



Improvement of the ellipsoid height for maps of Uzbekistan based on GPS data

E.Mirmakhmudov, E.Safarov, D.Fazilova

**The National University of Uzbekistan
Astronomical Institute of the Uzbek Academy of Sciences**

erkin_mir@yahoo.com
erkin_mir@mail.ru
mob. +998971111958



**United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems**

Dubai, United Arab Emirates

16 – 20 January 2011





1.Introduce

2.The National University of Uzbekistan(Geographic faculty).

3.Ellipsoids

4.The Geoid

5.Local geoids

6.Baltic sea level

7.CATs network

Conclusion



**United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011**





Workshop on the Applications of Global Navigation Satellite Systems, Chisinau, Moldova, May 2010 ,Working Group #2 Geodetic Reference Networks

Recognizing the present status of Global Navigation Satellite Systems (GNSS) and the prospects for continued development of a wide variety of applications critical to science, commerce, and infrastructure.

The working group participants recommend the continuation of forums such as this one; bringing together system providers, geodetic infrastructure providers, end users, industry and academia.

Furthermore, these forums should be encouraged to discuss and propose specific recommendations for consideration by the International Committee on GNSS (ICG) and its Providers Forum.

Recognizing the densification of the ground-based GNSS infrastructure by the EUPOS initiative on the basis of IAG services and Sub-Commissions, considering the varied degree of GNSS ground-based reference infrastructure development among different regions of the world the working group recommend that the ICG support the development of GNSS ground-based infrastructure in all regions of the world, taking into account the unique conditions present in each region and the need for tailored approaches to implementation.

The working group discussed ways and means of following up the geodetic framework project, based on continuous observation, an analysis of GNSS data that could support many geospatial applications across the region. The working group agreed that GNSS training courses and workshops should be organized for interested countries in the region with no currently operating permanent reference stations. In that respect, tutorials should be made available to improve understanding of concepts related to terrestrial reference systems and frameworks. Therefore collaborations between States in the region and reference station networks such as a EUPOS and the International Association of Geodesy Reference Frame Sub-commission for Europe (EUREF) was encouraged.

The working group gratefully recognized that EUPOS represents a regional augmentation system with high precision positioning and navigation,

The working group noted that countries can benefit as a partner in EUPOS by

Economical and technical advantages, which are offered by a “full-scale accuracy” ground-based DGNSS augmentation infrastructure with unified standards, suitable for any application based on GNSS, which covers large regions of the continental plates, e.g. reduced costs;

Implementation and provision of the DGNSS infrastructure in the country to enable the use of key-technologies for different kinds of applications;

Gaining influence with regard to technical improvements and standardizations invented as a partner in EUPOS;

Exchange and distribution of knowledge and expertise of the EUPOS community;

Transfer of applications which are tested and introduced in other EUPOS countries; and

Cross-border use of reference stations of neighboring countries.

The working group indicated the importance of the high precision geoid models to be used for scientific exploration.



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates



16 – 20 January 2011



The National University of Uzbekistan (1918)



