Засгийн газрын тохируулагч агентлаг
Газрын харилцаа, геодези, зураг зүйн газар

Administration of Land affairs, construction, geodesy and cartography of Mongolia

GEODETIC NETWORK AND GEOID MODEL OF MONGOLIA

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COORDINATE SYSTEMS USED IN MONGOLIA

- STATE coordinate system,
  - BALTIC sea level
    - Topographical maps produced in 1960-1990s /1:25000-1:1000000/
- LOCAL coordinate system,
  - BALTIC sea level
    - Topographical maps produced in 1960-1990s in Ulaanbaatar and other cities /1:500-1:10000/
- Monref97 coordinate system,
  - BALTIC sea level
    - Topographical maps produced since 2005
    - Cadastral maps
    - Orthophotos

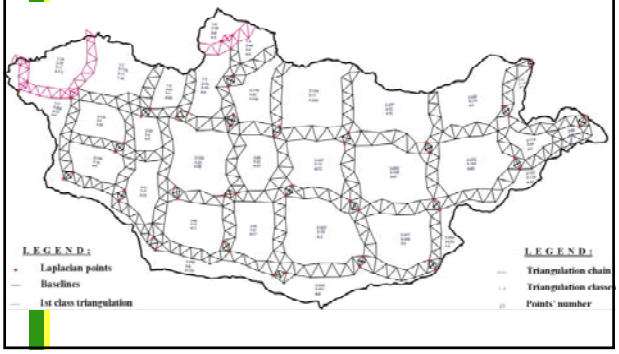
GEODETIC NETWORK AND GEOID MODEL OF MONGOLIA

- Coordinate systems used in Mongolia
  - Geodetic network
  - Datum, ellipsoid
- Coordinate transformation
  - State – GPS
  - Local – GPS
- Geoid height model of Mongolia
- Government decision
  - WGS-84 – coordinate system
  - Baltic sea level – height system
  - UTM – projection

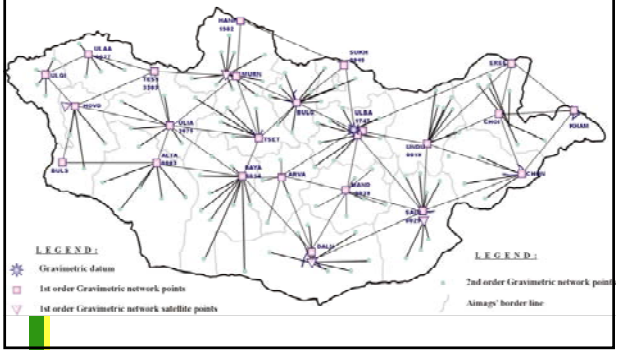
COORDINATE SYSTEMS - STATE

- **STATE coordinate system**
  - Datum: Pulkovo 1942,
  - Ellipsoid: Krassowsky,
  - Projection: Gauss-Kruger \6 degree's 5 zones\
  - Height system: Baltic sea level,
  - Geodetic network: Triangulation, trilateration, levelling, gravity /connected to Russian geodetic networks/
  - Topographical maps: small and medium scale \1:25 000-1:1 000 000\,

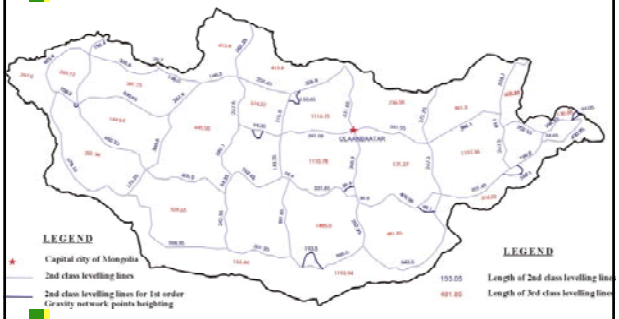
TRIANGULATION NETWORK /1940/



GRAVITY NETWORK



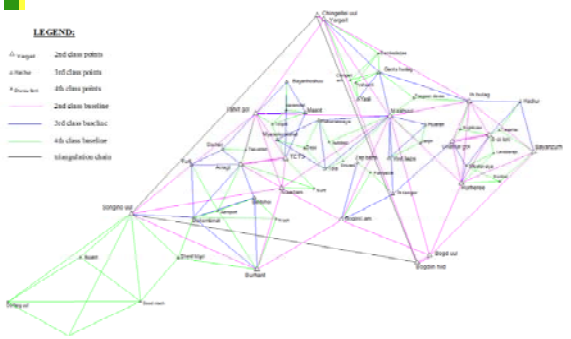
HEIGHT NETWORK



COORDINATE SYSTEMS - LOCAL

- **LOCAL coordinate system**
  - No geodetic definition
    - Datum: Already destroyed
    - Ellipsoid: no
    - Projection: no
  - Height system: Baltic sea level, local height system
  - Geodetic network: Triangulation, polygonometry and levelling
  - Maps: Large scale topographical maps \1:500-1:10000\
  - No connection to State coordinate system

