

Editors:
Akylbek Chymyrov
Aizhan Assylbekova



Austria-Central Asia Centre for GIScience
ACA*GIScience



Proceedings of the
7th Central Asia GIS Conference
Connected Regions: Societies, Economies and Environments

May 2-3, 2013, KazNU, Almaty, Kazakhstan



Жетінші Орталық Азиядағы ГАЖ
конференциясының материалдар жинағы
2-3 мамыр 2013 ж., ҚазҰУ, Алматы, Қазақстан

Сборник материалов Седьмой
Центрально-Азиатской ГИС Конференции
2-3 мая 2013 г., КазНУ, Алматы, Казахстан



Editors:
Akylbek Chymyrov
Aizhan Assylbekova

Austria-Central Asia Centre for GIScience
ACA*GIScience



Al-Farabi Kazakh National University

Z GIS

Department of Geoinformatics,
Salzburg University, Austria

PROCEEDINGS

The Seventh Central Asia GIS Conference - GISCA'13

May 2-3, 2013, KazNU, Almaty, Kazakhstan

Жетінші Орталық Азиядағы ГАЖ
конференциясының материалдар жинағы
2-3 мамыр 2013 ж., ҚазҰУ, Алматы, Қазақстан

Сборник материалов Седьмой
Центрально-Азиатской ГИС Конференции
2-3 мая 2013 г., КазНУ, Алматы, Казахстан



Almaty 2013

UDC 004

BBK 32.97

P78

P78 In: A.Chymyrov & A.Assylbekova (Eds). Proceedings of the 7th Central Asia GIS Conference - GISCA'13. -Almaty: KazNU, 2013. -154 p.

ISBN 978-9967-432-98-7

The Seventh Central Asia GIS Conference - GISCA'13 "Connected Regions: Societies, Economies and Environments", conducted by the Austria-Central Asia Centre for GIScience (ACA*GIScience) and the Al-Farabi Kazakh National University (KazNU) jointly with the Department of Geoinformatics (Z_GIS), Salzburg University, Austria and with support from TEMPUS Program, Trimble Navigation Ltd and Eurasia-Pacific Uninet in May 2-3, 2013, KazNU, Almaty, Kazakhstan.

Editors

Dr. Akylbek Chymyrov, ACA*GIScience, Geodesy and Geoinformatics Department, KSUCTA

Dr. Aizhan Assylbekova, GISCA'13 Secretary, Cartography and Geoinformatics Department, KazNU

Members of the Review Committee

Prof.Dr. Josef Strobl, Z_GIS, University of Salzburg

Prof.Dr. Vitali Salnikov, Dean of the Faculty of Geography and Environmental Sciences, KazNU

Dr. Alishir Kurban, Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences

Dr. Manfred Mittlboeck, Z_GIS, University of Salzburg

Dr. Gulnara Nyussupova, Geography, Land management and Cadaster Department, KazNU

Dr. Ainura Nazarkulova, ACA*GIScience, Geodesy and Geoinformatics Department, KSUCTA

P 2404000000-13

ISBN 978-9967-432-98-7

UDC 004

BBK 32.97



The GEM project has been funded with support from the European Commission. This proceedings reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

© Austria-Central Asia Centre for GIScience, 2013

© Al-Farabi Kazakh National University, 2013

CONTENT

PREFACE.....4

PAPERS ACCEPTED AS REVIEWED PUBLICATIONS BY THE PROGRAM COMMITTEE

ANALYSIS OF OPEN GIS AVAILABLE ON THE INTERNET. Assylbekova A. and Mussayeva A.5

GEOSPATIAL PLATFORM ON THE CLOUD: MAPPING, SHARING, COMMUNICATING. Strobl J. and Nazarkulova A.11

CURRICULUM AND QUALITY. Markus B.....18

IMPLEMENTATION OF GIS EDUCATION IN COLLEGES OF KYRGYZSTAN. Zhaparkulova A., Kulueva F., Nogoybaeva K., Chymyrov A.....28

DIGITAL = DIFFERENT? NEW PURPOSES OF MAPS. Traun C.33

WATER RESOURCES MANAGEMENT IN EL-MAGHARA AREA, EGYPT USING THE TECHNIQUES OF GIS AND REMOTE SENSING. Selmi M.....41

THE FUNCTIONALITY OF APPLICATIONS FOR PROCESSING OF THE REMOTE SENSING DATA. Assylbekova A. and Rakhymbay Z.....50

