



FIG WORKING WEEK 2019

Hanoi, Vietnam 22 - 26 April 2019

Geospatial information for a smarter life and environmental resilience

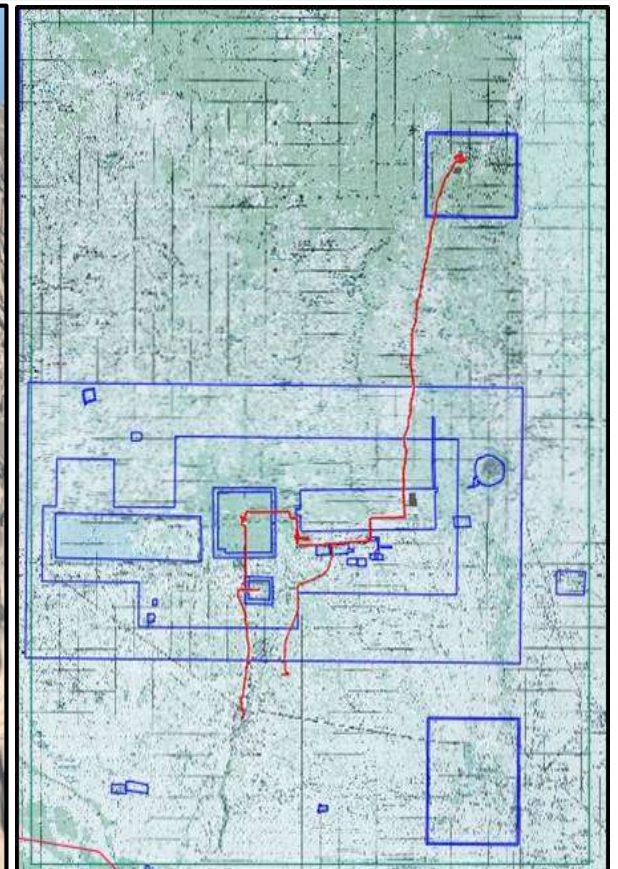
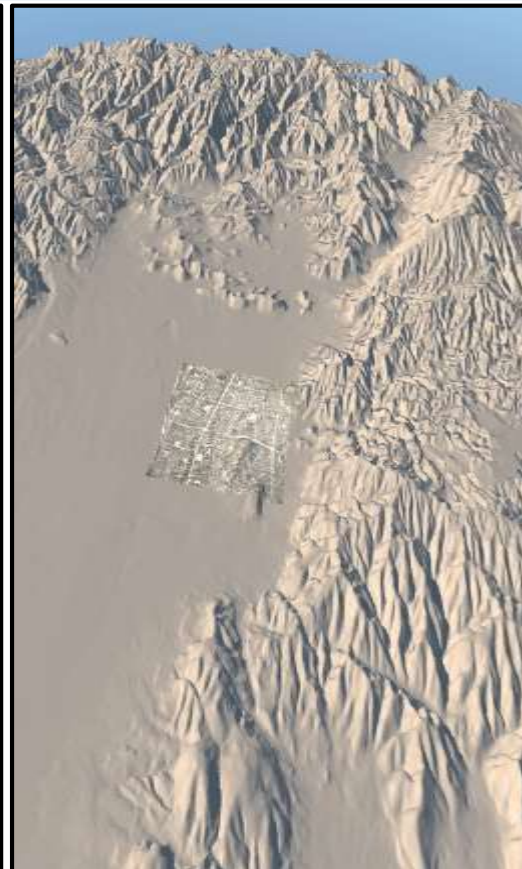
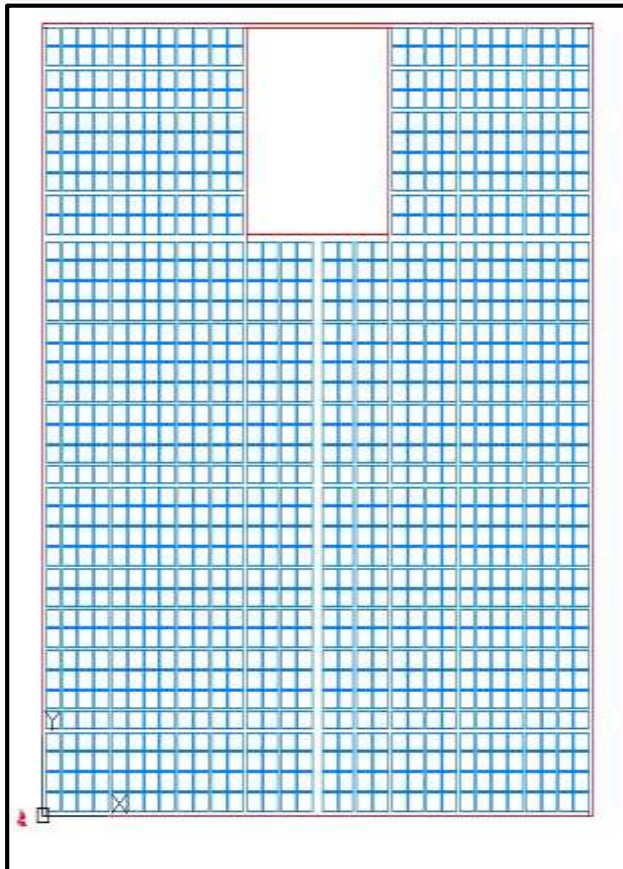


*Presented at the FIG Working Week 2019,
April 22-26, 2019 in Hanoi, Vietnam*

4D- IMADAS with 3D mapping of Kyoto (Heian) -Angkor (Khmer) capitals

by Mr. Hiroyuki HASEGAWA , President of GeoNet, Inc, Japan

Dr. Heng Kim LENG and Mr. Kim Samnang, APSARA National Authority, Cambodia



1. OLD MAP PROJECTIONS AND 4D IMAGE MAP ARCHIVE IN 19-20-21ST CENTURIES

1.1 Tadataka Inoh's 200K maps in 1820-1888 to Japan Geodetic Datum 2000 maps

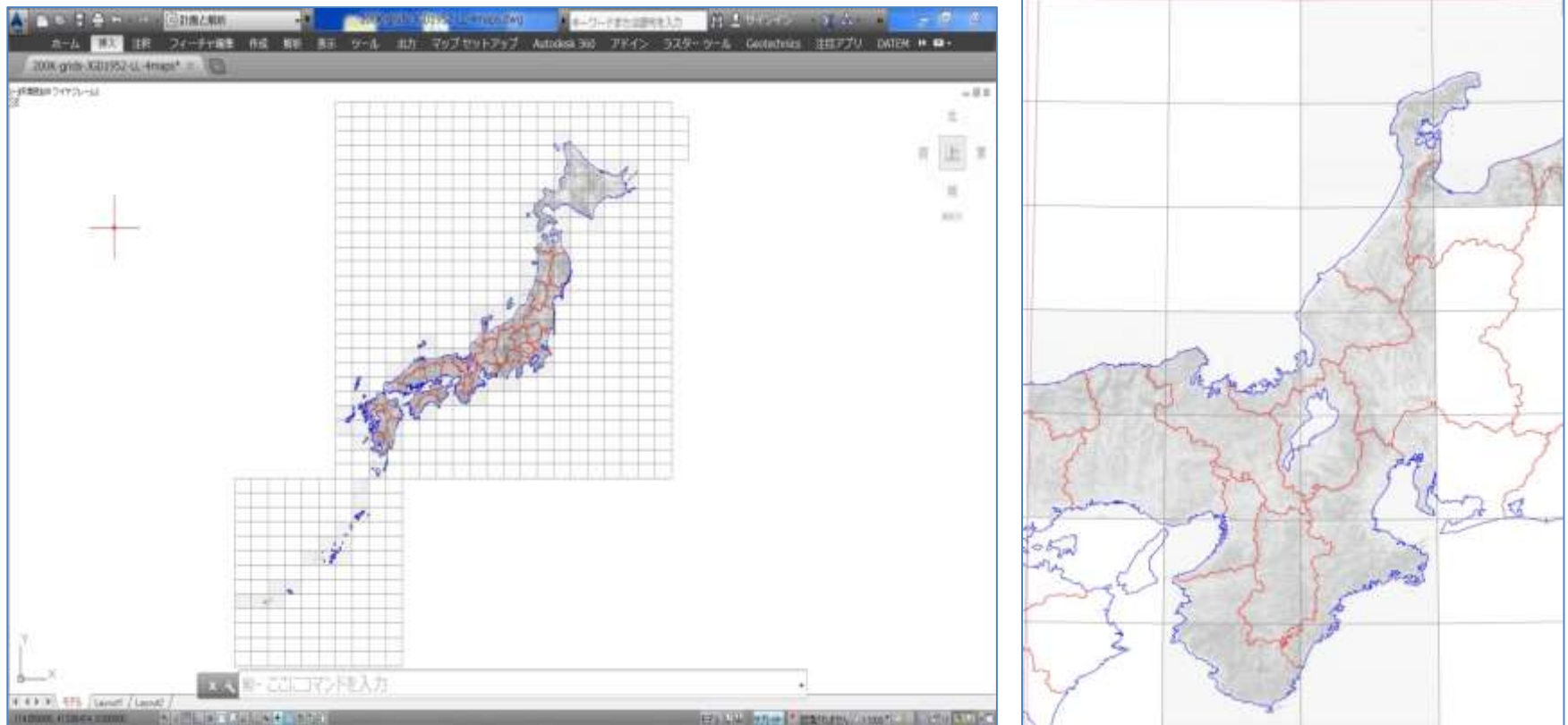
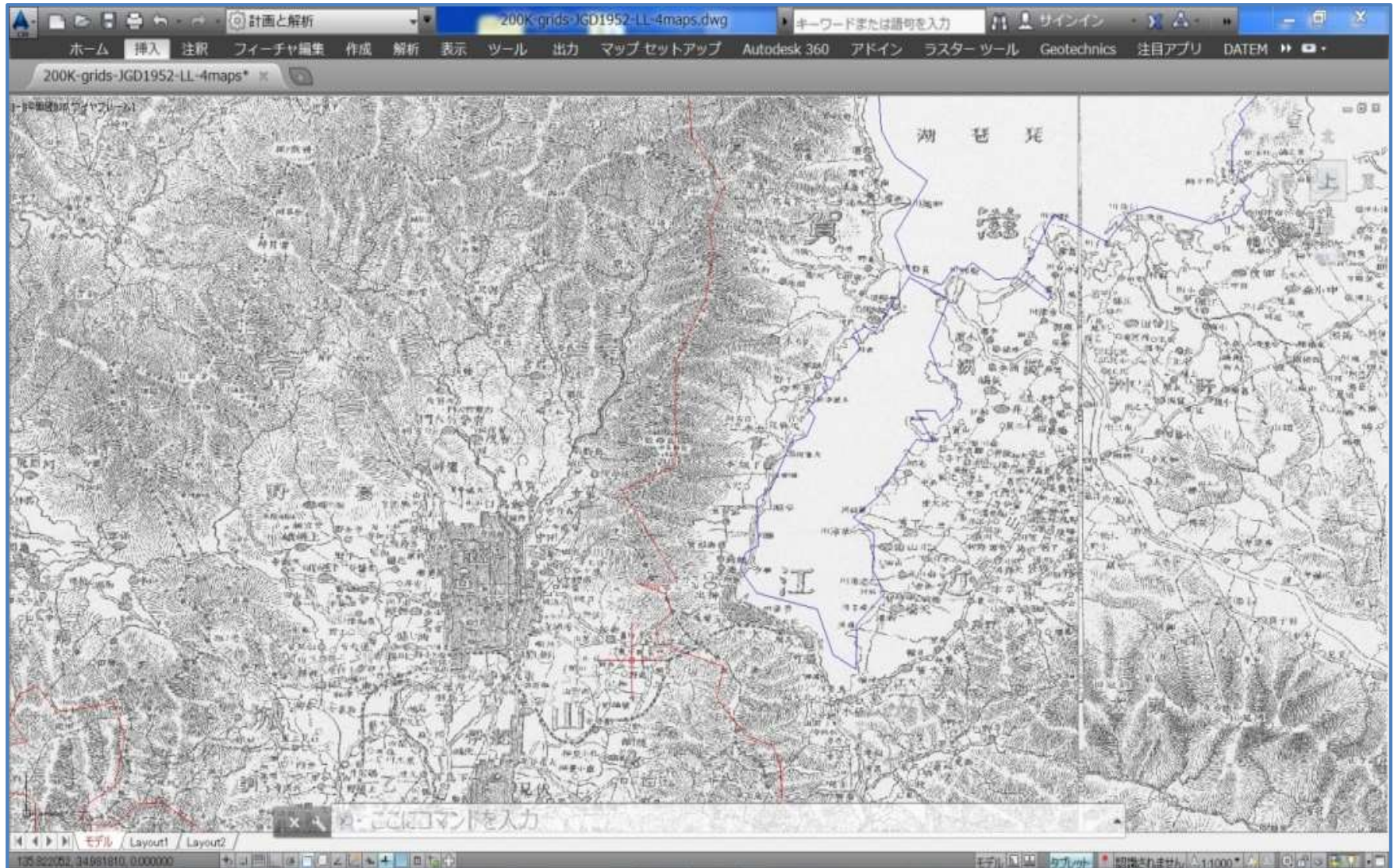