**United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011**



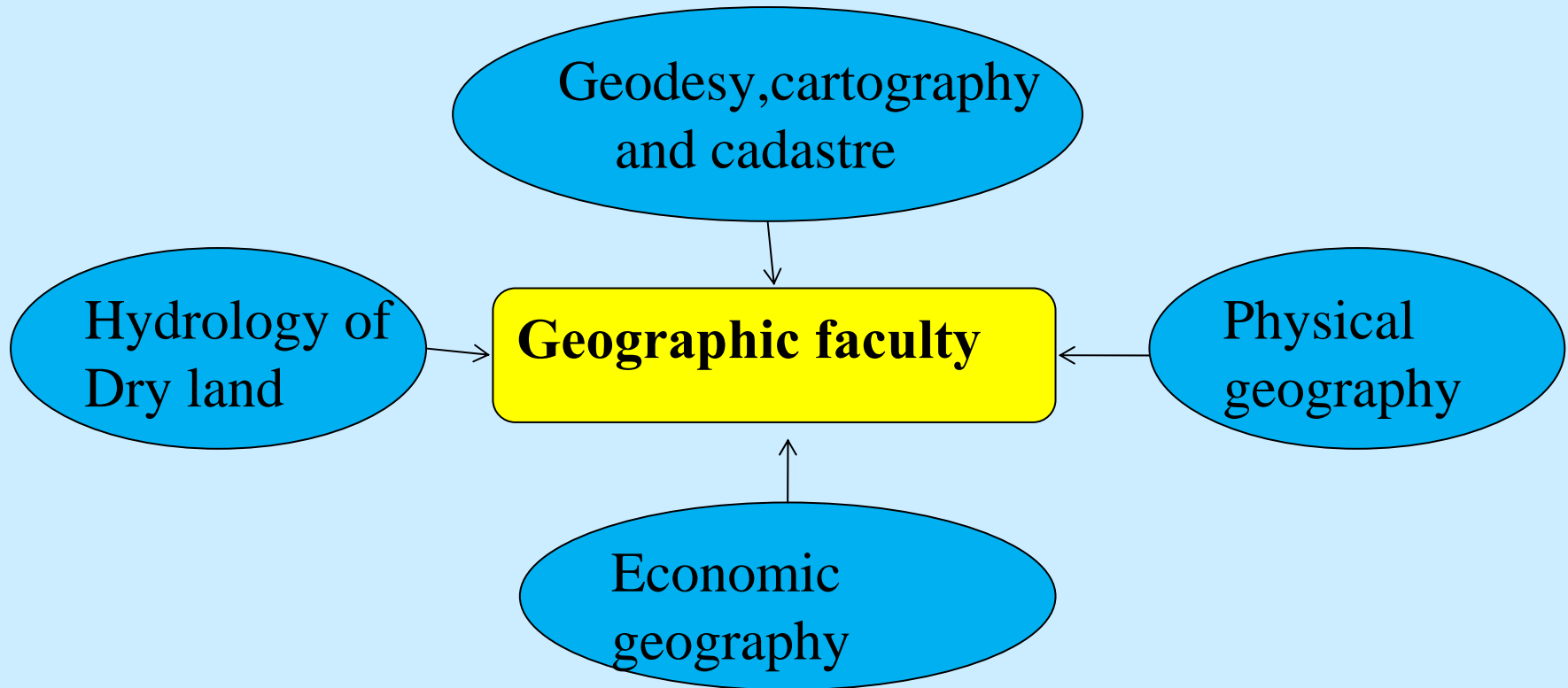


**The Geographic faculty of
the National University
of Uzbekistan
(1935)**



**United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011**







600
students



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011





**Geodesy, cartography
and cadastre sub-faculty**

subject

scientific invest.

- 1. topography,
- 2. Geodesy
- 3. Ing. geodesy
- 4. Math. cartography
- 5. Theory of math. cal.
- 6. Photogrammetry
- 7. digital mapping
- 8. GIS
- 9. High geodesy
- 10. Space geodesy
- so on

- 1. special mapping
- 2. digital mapping
- 3. Work out of the National Atlas
- 4. cartographic providing of a Education
- 5. mapping of Cadastre with help of GIS
- 6. Work out the local geodetic network



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates



16 – 20 January 2011



The first map of Uzbekistan (1772)



Location: the Royal Geographic Society (mr. Asis Div. 464) and in the British Library (Maps, King Topographical Collection, 114,53.4).



