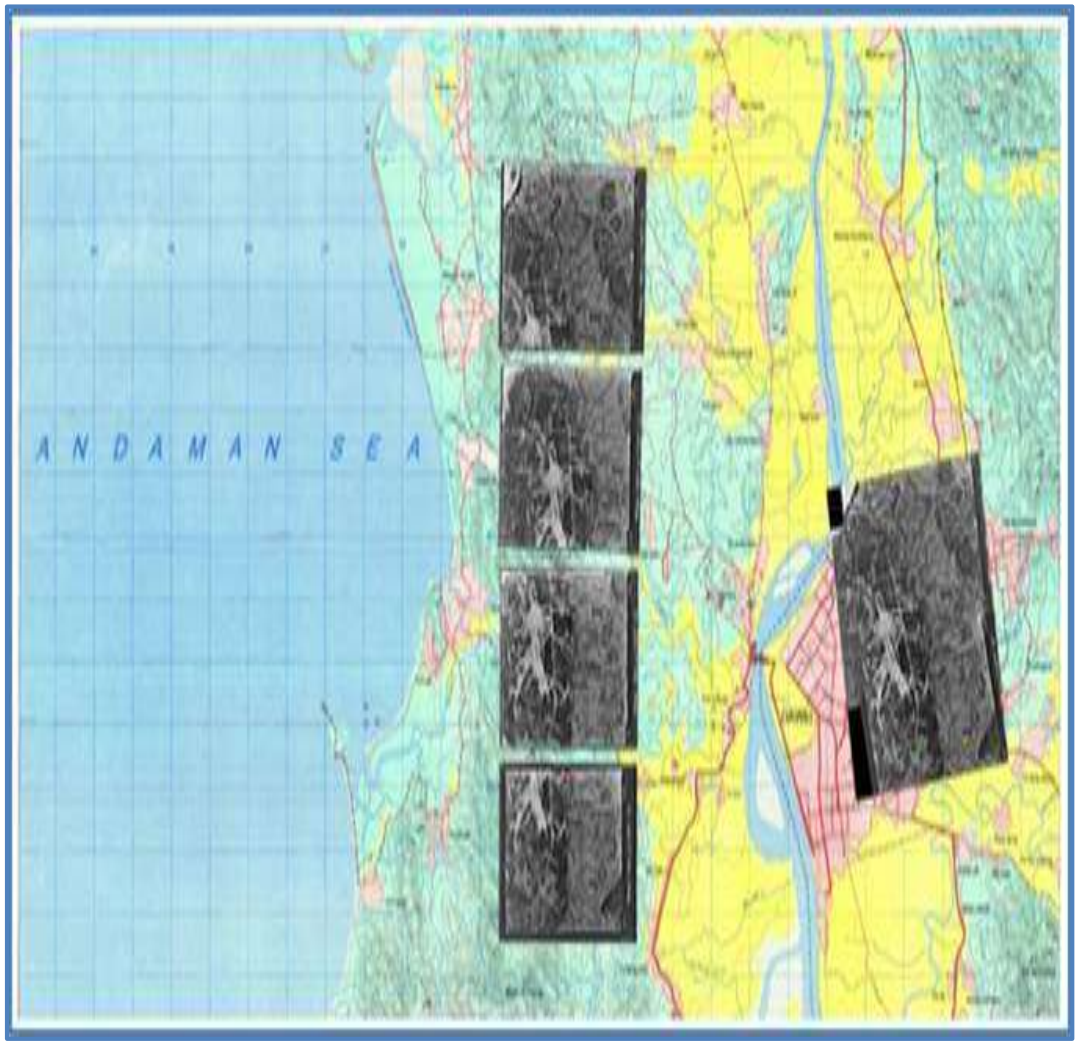
Applicable approach for 3D modeling;

1. Photogrammetry
   : drone, helicopter, satellite photogrammetry

Aerial photos(1944)
: Ortho images Mosaic

2. LIDAR terrain surfacing

3. Satellite sensor terrain surfacing and presentation



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Social Tenure Domain Model and 3D modeling by UAV photogrammetry

Thank you very much for your kind attention !!!

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