Fig. 1. 1880s-200K maps (130 maps) – year 2000 map coast lines (blue) in JGD06 zone

1.1.2 1880s-200K map vs. 2000-200K map

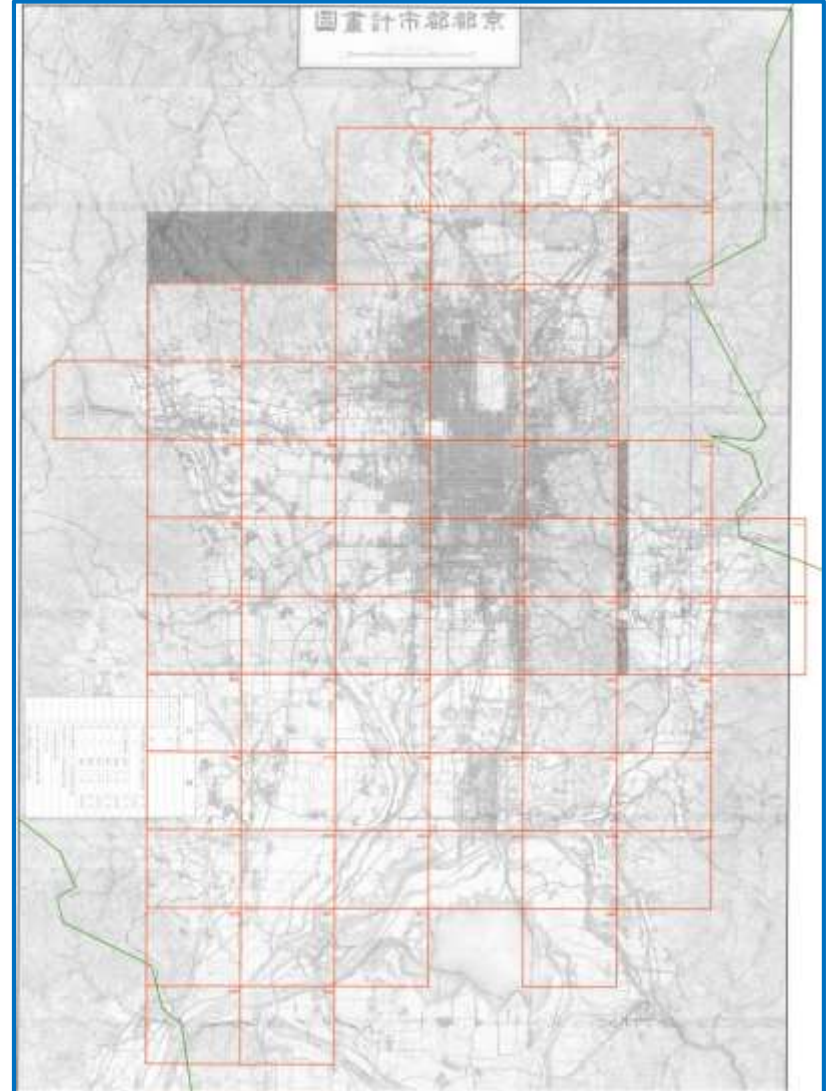
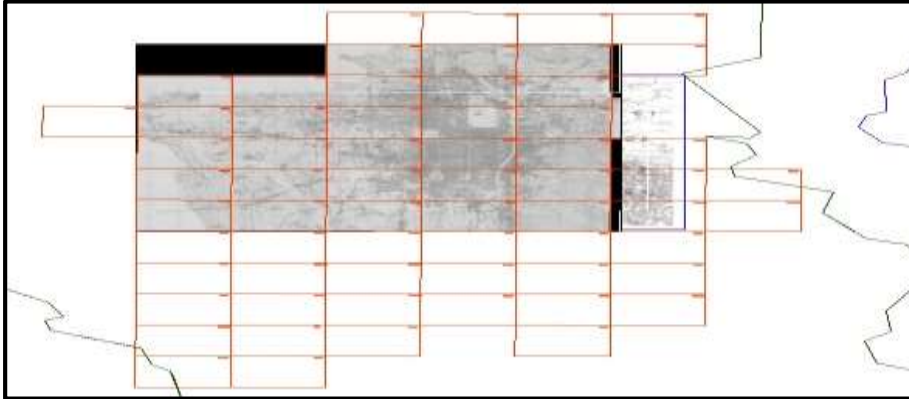
Kyoto Biwako-lake coast lines



1.2 Modern 20K maps of Kyoto City area Imperial palace and Kyoto University (1890 / 1912)



1.3 Urban planning base maps of 3K in 1936

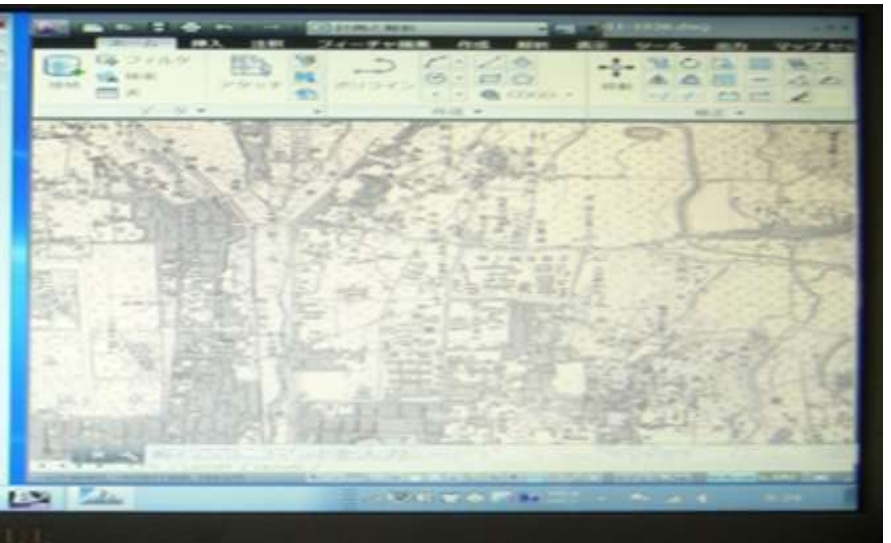
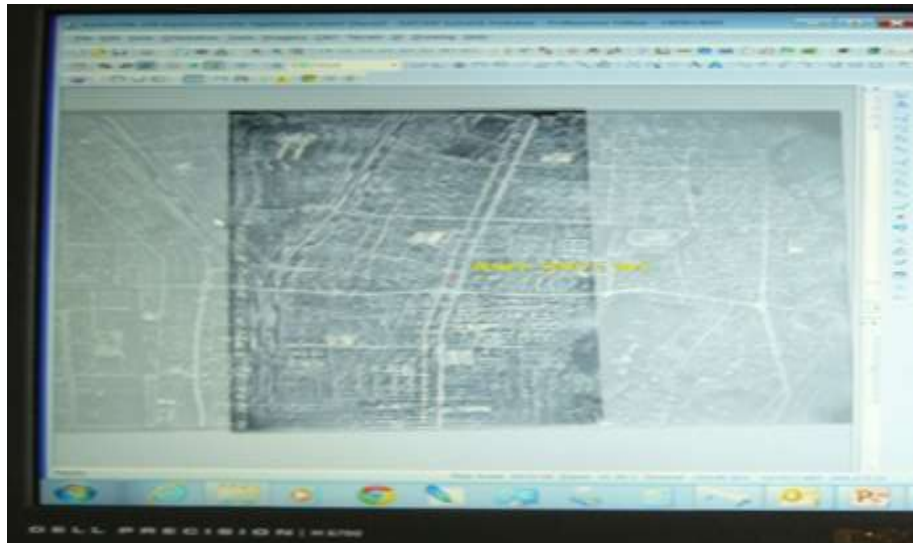
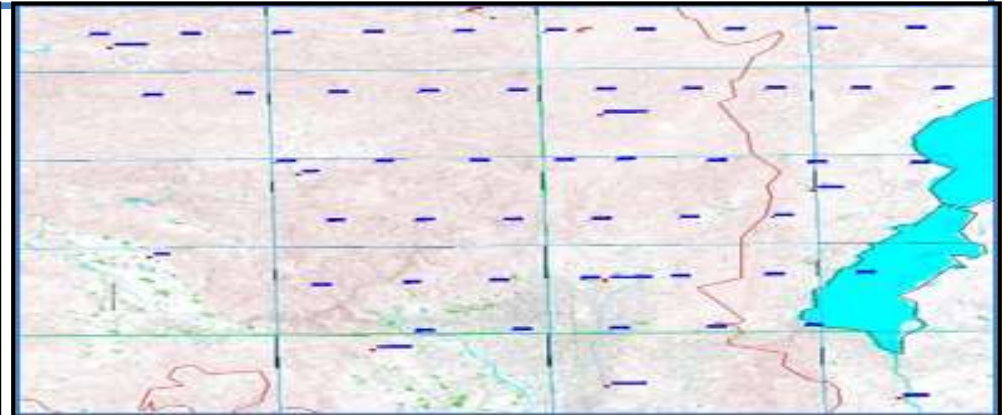
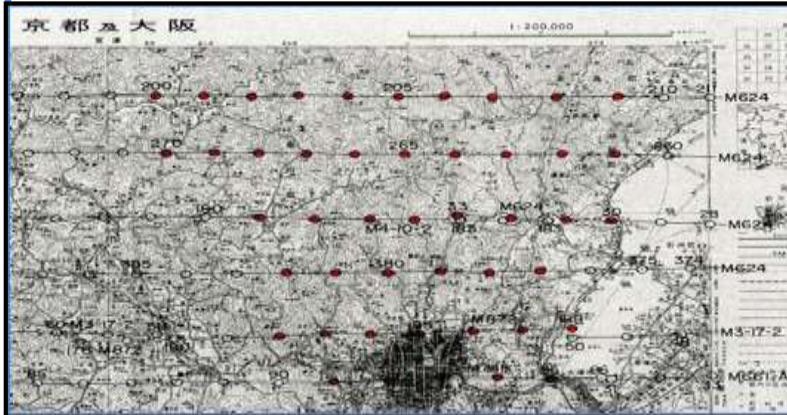


2. AERIAL PHOTOGRAMMETRY IN KYOTO CITY AREA

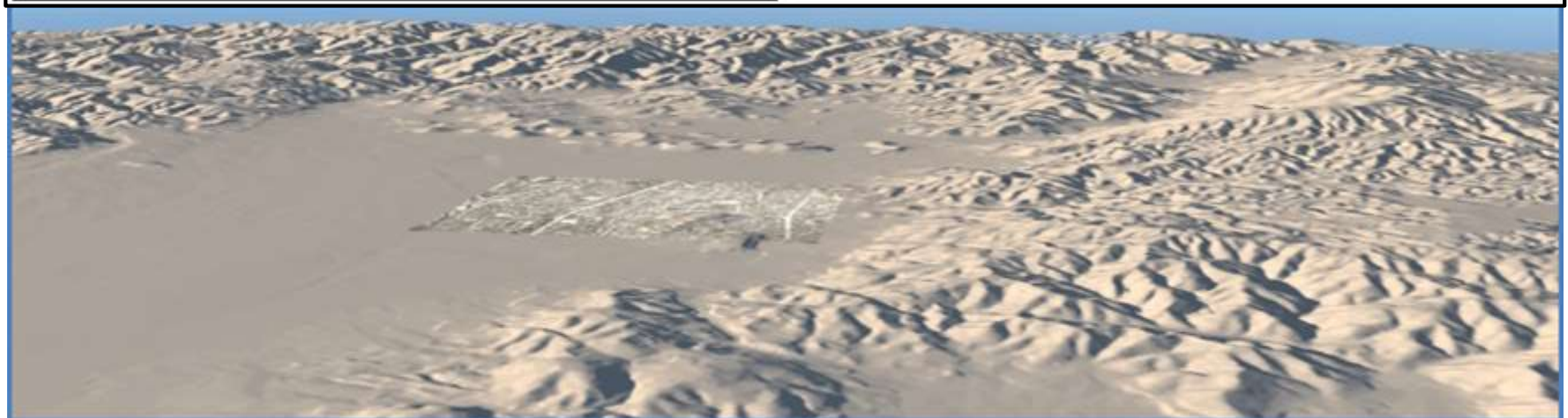
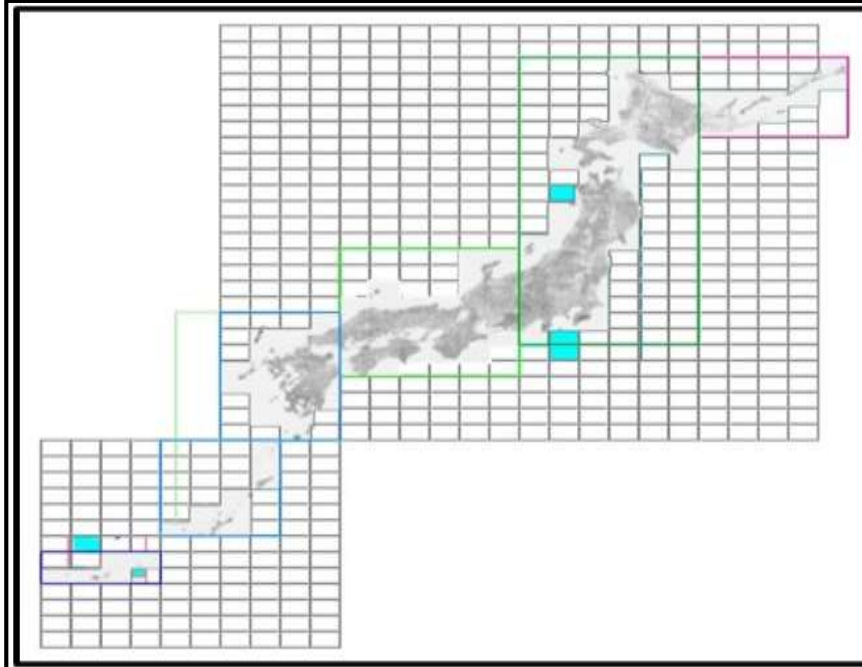
2.1 10K-40K aerial photos taken by US aerial cameras