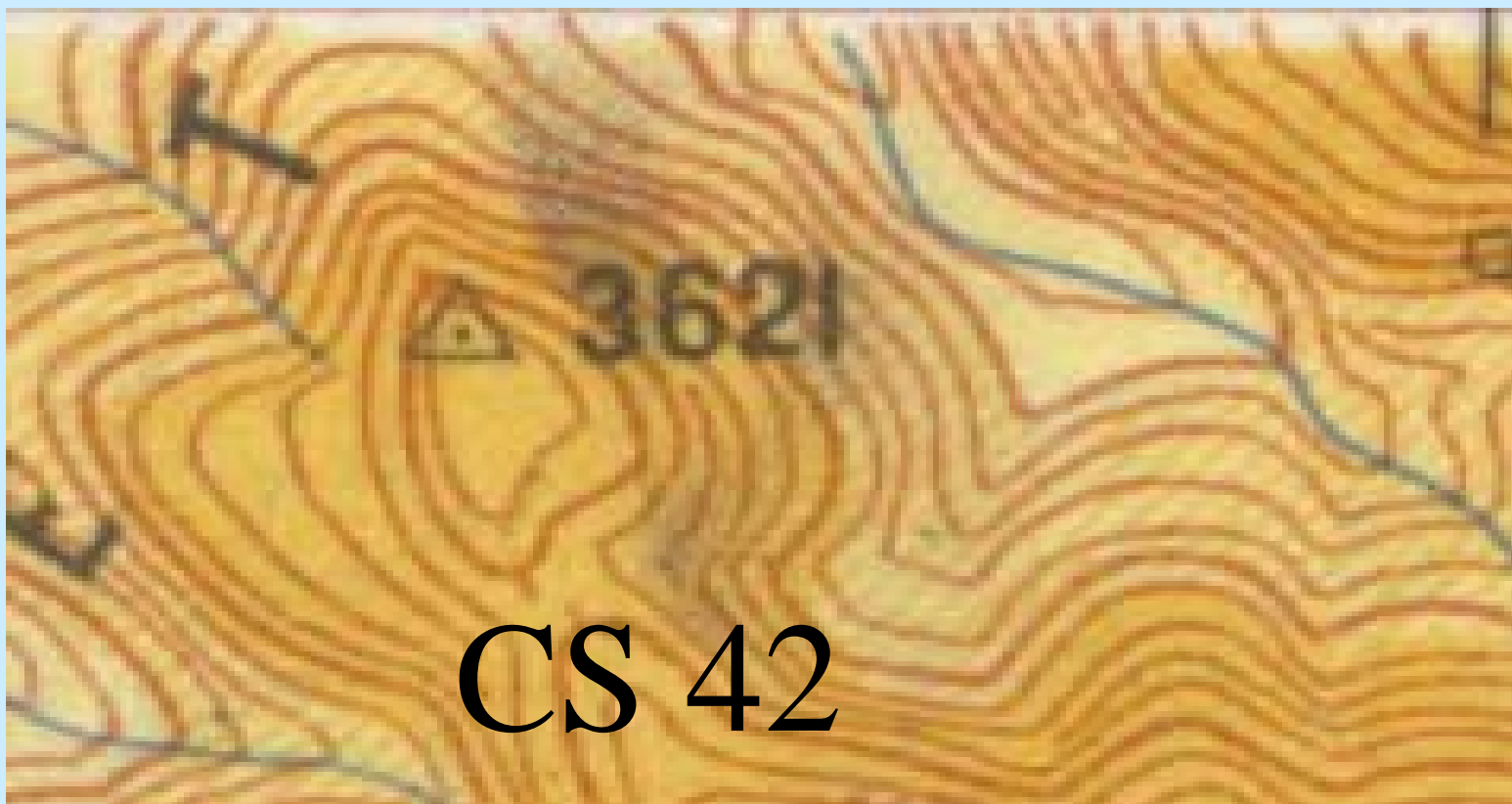
United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates



16 – 20 January 2011



The fragment of Uzbekistan map



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011





Kronstadt sea-gauge



$h = 0.0$ m.



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011





Widely in use are the following ellipsoids generally named after their generator:

Name	Date	a(m)(b(m)	Use
Everest	1830	6377276	6356079	India,Burma,Sn.Lanka
Bessel	1841	6377397	6356079	CentralEurope,Chile,Indonesia
Airy	1849	6377563	6356257	Great Britain
Clarke	1866	6378206	6356584	North America,Philippines
Clarke	1880	6378249	6356515	France,Africa (parts)
Helmert	1907	6378200	6356818	Africa (parts)
International (or Hayford)	1924	6378388	6356912	Word
Krasovsky	1940	6378245	6356863	Russia (former SU.Uzbekistan)
GRS80	1980	6378137	6356752	North America
WGS 84	1984	6378137	6356752	Word (GPS measurements)