OBJECT-BASED IMAGE ANALYSIS FOR BUILDING FOOTPRINTS DELINEATION FROM SATELLITE IMAGES. Djenaliev A.55

SPATIAL DATA ANALYSIS FOR AUGMENTATION OF SEWER SYSTEM IN A LOCALITY OF AMRITSAR CITY. Gursharan J. Kaur63

GEOSPATIAL DATABASE OF RESEARCH OF URBANIZATION PROCESSES IN THE REPUBLIC OF KAZAKHSTAN. Nyussupova G.71

GIS BASED GENERALIZED BUILDING VULNERABILITY ASSESSMENT. Djenaliev A., Abdykalykov A., Chymyrov A.78

USE OF GIS APPLICATIONS IN PREPARING BLOCK DEVELOPMENT PLAN IN PUNJAB. Gopal K. Johari....85

THE KYRGYZ NATIONAL REFERENCE SYSTEM "KYRG-06" AND GNSS CONTROL CENTRE "KYRPOS". Abdiev A. and Chymyrov A.....92

ADDITIONAL PAPERS AND ABSTRACTS PRESENTED AT GISCA'13

MOBILE GIS SOLUTIONS FOR COLLECTION AND PROCESSING OF GEOSPATIAL DATA. Englberger S. and Nizametdinov N.99

PRINCIPLES OF SYSTEMS APPROACH IN KAZAKHSTAN GEOINFORMATION MAPPING. Bekmurzaev B., Taukebayev O., Zhalgasbekov E.....102

MARKETING ANALYSIS OF PUBLIC SERVICES IN THE BISHKEK CITY BY USING GEOINFORMATION SYSTEMS. CASE STUDY: MICRODISTRICT 12. Shibkov E.107

THE ROLE OF GIS IN CONSTRUCTION OF WINDMILLS IN TUPKARAGAN REGION (MANGYSTAU AREA). Assylbekova A. and Mailybayeva G.113

MAPPING& DEVELOPMENT OF GIS GEODATABASE AND CREATING MAPS FOR INFRASTRUCTURE PROJECTS. Nazarkulov K. and Zheentaev E.118

GIS TECHNOLOGY ADAPTIVE-LANDSCAPE SYSTEM AGRICULTURE OF THE NORTH SLOPE ILI ALATAU. Kerimbay N., Kakimzhanov E., Assylbekova A.....124

METHODS OF STUDIES OF DANGEROUS TECTONIC PROCESSES. Nurpeisova M.B. and Kassymkanova K.M.....129

GIS BASED LAND MARKET ANALYSIS IN KADAMJAI DISTRICT, KYRGYZSTAN. Alimbekova N.134

RESEARCH OF THE ROAD CONDITIONS AND FUEL ECONOMY ON THE ROAD OSH-KHOROG WITH APPLICATION OF GIS TECHNOLOGIES. Zhorobekov B., Saidamatov Sh., Zhakypdzhanova V., Mamazhakypova G.....140

STUDY ON NATURAL FORMATION OF WATER RESOURCES OF TAJIKISTAN AND CENTRAL ASIAN REPUBLICS. Juraev A.J., Kadirova Z.K., Samiev A.M., Safarov H.N.146

THE USE OF GEOGRAPHIC INFORMATION SYSTEM (GIS) SOFTWARE SETTINGS IN KYZYLORDA. Daurenbekov K., Abdrassul G., Buinaya M.149

MULTILINGUAL (FOUR LINGUAL) PLACE NAME DATABASE FOR REGIONAL SDI. Kurban A., Xi Ch., Ablikim A.154

The functionality of applications for processing of the remote sensing data

Aizhan Assylbekova and Zabira Rakhymbay
Al-Farabi Kazakh National University, Almaty, Kazakhstan

The GISCA'13 Program Committee accepted this paper as a reviewed full paper

Abstract

The article deals with the functionality of applications for remote sensing data processing by comparing NDVI to create maps of agricultural land.