2.2 Bundle triangulation of 1946 aerial photos
and 3D image modeling and 3D-diorama

Kyoto University : 1946 stereo model -1911 Image Map on AutoCAD Map



2.3 CAD-Globe (Autodesk Infraworks360: Japan archipelagos) 1946 aerial photos + 5m DEM for Kyoto University 3D diorama

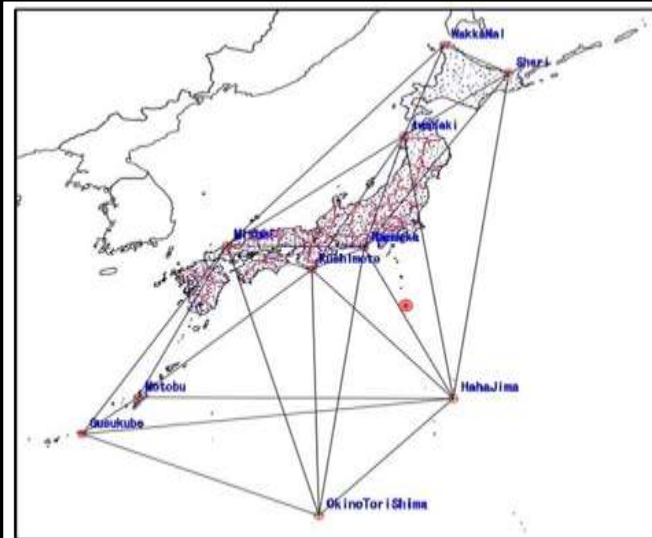


3.2 KYOTO (HEIAN) CAPITAL

4D- IMAGE MAP ARCHIVE “Helicopter Photogrammetry”

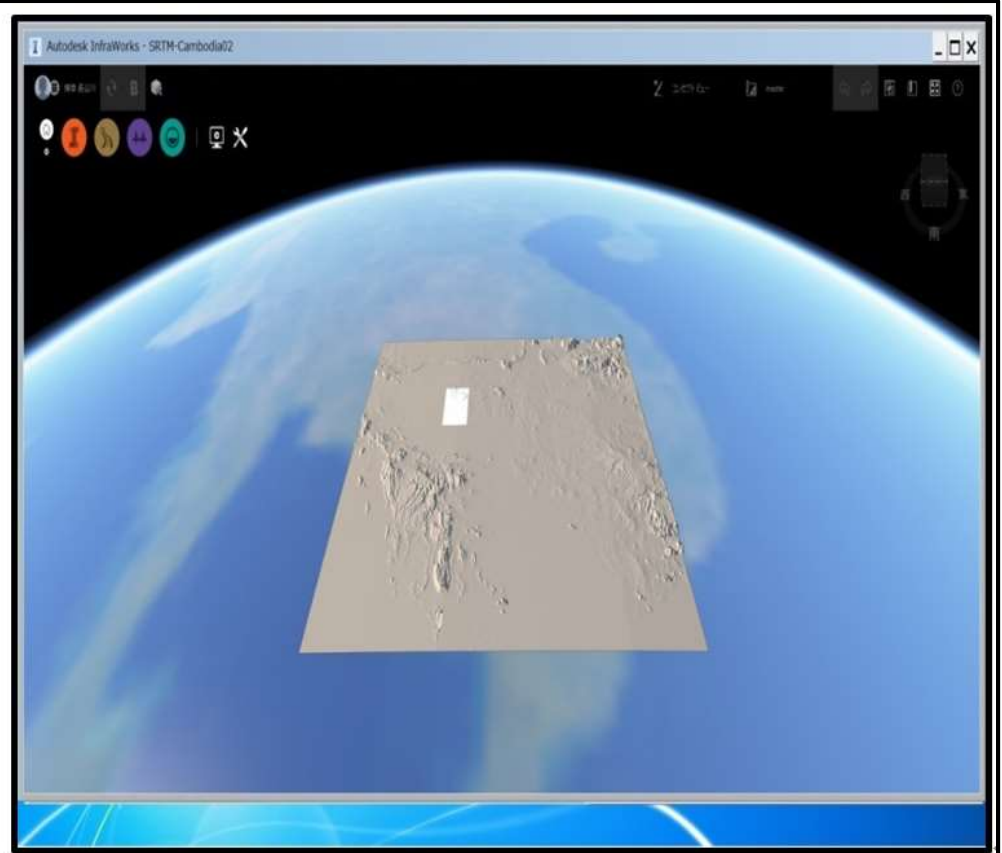
Japan Nationwide Geodetic Networking

and “One step parcel cadastral mapping”

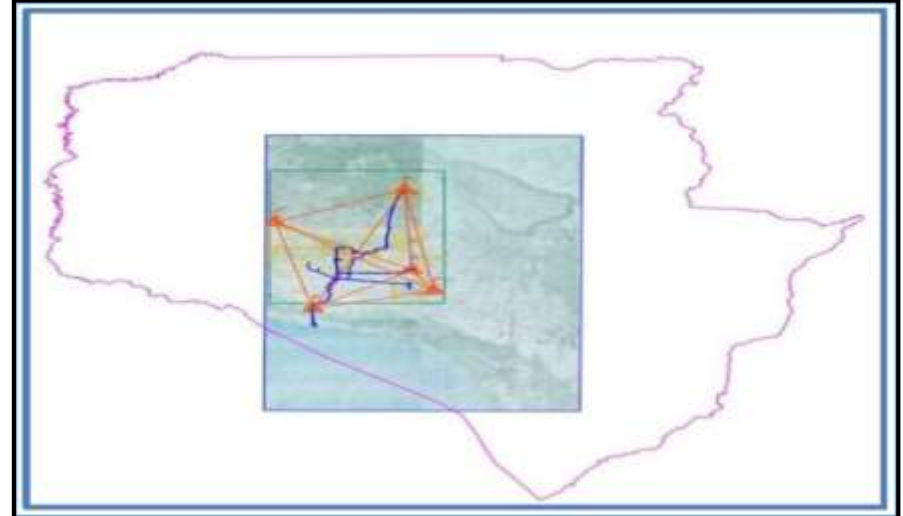
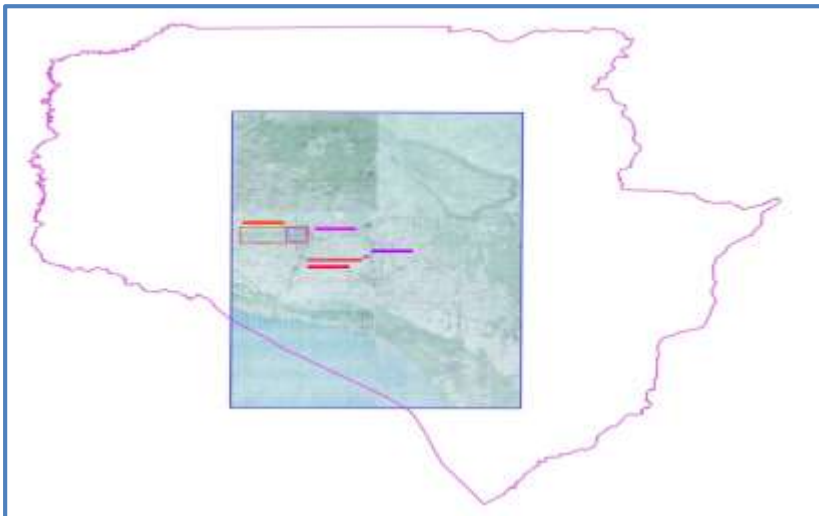
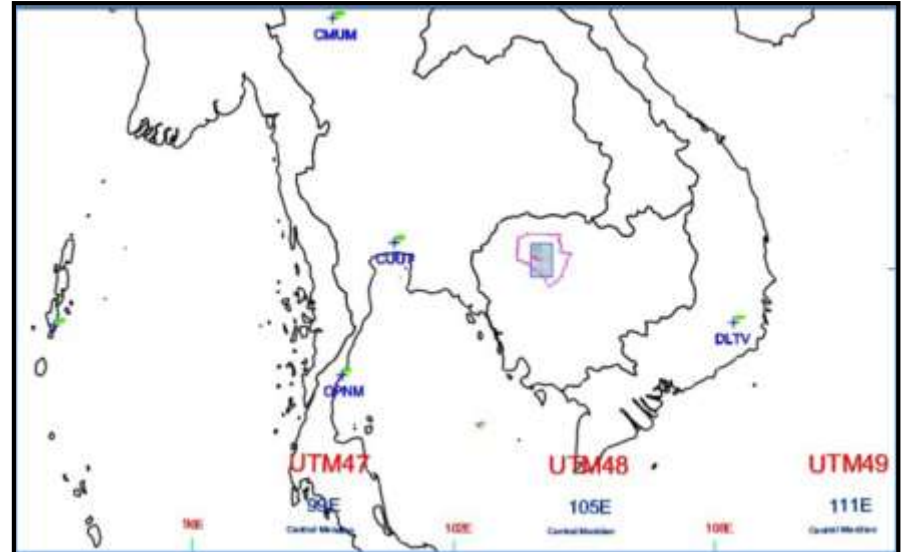
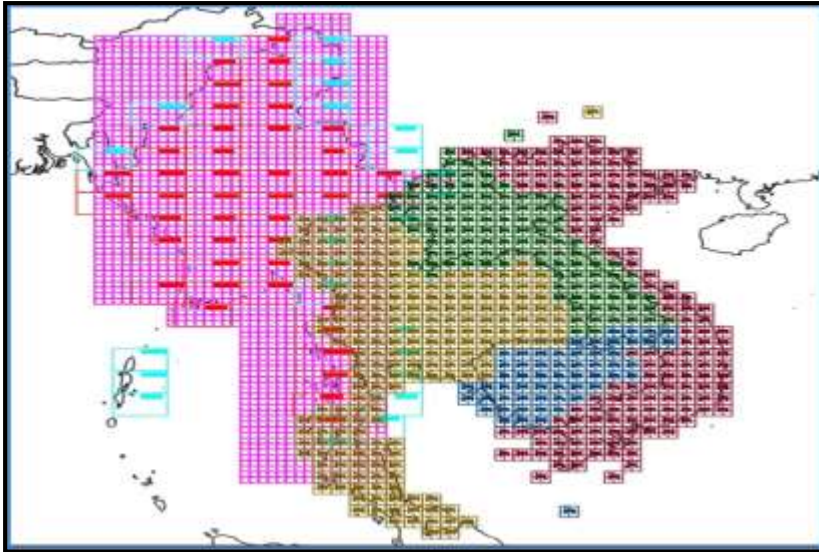