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems

Dubai, United Arab Emirates

16 – 20 January 2011





**For WGS84
(GLOBAL)**

$$a_1 = 6378137\text{m}$$

$$b_1 = 6356752\text{m}$$

$$\text{Diff } a_1 \text{ \& } b_1 = \\ 21385\text{m}$$

For CS42

$$a_2 = 6378245\text{m}$$

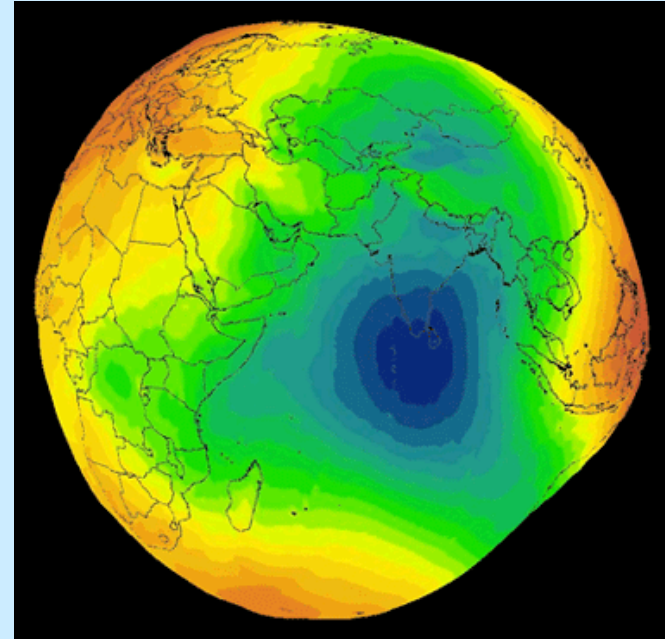
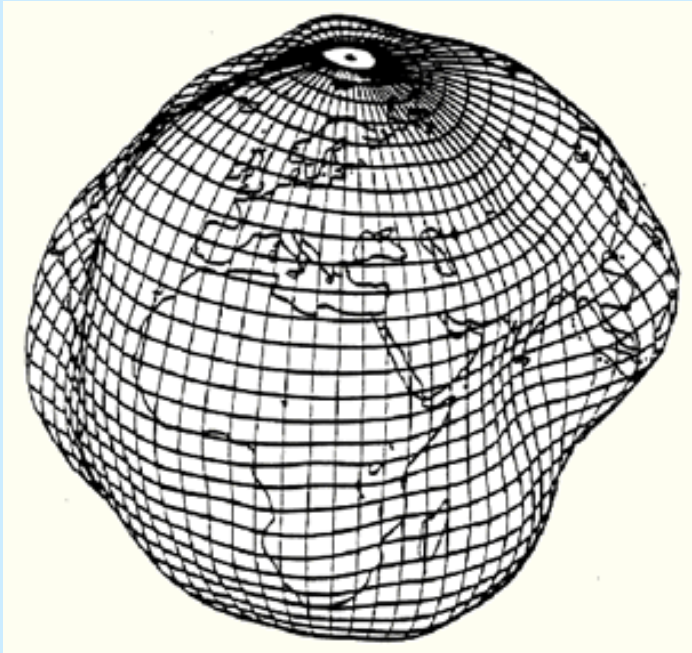
$$b_2 = 6356818\text{m}$$

$$\text{Diff } a_2 \text{ \& } b_2 = \\ 21427\text{m}$$





The Geoid



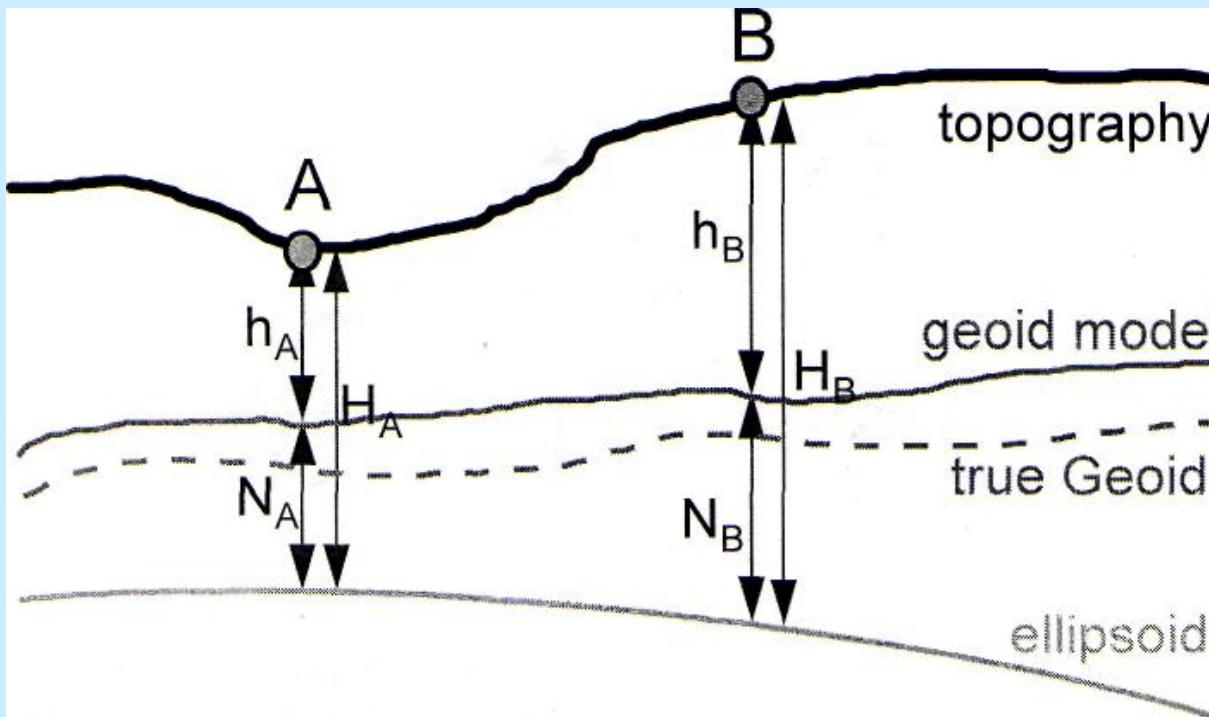
The geoid is an equipotential surface which most closely relates to mean sea level.