Keywords: the remote sensing, NDVI, agriculture

Introduction

Relevance of the topic. Vast territories is agricultural land, it is difficult to control due to the lack of the accurate maps, poor network of real-time monitoring, ground stations, including the weather, the lack of aviation support because of the high cost of maintenance staff, etc. In addition, due to various natural processes, there is a constant change in the borders of areas under crops, soil properties and vegetation conditions in different fields and from section to section. All those factors which prevent the objective, timely information necessary for ascertaining the current situation, and its assessment and forecasting. It's impossible virtually to increase without it in agricultural production, optimization of land use, crop yield forecasting, reduce costs and increase profitability. Therefore, spatial data of the remote sensing in recent years have become an important part in solving the problems of creating and updating digital maps, plans and project implementation of geographic information systems (GIS) for various levels and purposes.

In this article, we discussed the possibility (in the example, Normalised Vegetation Index (NDVI)) the most common complex of ENVI 4.8 software for the remote sensing data processing. NDVI identifies problem areas depressed vegetation, giving the opportunity to the most loyal in the long-term solutions to increase productivity. Typical problems in this area are: inventory of agricultural land, crop condition monitoring, allocation of areas of erosion, paludification, salinization and desertification, the determination of the composition of soil, monitoring the quality and timeliness of various agricultural activities.

Agriculture - one of the most perspective areas for the use of the remote sensing to increase the intensification of livestock and especially plant growing production. Agricultural crops are brilliantly displayed on the satellite images, they are no hidden, single storey, well deciphered as a texture, and the spectral characteristics /1/.

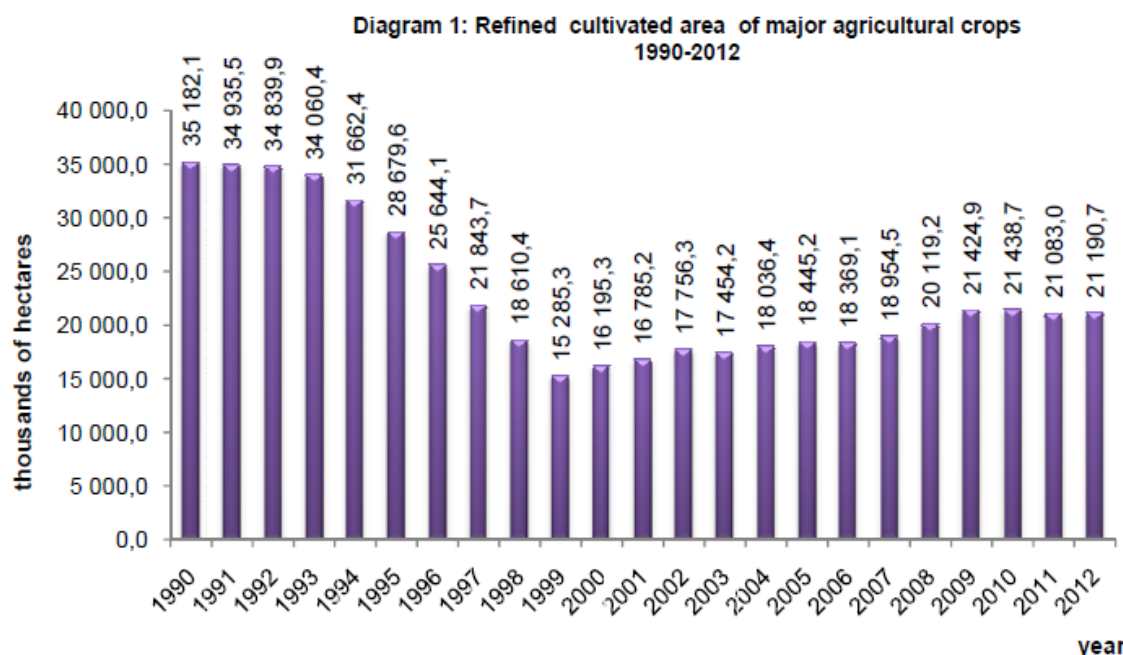
Kazakhstan has a vast territory which is more than 2.7 million square km. Nature and landscape of Kazakhstan is very diverse and represented as highlands east and low-lying plains of the West, as well as harsh climate industrial north, vast, arid steppes of the center and highly fertile land south of the country.

Important sector of the economy of Kazakhstan is agriculture. According to the Agency of Statistics of the Republic of Kazakhstan, the total refined cultivated area of major agricultural crops in the country amounted to 21,190,710 hectares in 2012 (Diagram 1) /2/.