UB CITY'S TRIANGULATION NETWORK



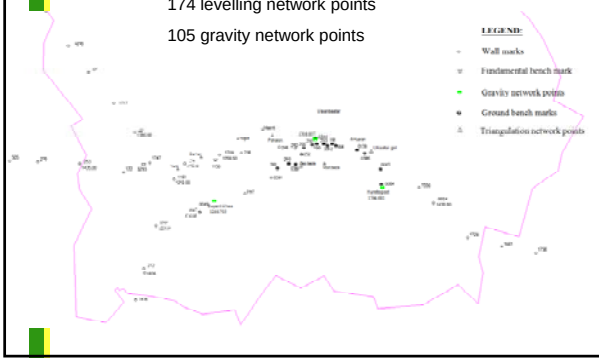
COORDINATE SYSTEMS – Monref97

- **GPS coordinate system**
  - Datum: WGS-84,
  - Ellipsoid: GRS-80,
  - Projection: Gauss-Kruger \6 degree's 5 zones\
  - Maps:
    - Cadastral maps,
    - Aimag and sum centers'1:1000-1:2000 maps, Orthophotos,
    - Topomaps produced along Mongolia-China border,
    - 1:5000 topographic map produced by JICA in UB
  - Height system: Baltic sea level,
  - Geodetic network: Monref 97
  - Monref 97 connected to IGS 5 stations

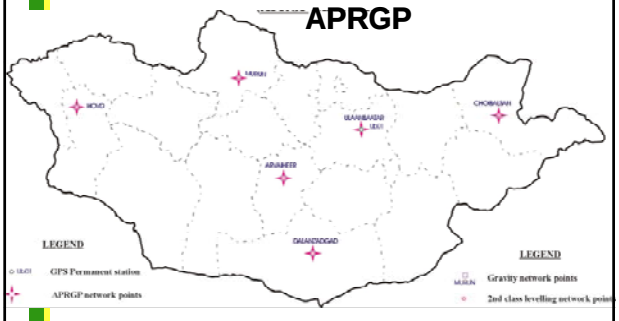
UB CITY'S HEIGHT AND GRAVITY NETWORK

174 levelling network points

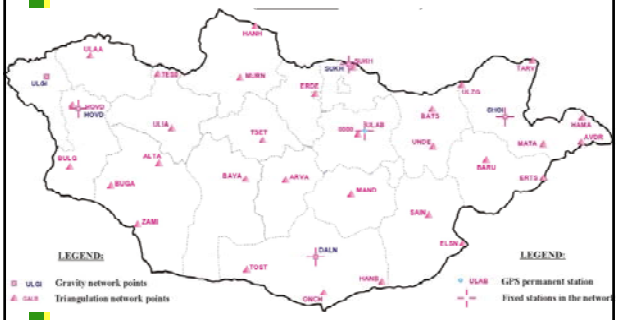
105 gravity network points



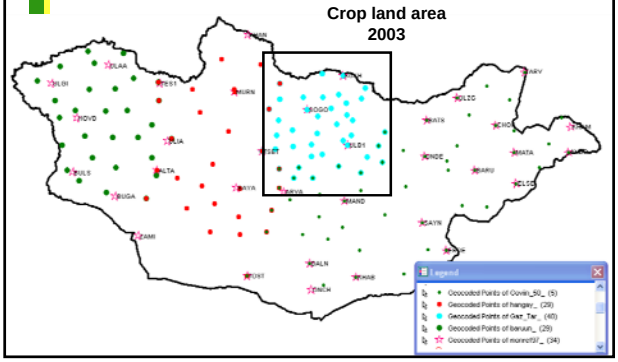
ASIA-PACIFIC REGIONAL GEODETIC PROGECT /1999-2009/