Derived by approximating size and shape of the world using mathematical figures.





Ellipsoid height H and orthometric height h of two points A and B related by a model of Geoid-ellipsoid separation N



$$H = h + N$$

$$\Delta h_{AB} = h_B - h_A = \Delta H_{AB} - \Delta N_{AB}$$



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems

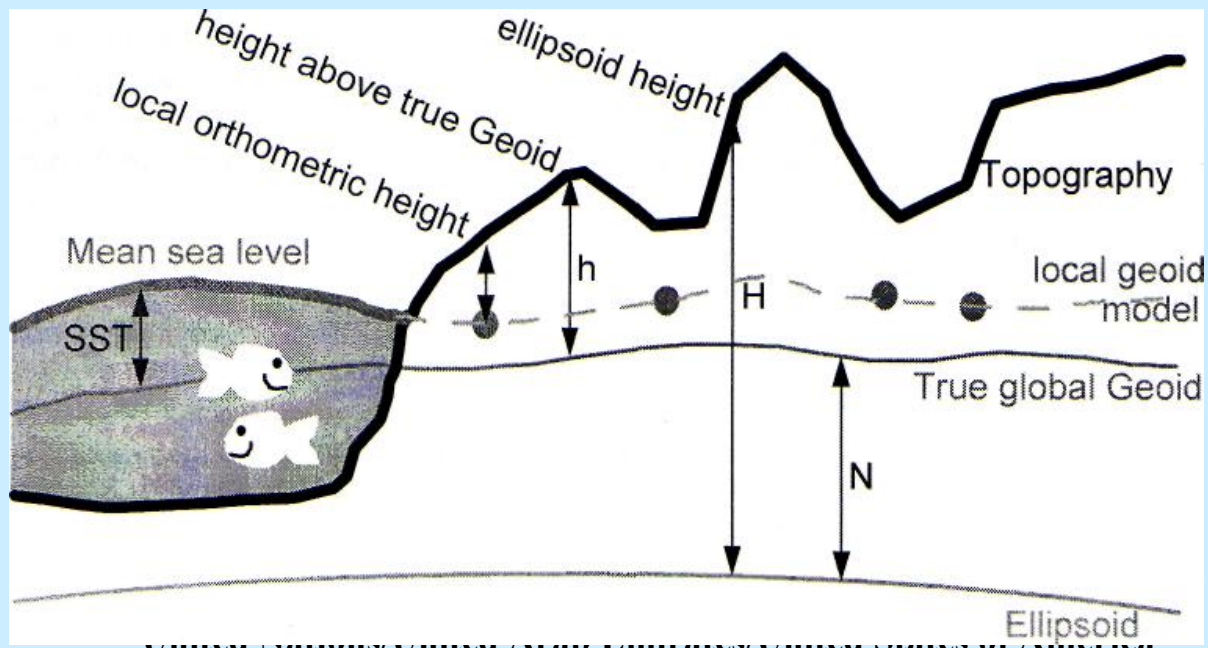


Dubai, United Arab Emirates

16 – 20 January 2011

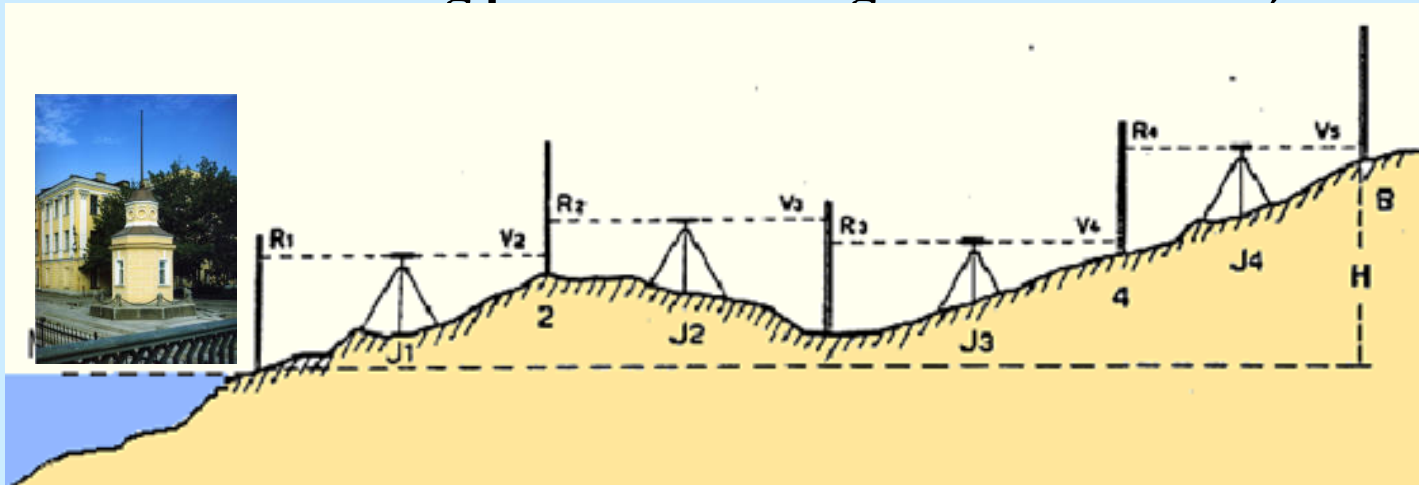


The relationship between the Geoid, a local geoid model (based on a tide-gauge datum), mean sea level, and a reference ellipsoid.





Differential leveling for height measurements (Baltic Sea Level is the starting point for the height measurements)





Why map datum's?

- **The Earth's surface is not a regular shape.**
 - **Cannot be used to make a map**
 - **The Earth is not round.**
 - **To make a map we need a regular shape.**
- **Maps came first, not GPS**