4. Cambodia-Angkor 4D-IMADAS

Khmer empire and SRTM-30m DEM on CAD globe



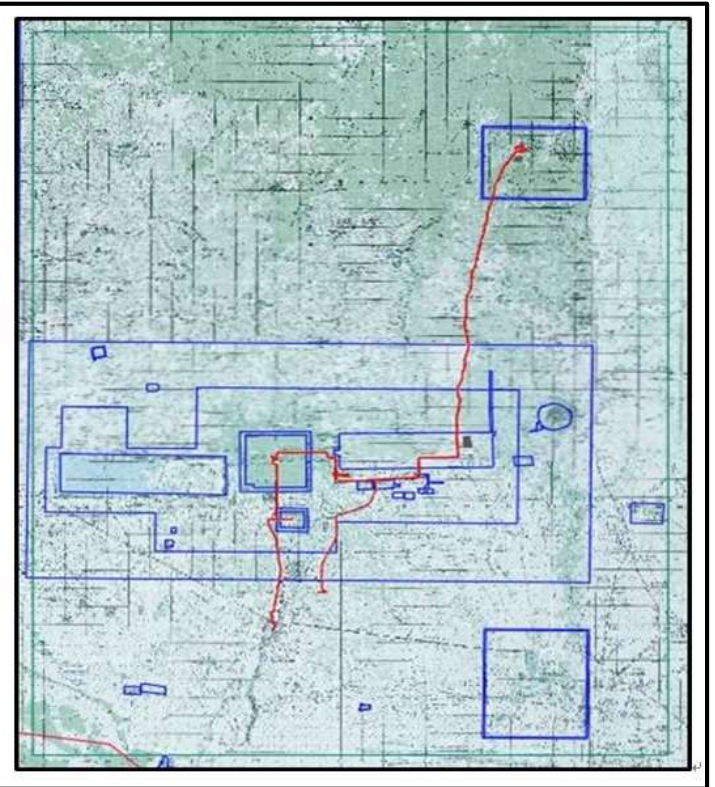
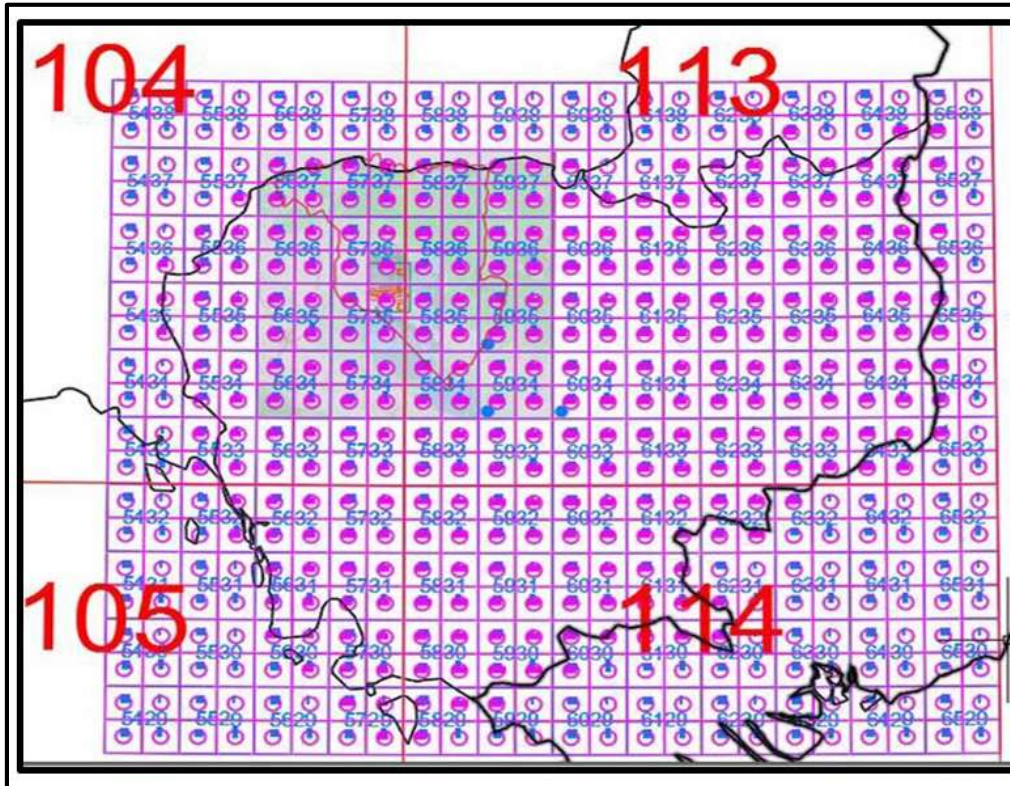
4.1 Approaches and basis of 3D mapping projects



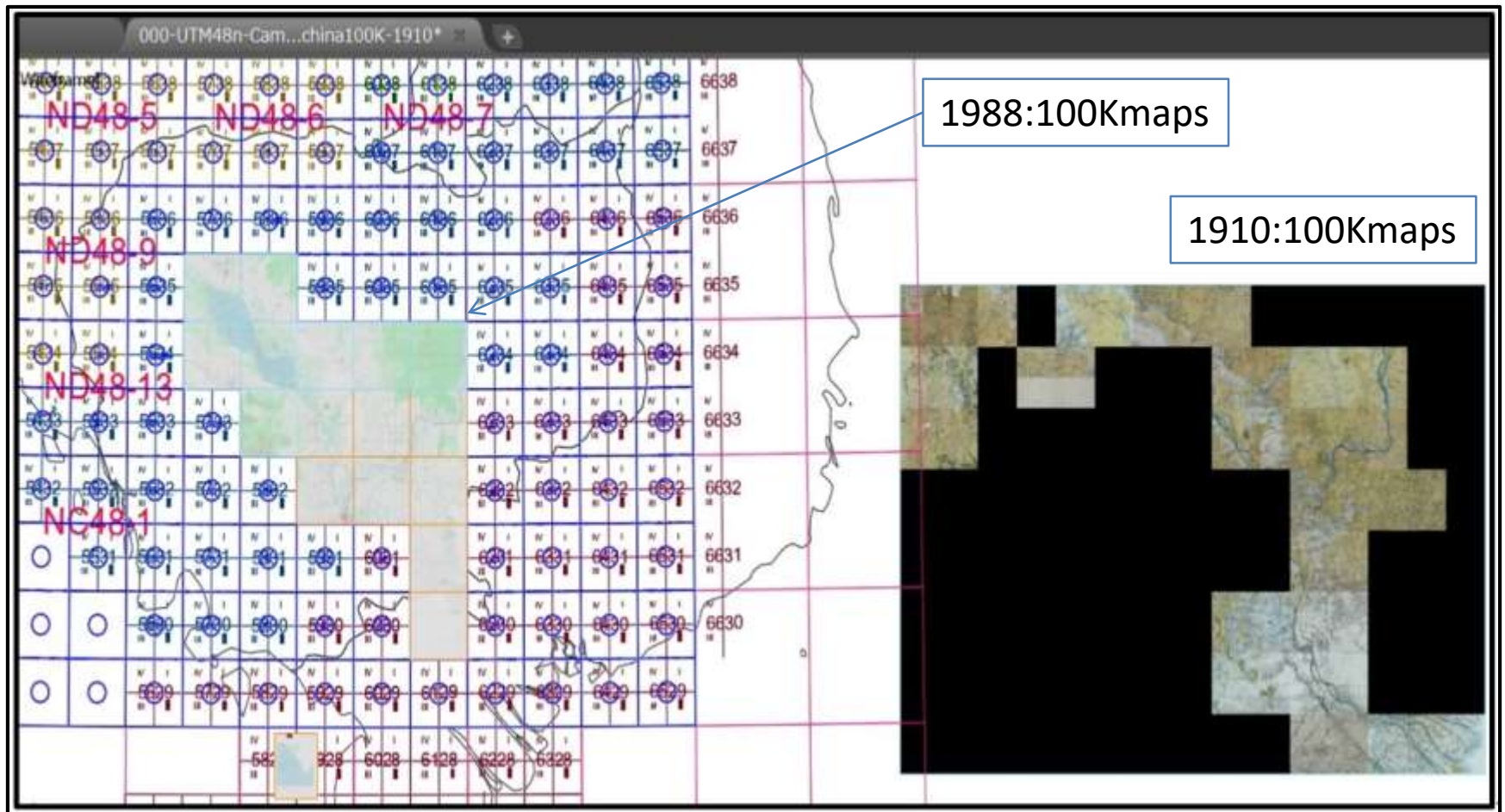
4.1.1 SRTM-DEM - Angkor and JICA 100k map (1998)



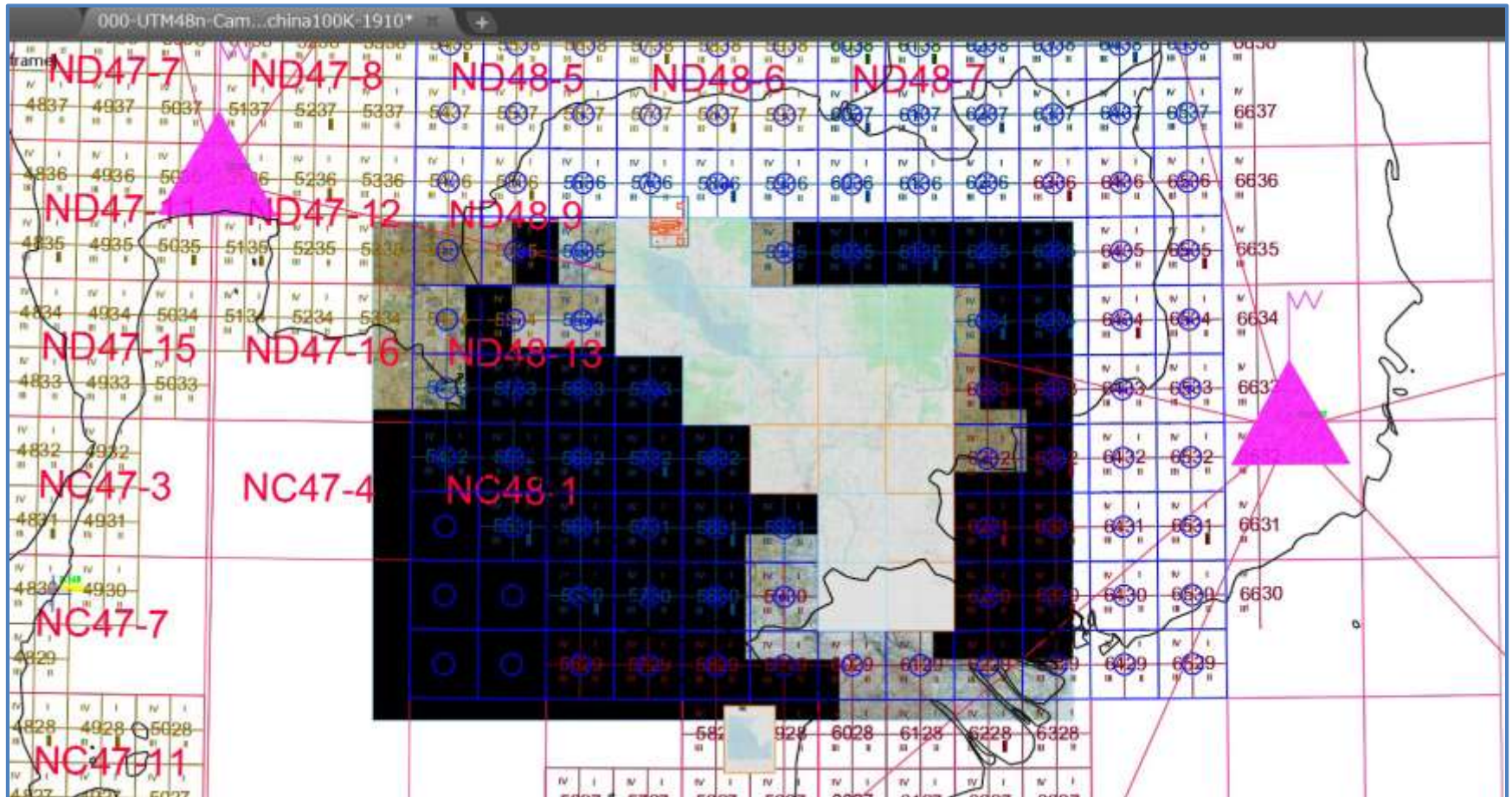
4.1.2 Cambodia map grids on AutoCAD and DGPS mapping in Angkor area



4.1.3 Cambodia 100K maps: 1910-1988



4.1.4 Angkor-UN-GGRF- Networking 1998-1910 maps overlapped



4.1.5 UN-GGIM and UN-GGRF initiatives

The Global Geodetic Reference Frame



Observing instruments



Goal/Challenge: determine locations & deformations with an improved precision, Everywhere & Anytime on Earth, to satisfy societal and science requirements