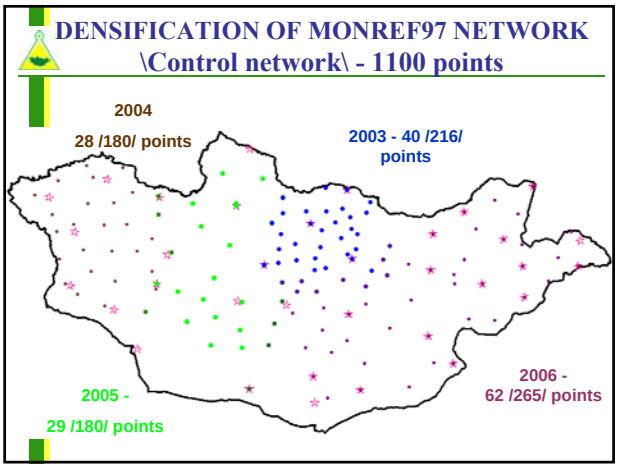
PRIMARY GEODETIC NETWORK- MONREF97 /1997-1998 - 34 points/



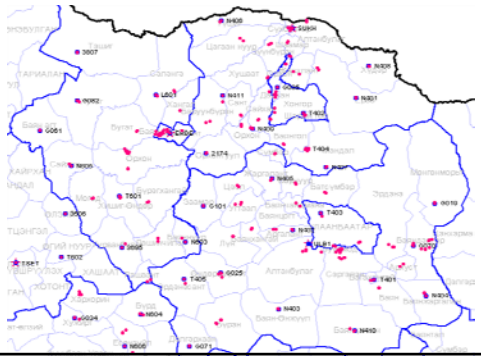
DENSIFICATION OF MONREF97 NETWORK \Mapping network\ - Crop land area



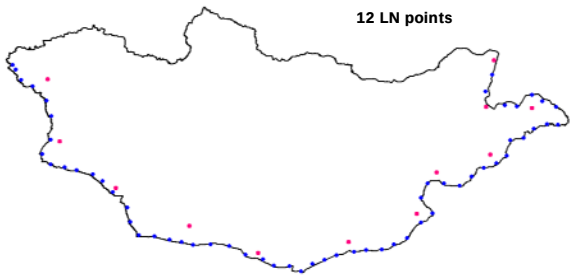
DENSIFICATION OF MONREF97 NETWORK \Control network\ - 1100 points



DENSIFICATION OF MONREF97 NETWORK \Mapping network\ - Crop land area 90 - aimag, sum, village 216 points

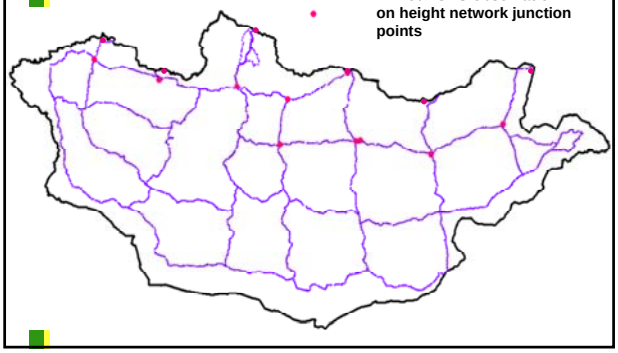


GPS NETWORK ALONG MONGOLIA-CHINA BORDER



UB CITY'S GEODETIC NETWORK /2002/

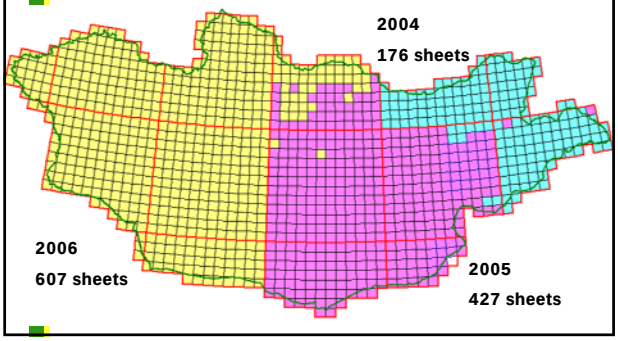
MONGOLIA- RUSSIA GPS NETWORK



COORDINATE TRANSFORMATION

- **Transformation between State and GPS coordinate system**
  - 1-2 m accuracy 2D
  - 3-4 m accuracy 3D
  - 2D transformation was used for 1:100000 and 1:25000 topographic map digitalization