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems

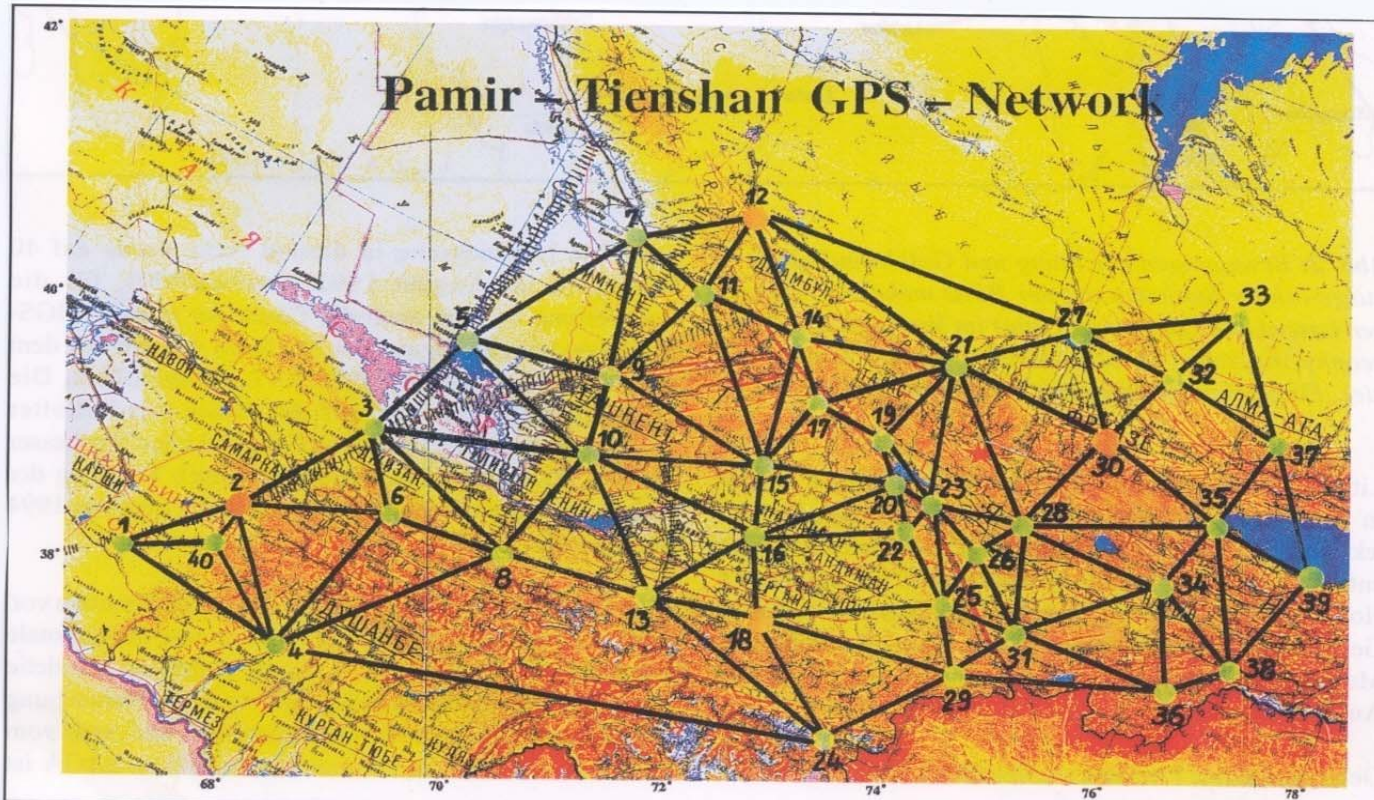
Dubai, United Arab Emirates

16 – 20 January 2011



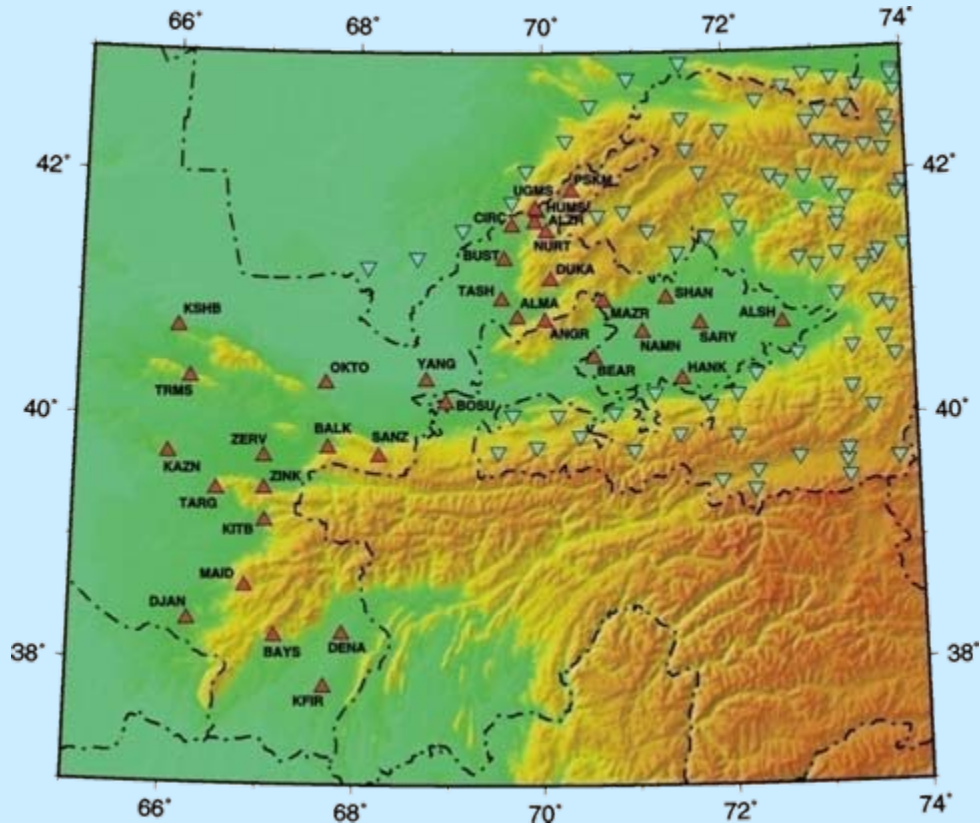


Central Asian Tectonic Sciences (CATs), GFZ, GERMANY





GPS network in Uzbekistan



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems

Dubai, United Arab Emirates

16 – 20 January 2011





GPS network in Uzbekistan

#		B	L	H,m
1	DJAN	38°20'16".1	66°6'21".7	790.5
2	KITB	39°8'5".2	66°53'7".6	622.6
3	OKTO	40°17'25".7	67°40'11".3	334.5
4	DENA	38°14'6".7	67°52'48".8	477.5
6	SANZ	39°41'37".7	68°14'46".1	1942.5
9	CICR	41°34'20".8	69°39'39".0	771.2
10	ALMA	40°49'42".9	69°43'49".0	737.9
16	SARY	40°46'25".2	71°42'2".3	351.0
40	MADA	38°41'4".1	66°56'29".3	2690.7
54	ANGR	41°6'7".7	70°4'53".7	1307.3
55	ADRA	40°48'1".3	70°1'21".6	1556.0
56	BESH	40°21'24".0	70°31'25".2	421.7
58	BAYS	38°10'31".0	67°2'45".6	1061.3
59	KFIR	37°50'17".3	67°52'5".5	590.9
79	BOZB	41°28'44".6	71°47'7".9	1758.7

United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011





GPS network in Uzbekistan

1992-1996

The international program CATs(GFZ,Germany)

RMS: 1-3mm. for x, y

RMS: 5mm. for H.