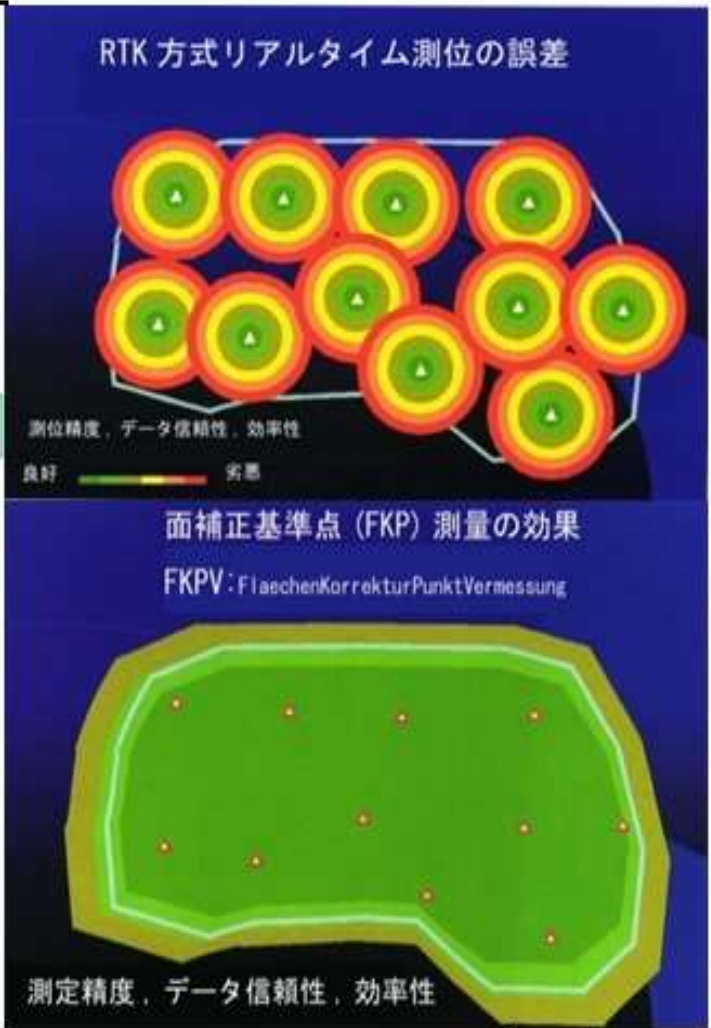
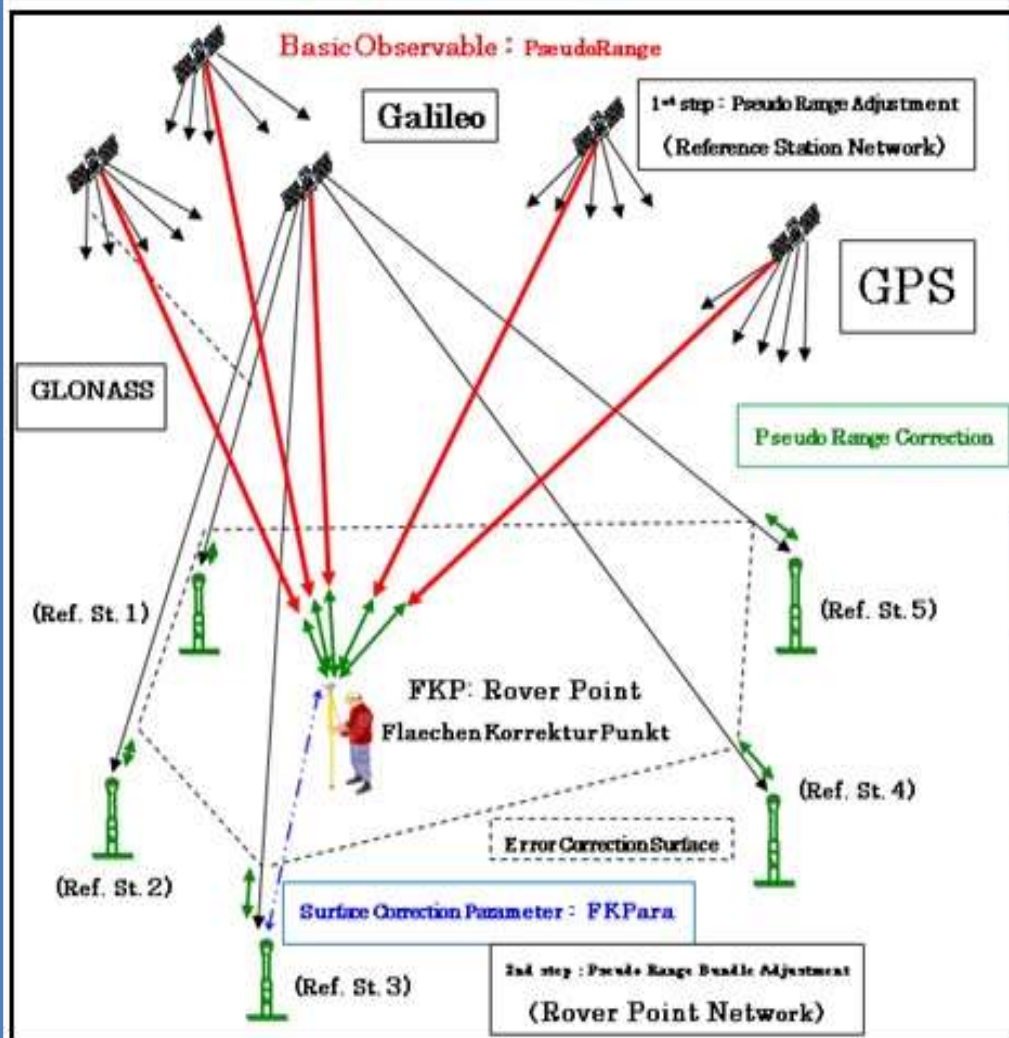
UN-GGIM

United Nations Initiative on
Global Geospatial Information Management

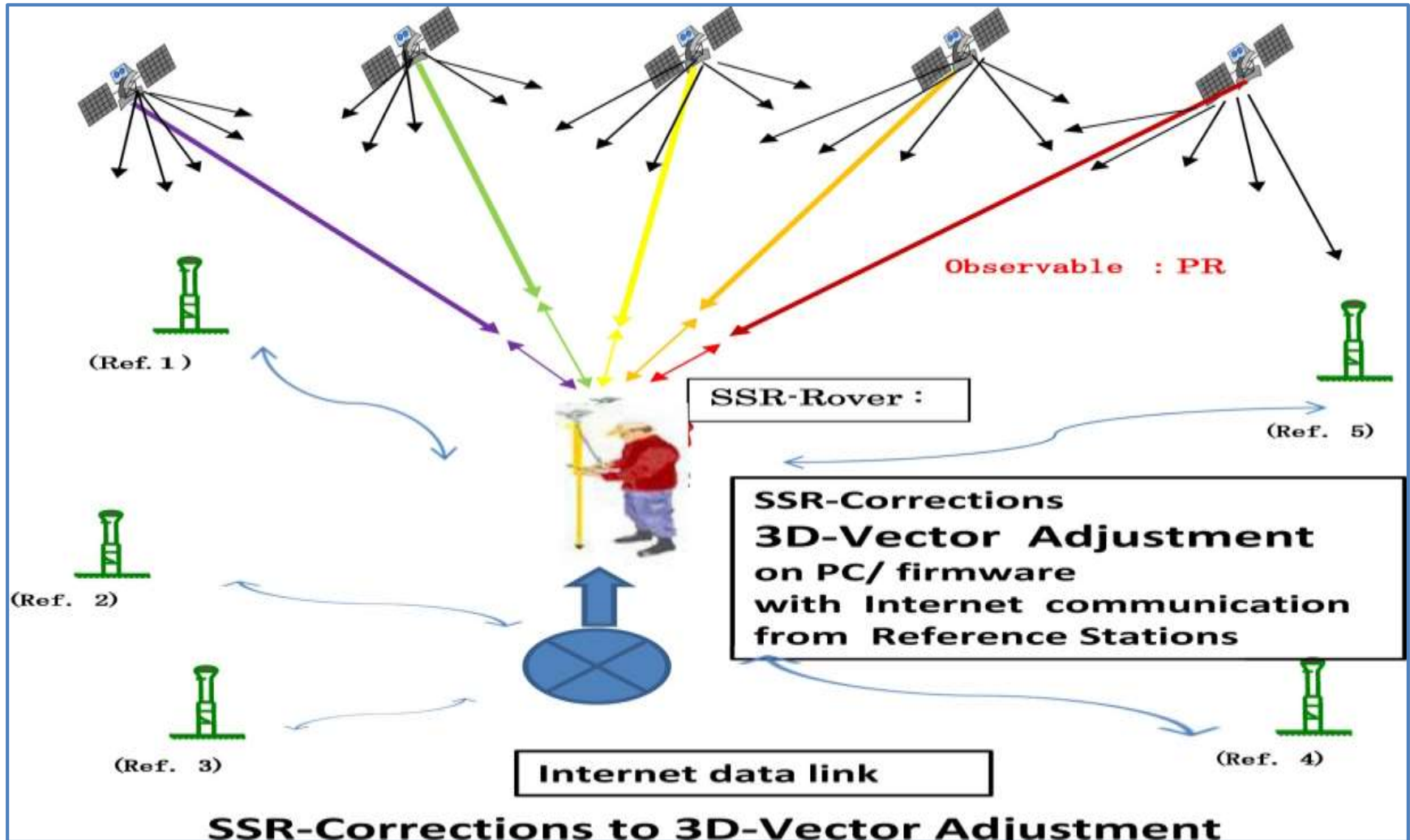
Positioning geospatial information to address global challenges

ggim.un.org

4.1.6 Angkor-UN-GGRF-PANDA-GN-SMART- Networking FKP-Parameter Estimation - Real Time Adjustment

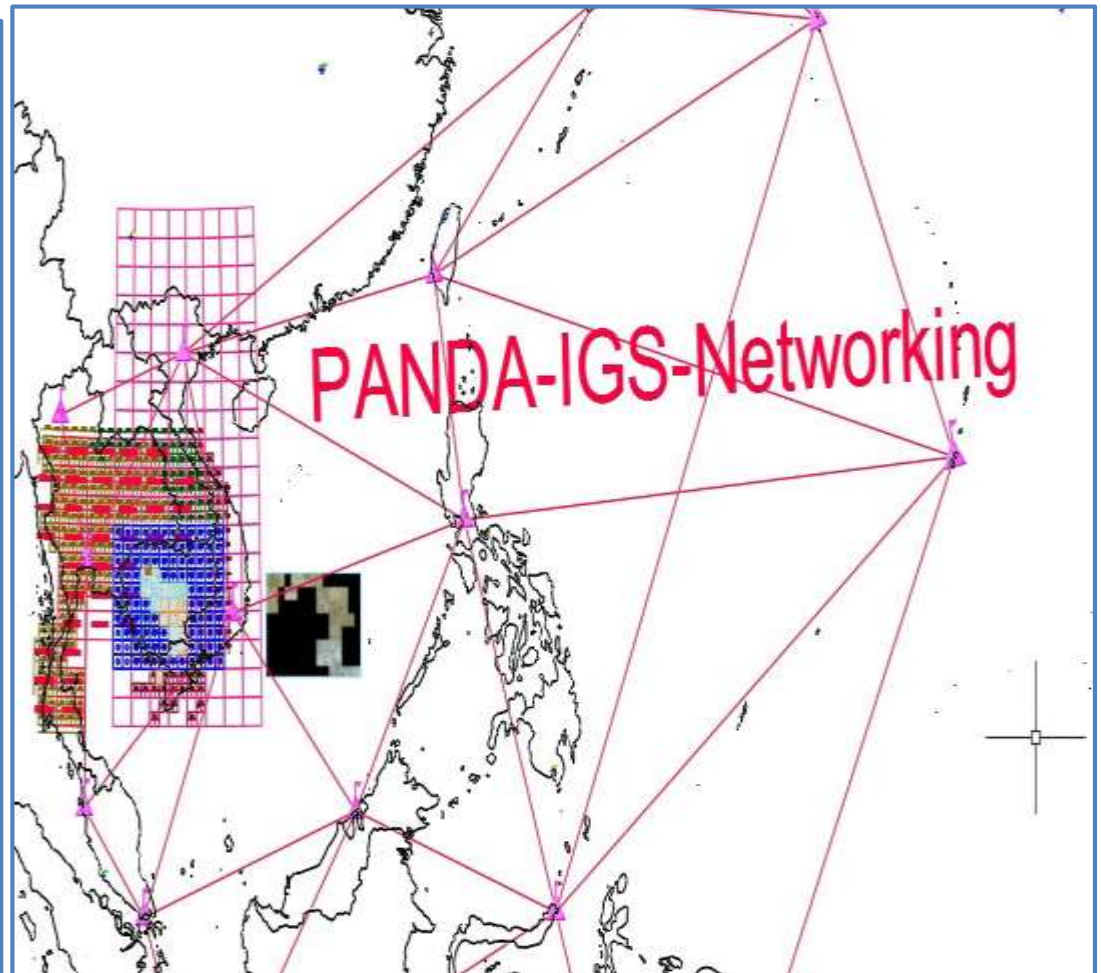
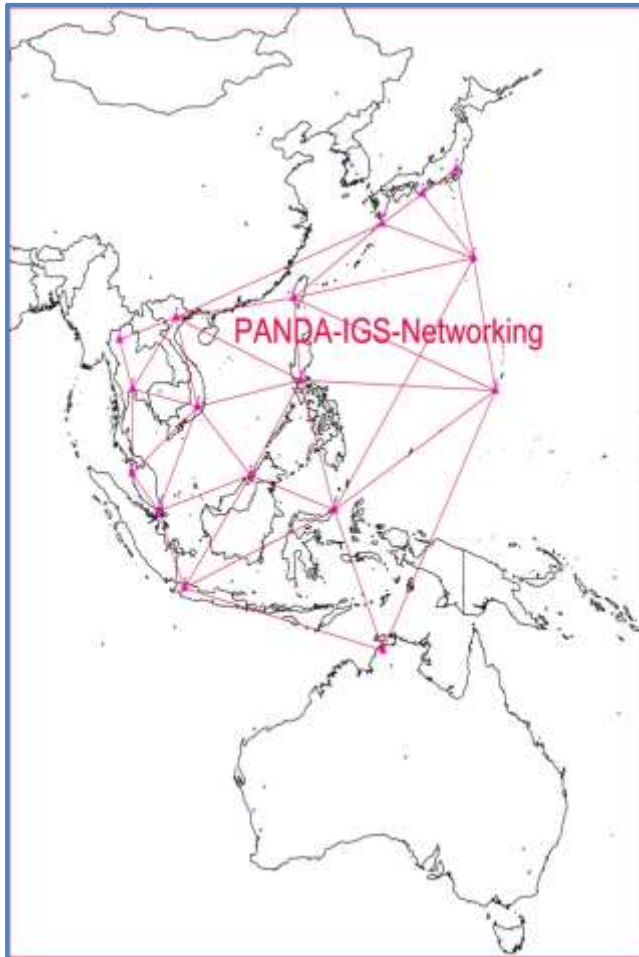