1:100 000 SCALE MAP DIGITALIZATION

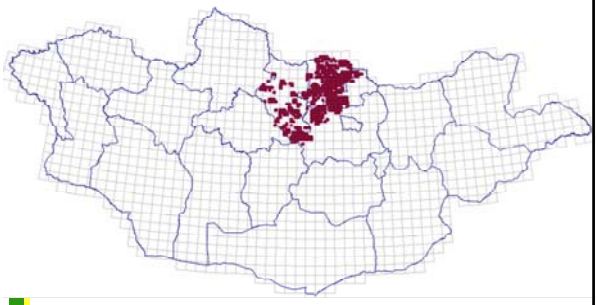


COORDINATE TRANSFORMATION

- **Transformation between Local /UB/ and GPS coordinate system**
  - 40 cm accuracy using 9 points data /2-3rd class triangulation network points/
  - 16 cm accuracy using 100 points data /4th class triangulation network points/

To produce large scale topographical maps /new/ - KOIKA project in 2010 for producing 1:1000 scale map

1:25 000 SCALE MAP DIGITALIZATION



MONGOLIAN GEIOD HEIGHT MODEL

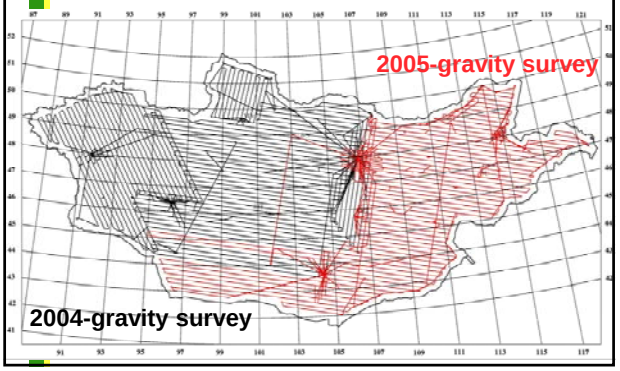
- Airborne gravity project
  - Financed by USA /NGA/
  - Implemented by
    - NGA /USA/
    - Danish National space center
    - University of Bergen /Norway/
    - Monmap LLC /Mongolia/
    - ALACGaC /Mongolia/
  - Purpose:
    - To produce Mongolian geoidal height model
    - To improve EGM96 for Mongolia

MONGOLIAN GEIOD HEIGHT MODEL

AIRBORNE GRAVITY PROJECT

- Airborne gravity measurement in 2004-2005 /USA financed project/
- DGPS measurement
- Absolute gravity measurement
- 2004-2005 data processing
- Training on data processing
- EGM06 model improvement /in Mongolia/

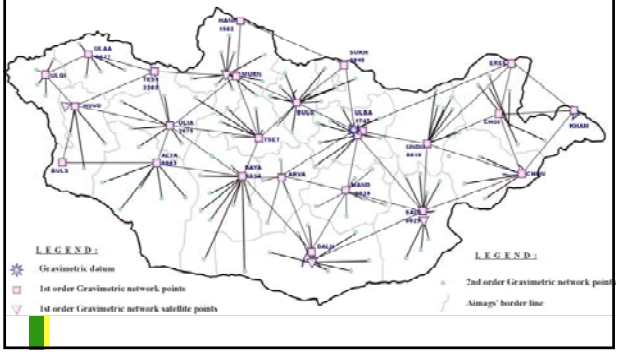
MONGOLIAN GEIOD HEIGHT MODEL



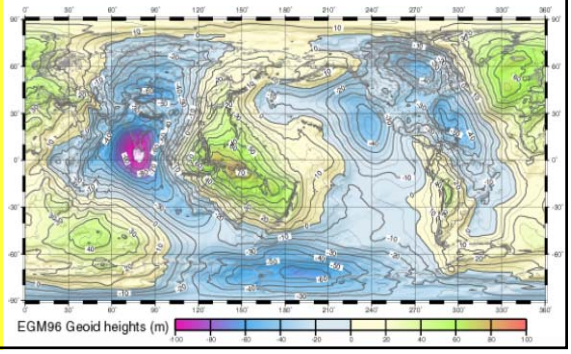
GEIOD MODEL OF MONGOLIA

- **Processing /combination of data/**
  - Airborne gravity data
  - Mongolian gravity network data
  - Geological gravity survey data
  - EGM96 data
  - GRACE data
  - SRTM /1-3 sec/
  - GPS/Levelling data