In the north of the climatic conditions are favorable for the cultivation of spring wheat, oats, barley and other grains, as well as allow to develop vegetable, melon and cultivate a number of industrial crops - sunflower seeds, etc. In the south of the country in the foothill

and river valleys, where a lot of heat, with irrigation give high yields of cotton and sugar beets, rice, fruit orchards and vineyards.

It follows that the most important task which first need to be addressed through remote sensing data in the agricultural sector of the economy, an inventory of agricultural lands, and special thematic maps /1/.



The data source: The Agency of Statistics of the Republic of Kazakhstan, www.stat.kz

Studies

Methods of the remote sensing are used widely in agriculture around the world (USA, Canada, European Union, India, Japan, etc.). In the economy of Kazakhstan introduced modern technology of the remote sensing for applications of monitoring of agricultural land, emergency, environmental and technological safety. So, for the Ministry of Agriculture determined area of crops and condition of crops, perspectives of crop on are estimated, implemented inventory and monitoring of agricultural land /3/.

The use of the remote sensing data in agriculture is a rapidly growing and promising area. An important advantage of satellite imagery is timely information use on the spatial distribution of agricultural land, as well as the objectivity and independence of information obtained /4/.

Currently, there are a number of software tools used for preliminary and thematic processing of the remote sensing data. The most common ERDAS Imagine, ER Mapper, ENVI, IDRISI, etc. The distinctive feature of ENVI is an open architecture and the availability of programming language IDL (Interactive Data Language), with help which can significantly extend the functionality of programs for specialized tasks: automate the existing algorithms as well as create their own data processing algorithms, and perform batch processing of the remote sensing data /5/.

Observations of the dynamics of agricultural crops by the remote sensing data showed that in the spectral feature space each type of culture at certain times and in certain phase of development forms a compact cluster /6/.

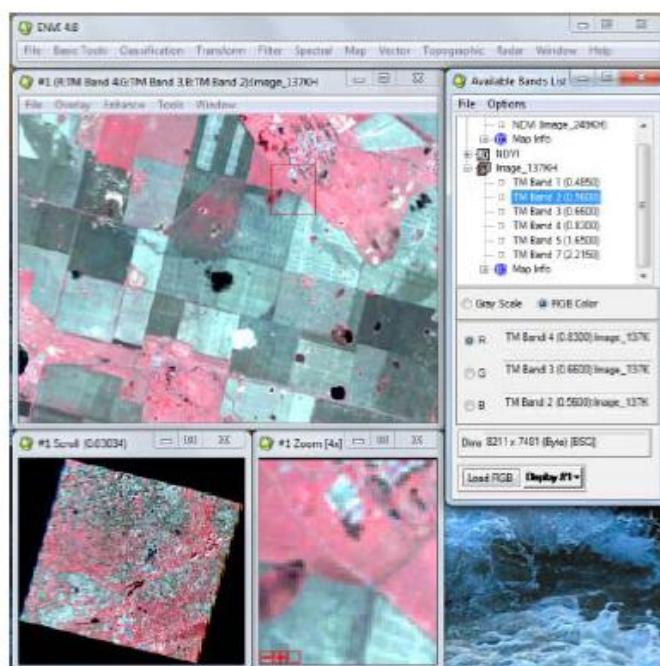
Quantitative characteristic of the crop condition is normalized vegetation index (VI) NDVI (Normalised Vegetation Index). Calculation of the most popular and commonly used the vegetation index NDVI (Normalized Difference Vegetation Index) additionally placed in a separate instrument ENVI. NDVI - normalized difference vegetation index was first described Rouse B.J. in 1973, a simple quantitative measure of the phytomass. Speaking vegetation index, often imply it instead. The index is calculated by the following formula:

$NDVI = (NIR - RED) / (NIR + RED)$, where RED and NIR - the spectral brightness of the red and near infrared bands, respectively.

The vegetation index NDVI is positive, and the more green phytomass, so they are higher. On the value of the index is also influenced of the species composition of vegetation, its compactness, condition, exposure, and the angle of inclination of the surface, the color of the soil under the rarely vegetation. Index is moderately sensitive to changes in soil background, except when the density of vegetation cover below 30%. The index can range from -1 to 1. For the green vegetation index usually ranging from 0.2 to 0.8 /7/.