4.1.7 Angkor-UN-GGRF-PANDA-GN-SMART- Networking GNSS real time : SSR-bundle adjustment

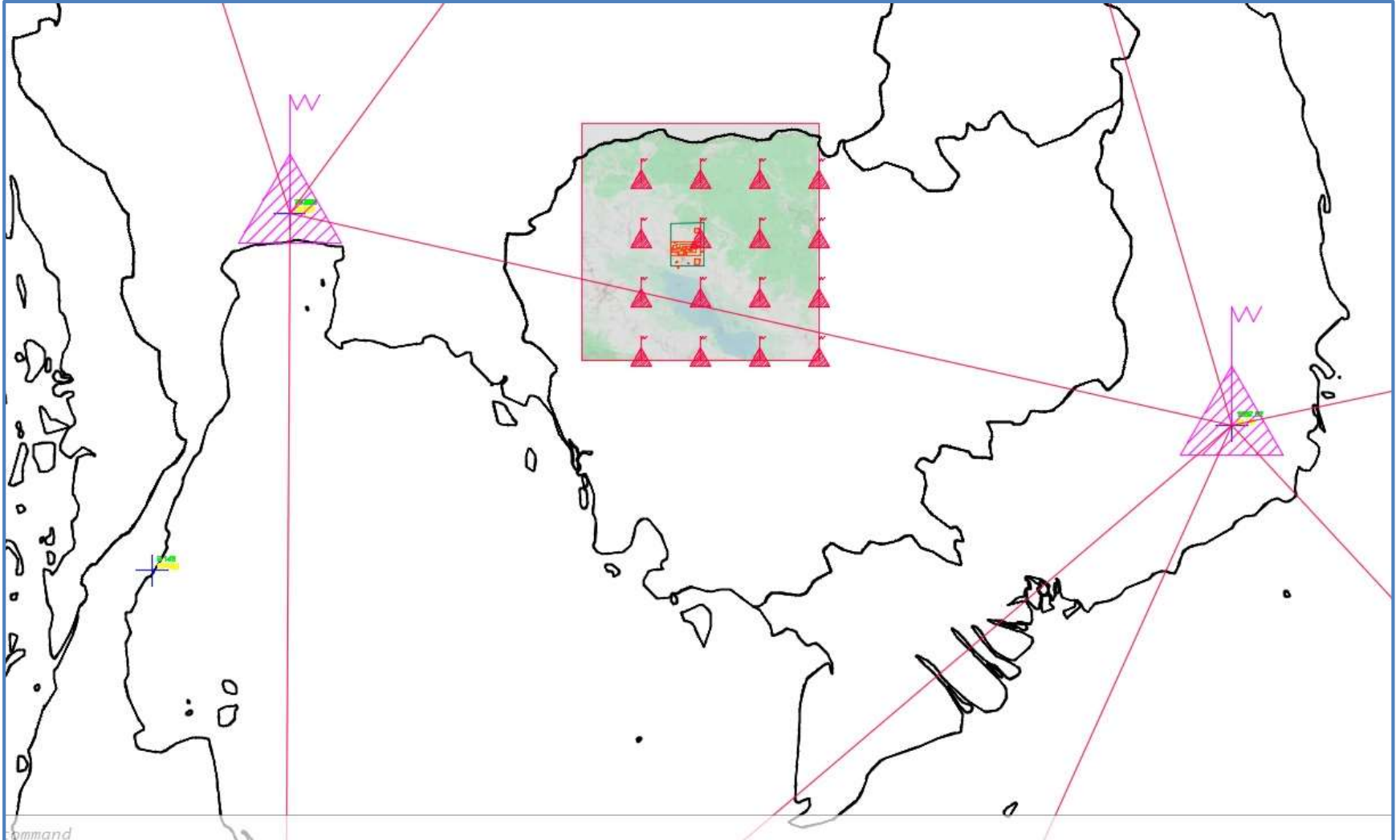


4.1.8 Angkor-UN-GGRF-PANDA-GN-SMART- Networking

4.1.8.1 1998-1910 maps PANDA-IGS-networking



4.1.8.2 Angkor-UN-GGRF- Networking IGS references – Siem Reap Province references



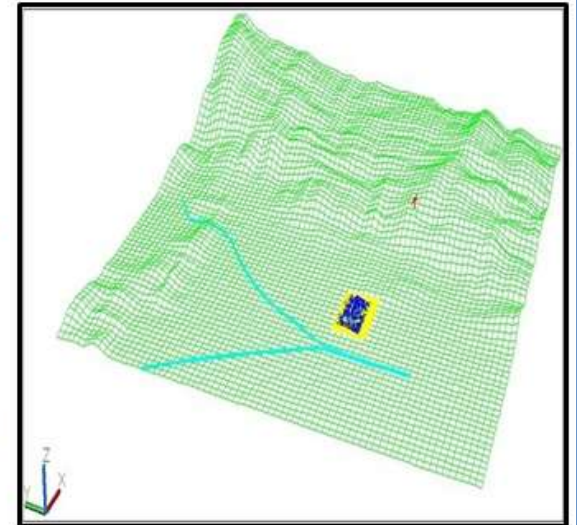
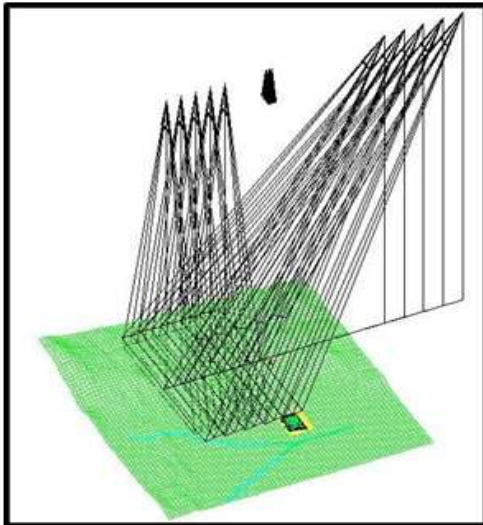
4.2 Satellite Photogrammetry

4.2.1 Satellite stereo-image model – 3D Mapping

Kyoto University stereo Pair : World View2

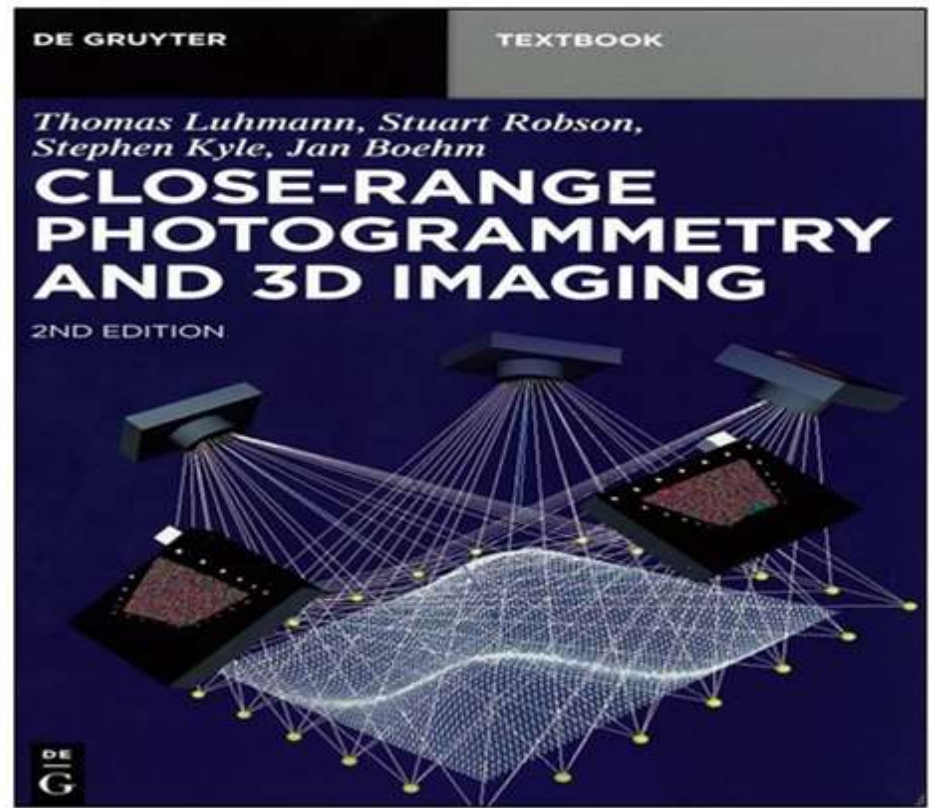
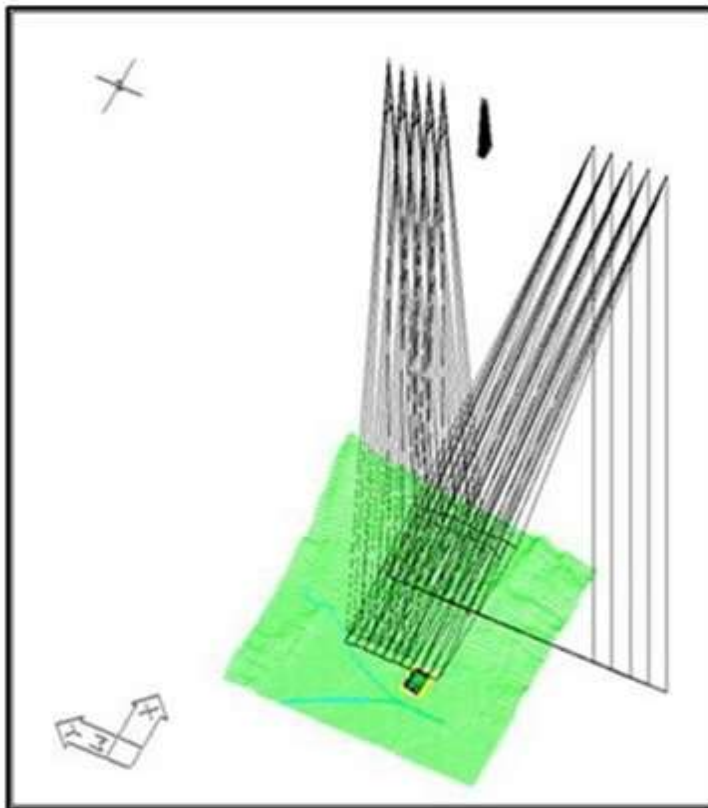
衛星画像3D-Mapping: Satellite stereo-image model – 3D-Mapping

- (1) リモートセンシングは衛星画像3D-Mapping: 衛星画像航測法に進化する。
Remote Sensing technology evolves to Satellite Image Photogrammetry for 3D-Mapping.
- (2) 高解像度衛星画像は航空撮影の精度: 地上精度10cmに達した。
High resolution satellite imagery realizes ground accuracy of 10cm, as aerial photogrammetry reached.
- (3) 航測法(航空写真、衛星画像)は、3D-CADによる3D-Mappingに、3D画像モデルを提供する。
3D Photogrammetric models, with CAD maps and CAD globe on 3D-CAD, represents Historical Reality.
- (4) 3D画像モデル-4D画像地図は、画像アーカイブとして、国土情報制度(GISe)の社会基盤である。
3D-Image models and 4D-Image maps represent infrastructural basis of GeoInformationsSysteme.