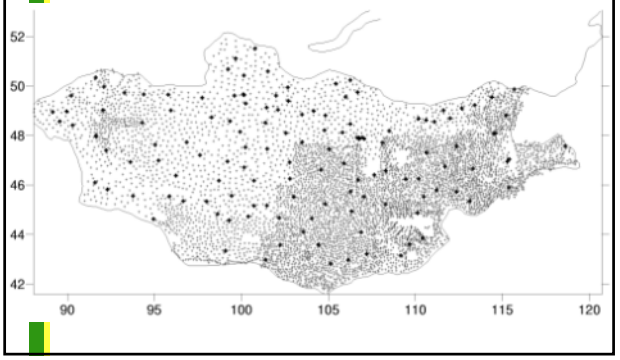
GRAVITY NETWORK



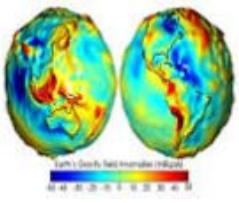
EGM96



GEOLOGICAL GRAVITY SURVEY DATA

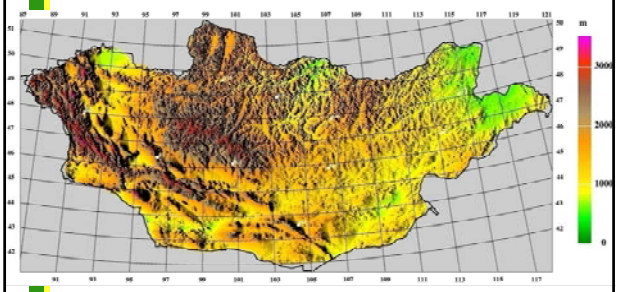


GRACE SATELLITE DATA

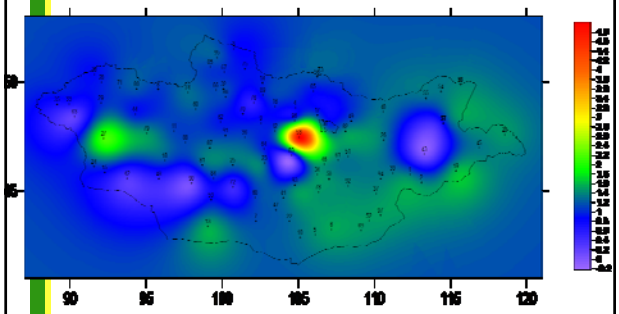


SHUTTLE RADAR TOPOGRAPHY MISSION, SRTM, DEM

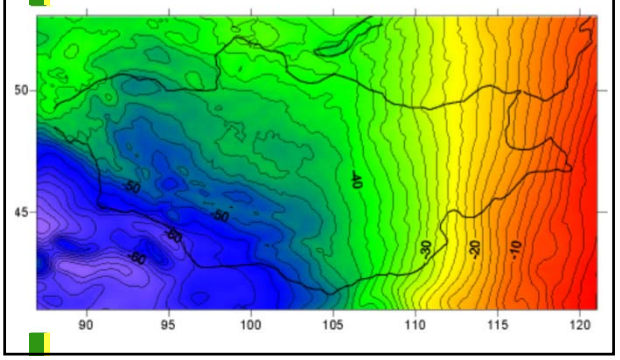
NASA, NGA, USGS
30-90 ì



ÃÅÎÈÄÛÍ ÇÀÃÂÀÐÛÍ ÍÀÐÈÉÂ×ËÀËÛГ САЙЖРУУЛСАН НЬ



COMPUTED GRAVIMETRIC QUASIGEOID OF MONGOLIA



GEIOD HEIGHT MODEL OF MONGOLIA

- **Geoid model accuracy**
  - < 20 cm for whole country
  - 2-5 cm in UB
  - Used for cadastral and topographic mapping
- **GPS measurement on levelling network's junction points in 2010 to improve geoid height model accuracy**

THE MONGOLIAN GOVERNMENT DECREE ON UNIQUE COORDINATE SYSTEM

- **Government decree No25 on 28 January 2009**
  - WGS-84 coordinate system
    - WGS-84
    - Transformation parameter
  - Baltic sea height system
    - Geoid height model
  - UTM projection
    - 6 degrees

THANK YOU FOR YOUR ATTENTION