RMS: 1-2cm. for Global network





KITAB



TASHKENT



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems

Dubai, United Arab Emirates

16 – 20 January 2011



The National University of Uzbekistan
Astronomical Institute of the Uzbek Academy of Sciences

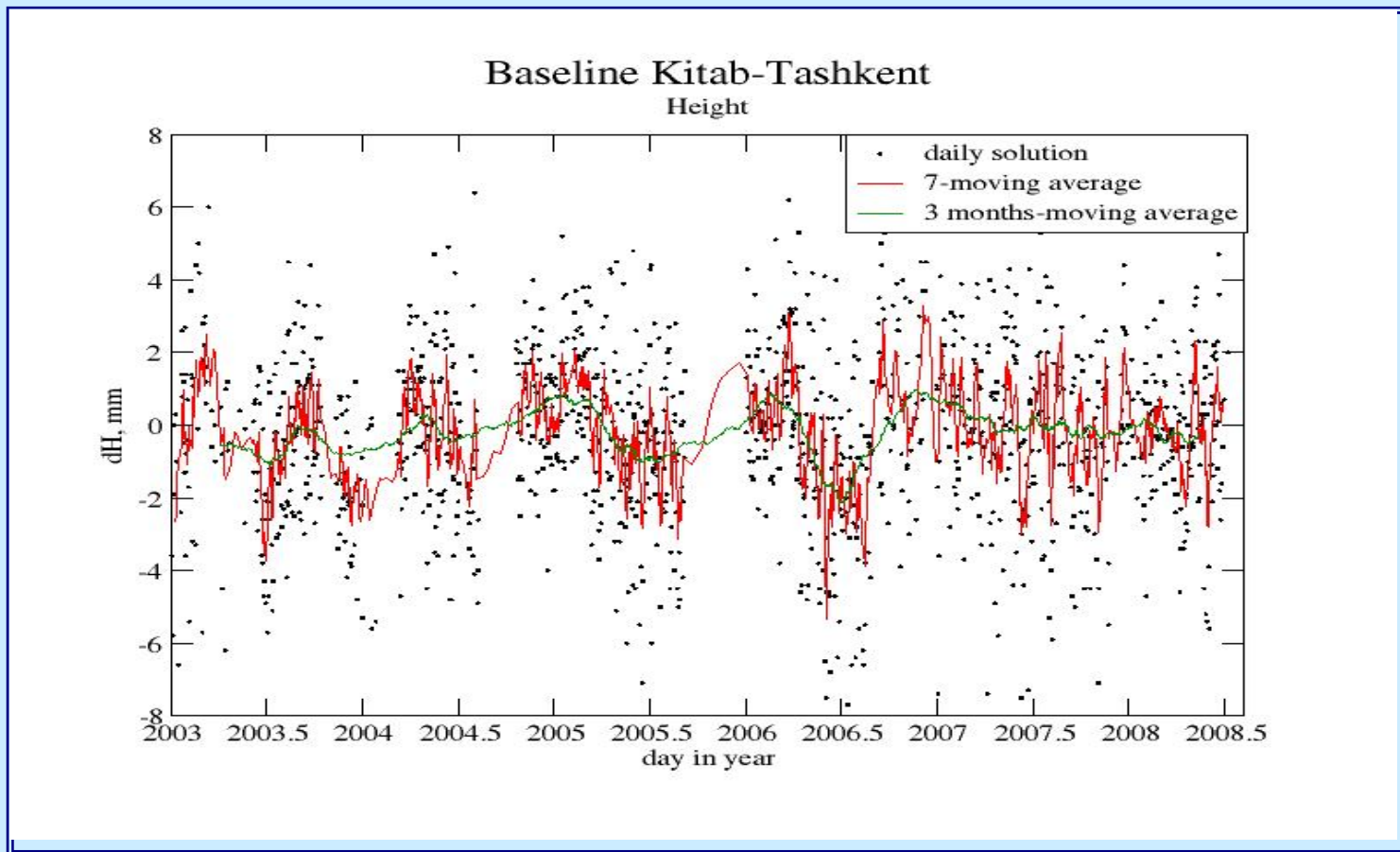


United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems

Dubai, United Arab Emirates

16 – 20 January 2011







Height of classic ,GPS and Doris stations in Kitab

h=590m. (Krasovsky 42 ellipsoid)

h=657m. (CS-42)(transfer

h=622m. (GPS)

h=623m. (DORIS)

United Nations/United Arab Emirates/United States of America

Workshop on the Applications of Global Navigation Satellite Systems

Dubai, United Arab Emirates

16 – 20 January 2011





In the future

- to determine the connection between geocentric and local coordinate system,
- to create a space geodetic network of region,
- to select or to work out optimal ellipsoid for region.



United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems

Dubai, United Arab Emirates

16 – 20 January 2011





Thank you
for your attention!



**United Nations/United Arab Emirates/United States of America
Workshop on the Applications of Global Navigation Satellite Systems
Dubai, United Arab Emirates
16 – 20 January 2011**