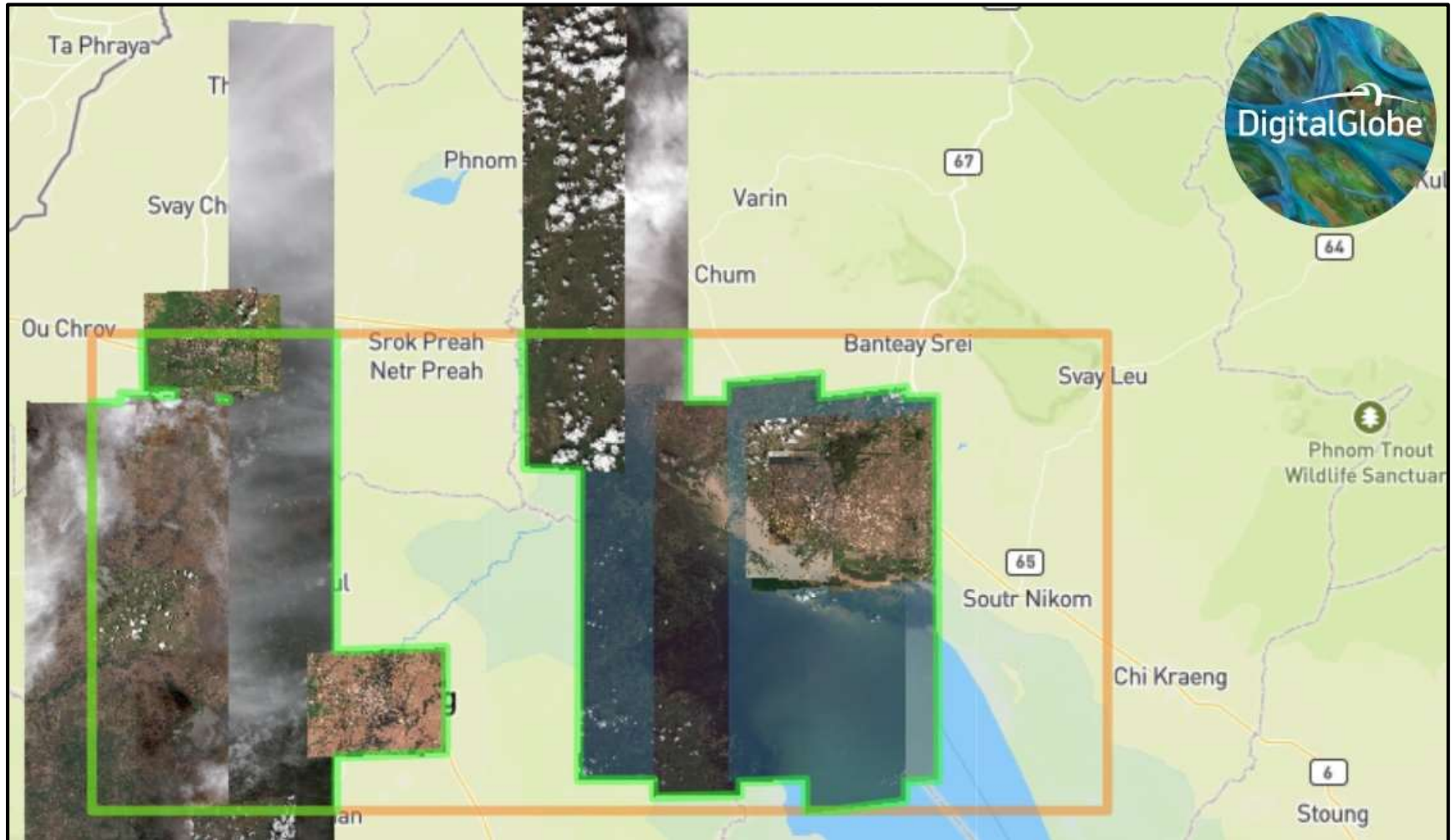


4.2.2 Satellite Photogrammetry and Close-Range Photogrammetry

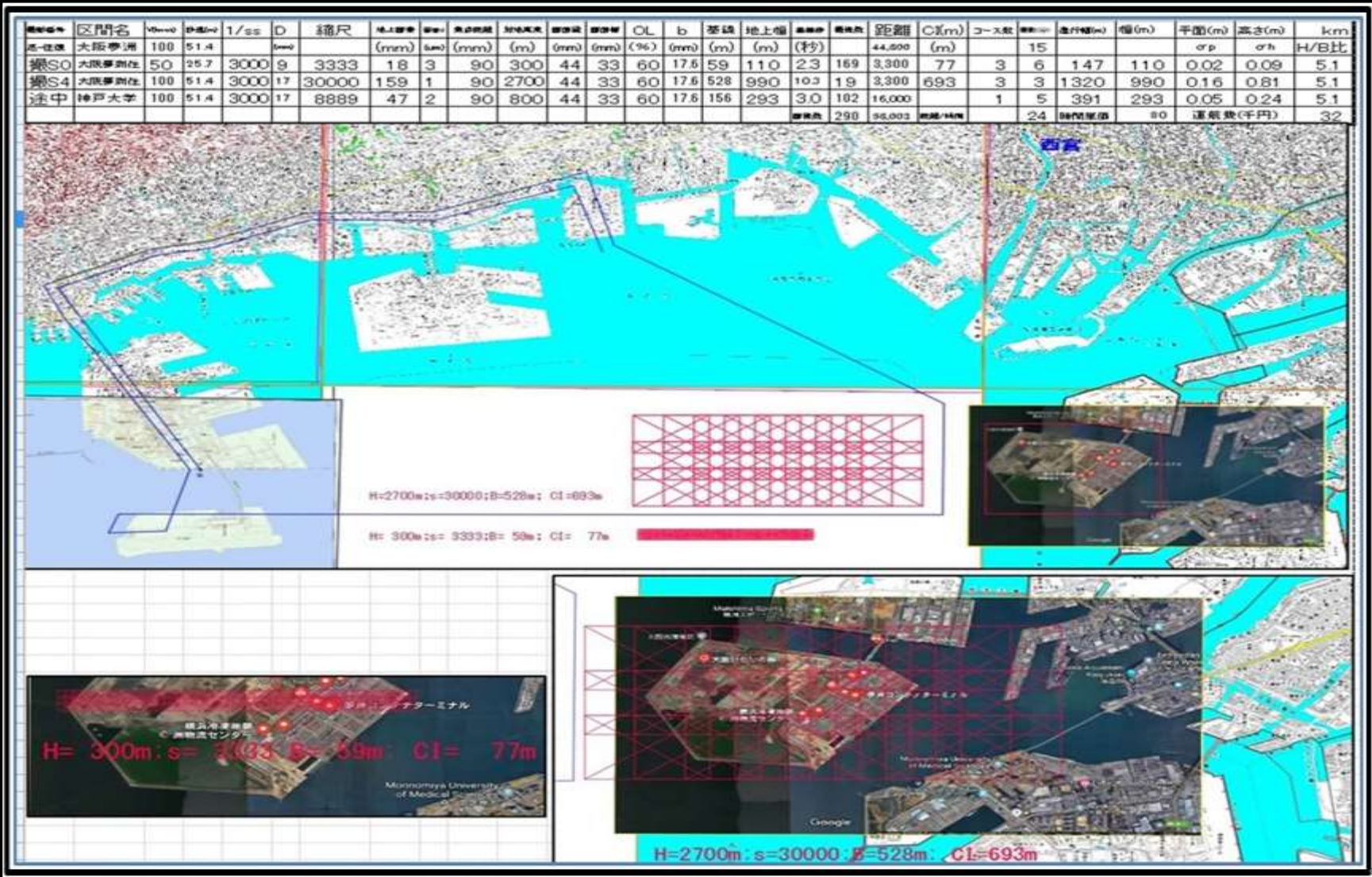
Satellite Photogrammetry and Close-Range Photogrammetry Stereo model of line sensor imagery and Close Range Photogrammetry and 3D Imaging: Thomas Luhmann 2015



4.2.3 Digital Globe - Angkor Wat area Index map



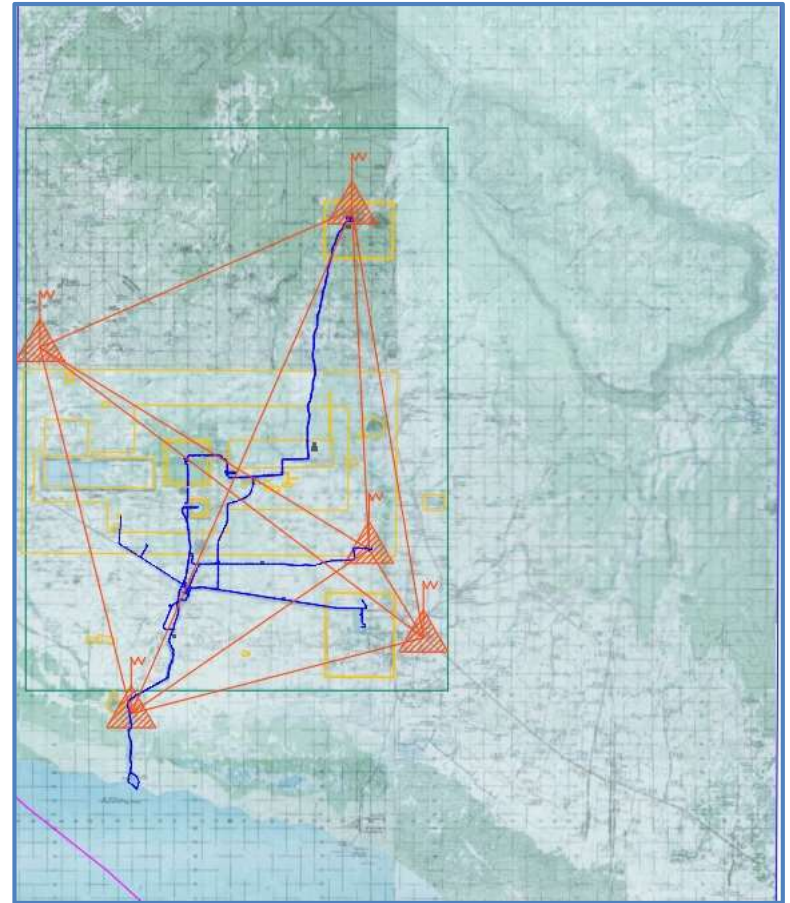
4.3 Helicopter photogrammetry Osaka EXPO2025 area : R22- Pentax planning



4.3.1 Helicopter/Drone photogrammetry APSARA area Flight areas04

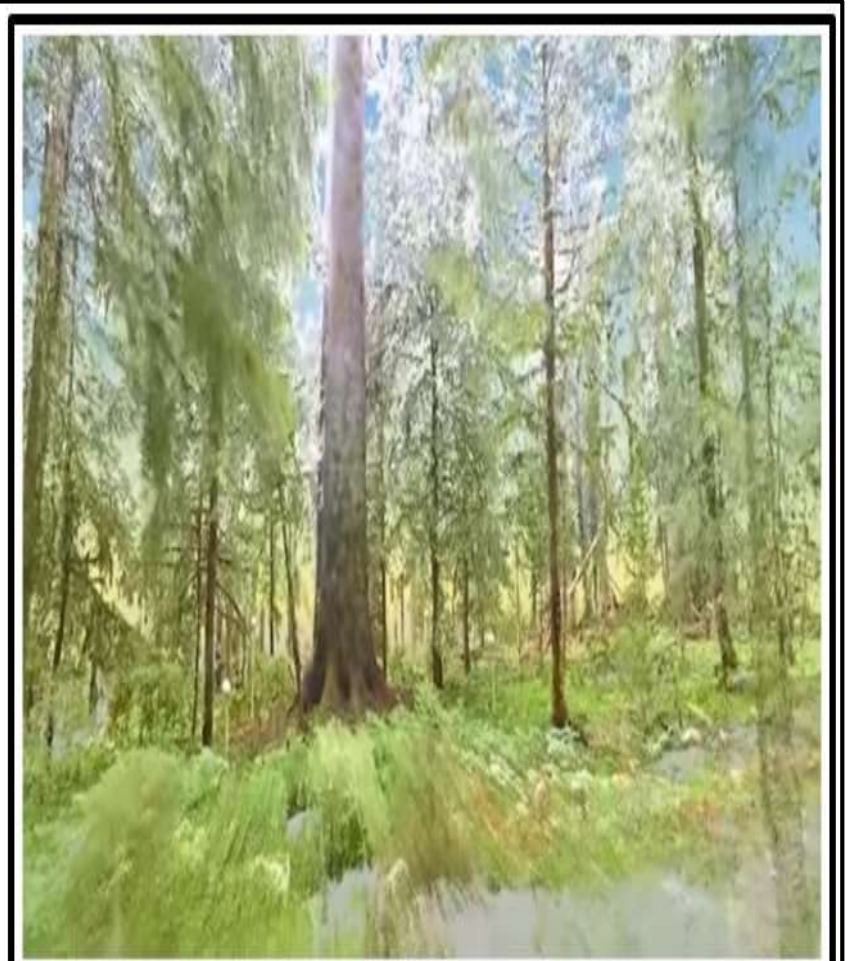


4.4 DGPS 3D mapping : TakTak mobile and TS-3D CAD



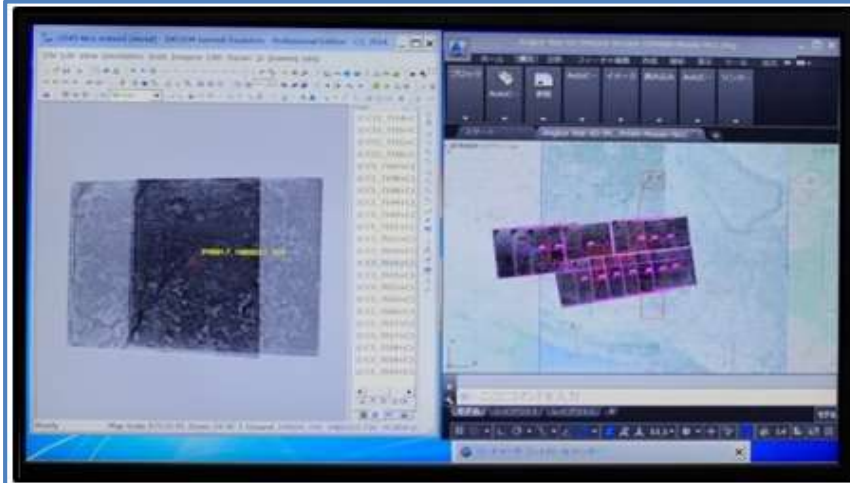
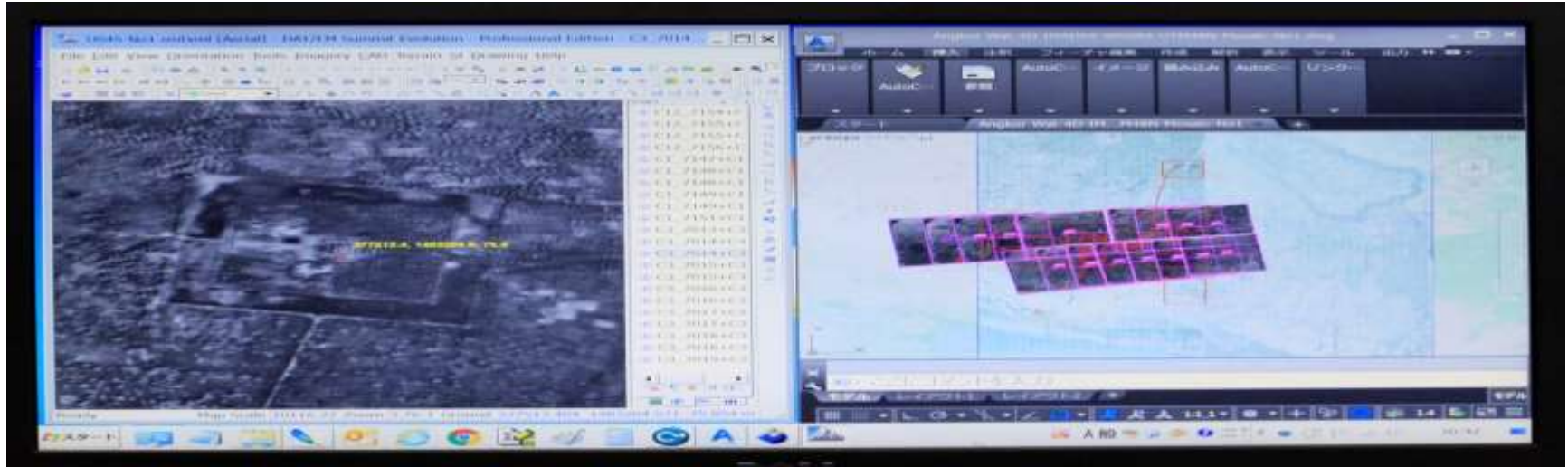
LIDAR mapping, TS and GNSS – 3D CAD system

4.5 TLS-TS Dome-shape traversing Leica-BLK360 and Forest laser dome traversing

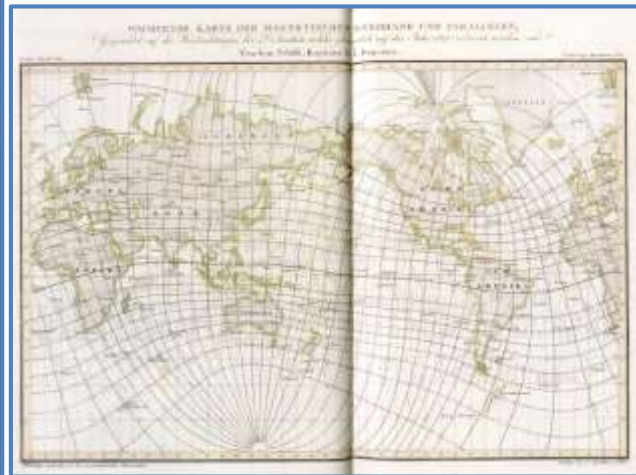
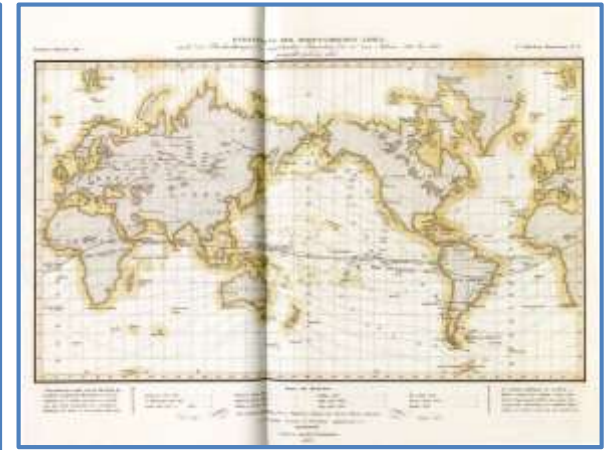
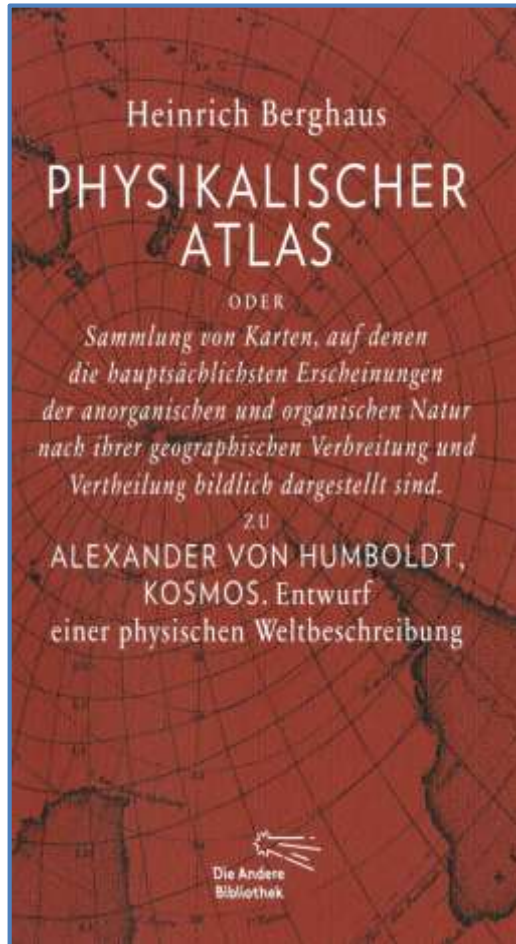


Terrestrial Laser Scanning of a "Plenterwald" Forest in Southwest Germany

4.6 Aerial photogrammetry :Angkor Wat 1945 bundle adjustment



5. 3D image modeling as Historical Reality : 4D-IMA : Physikalischer Atlas zu KOSMOS: A.v. Humboldt (1850)



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

References

Hasegawa, Hiroyuki (2013)

**, 3D Image Map Archive Designed Area Studies (3D-IMADAS)
Pacific Neighborhood Consortium :
Annual Conference and Joint Meetings 2013**

Niemeier, Wolfgang (2008)

, “Ausgleichsrechnung”; Walter de Gruyter

Seeber, Guenter (2003)

, “Satellite Geodesy “; Walter de Gruyter

Luhmann, Thomas (2018)

, ”NahbereichsPhotogrammetrie”; Herbert Wichmann Verlag



FIG WORKING WEEK 2019

Hanoi, Vietnam 22 - 26 April 2019

Geospatial information for a smarter life and environmental resilience

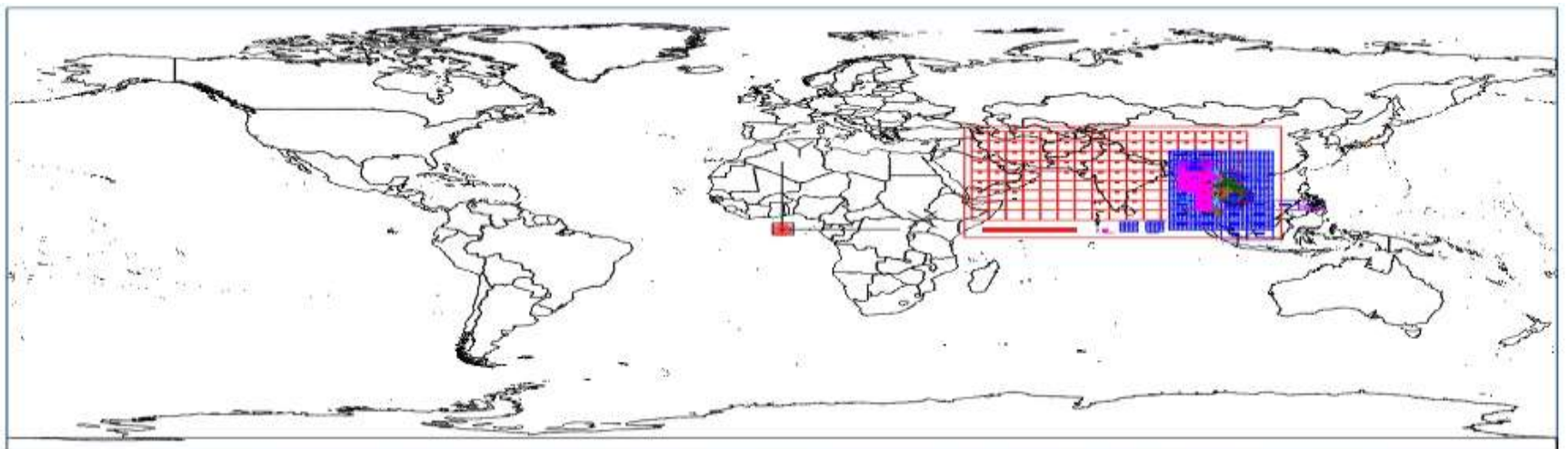
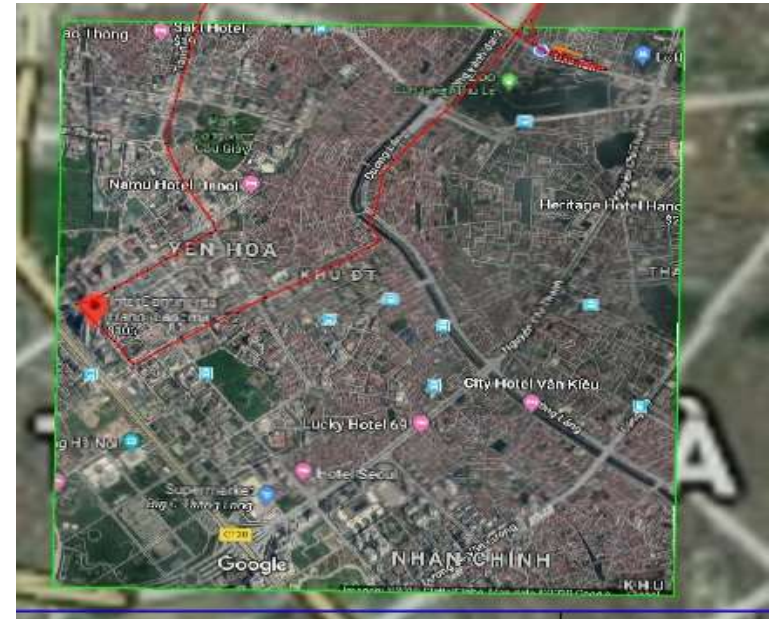




FIG WORKING WEEK 2019

Hanoi, Vietnam 22 - 26 April 2019

Geospatial information for a smarter life and environmental resilience



4D-IMADAS with 3D mapping of Kyoto(Heian) - Angkor(Khmer) capitals

**Thank you very much
for your kind attention !!!**

**Hiroyuki HASEGAWA, GeoNet, Inc. , Japan
Dr. Heng Kim LENG and Mr. Kim Samnang
, APSARA National Authority, Cambodia
2019.4.25**