For example, of calculation of the index NDVI, clearly showing its information. The initial data was taken from the satellite image Landsat 4-5 TM (<http://glovis.usgs.gov/>) on a part Denisovskoye, Karabalyk, Kostanai, Taranovskiy, Fedorovsky regions of Kostanai oblast (Figure 1) for May 17, 2011. Since the degree of processing of satellite imagery 1G, its projection UTM on the ellipsoid WGS84.

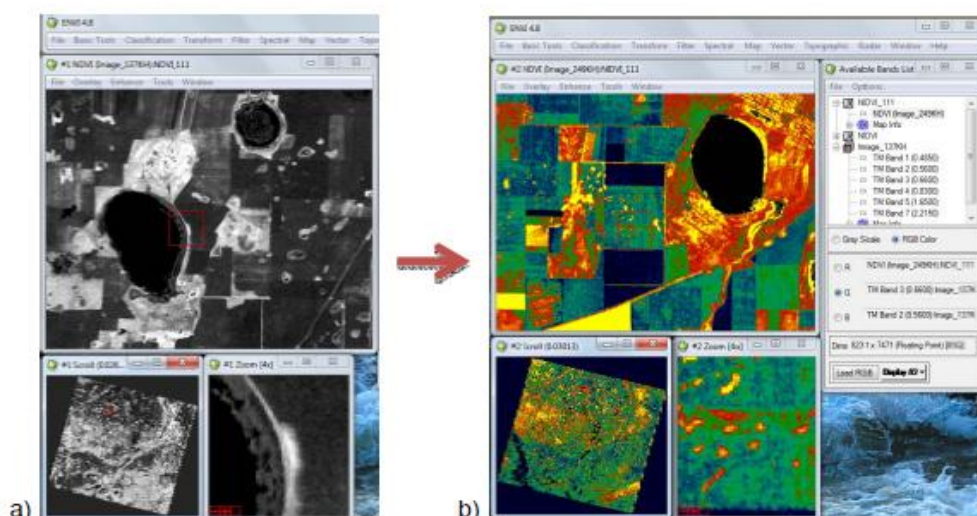
Figure 1: The original image of Landsat 4-5 TM



The next step is the calculation of vegetation index NDVI to the original image (Figure 2):

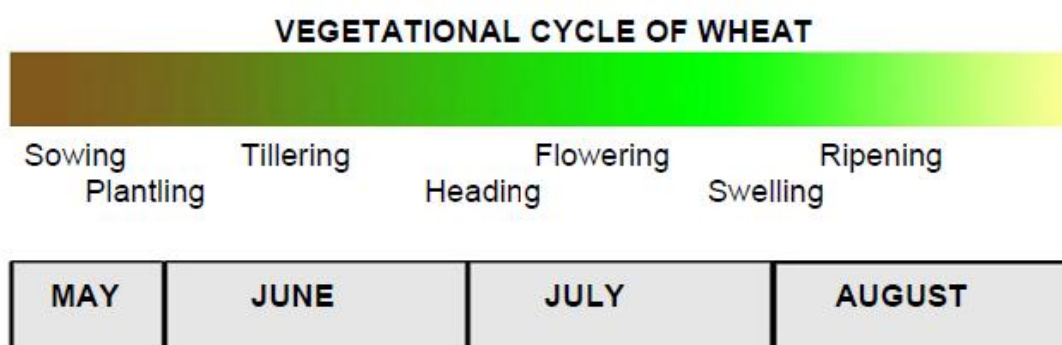
The resulting image (Figure 2a) can "colorize". There is a standardized scale of NDVI, it is used infrequently. If describe space image by value NDVI, the yellow color characteristic of rarefied vegetation, orange mainly for roads, buildings and other man-made objects, green and dark green - for open soil, black - for water, and the different shades of blue - for man-made materials. Open ground on NDVI is intermediate between vegetation / no vegetation and water. Often, areas of open soil are recognized as water or as an artificial material, have

Figure 2: The result of the calculation of the index NDVI:
a) indexed image to grayscale version; **b) The index picture, painted in false color**



index values near 0 or <0 . In the observable image to very little vegetation and almost not at all dense vegetation, because the image was taken in mid-May. As known to all, Kostanai oblast well known outside of Kazakhstan his own kazakh agro-industrial potential. It is traditionally called the main bread granary of the country. Special climatic conditions of the region help grow wheat (spring) with characteristics unique in the world. According to that table below (table 1), in the month of May has just begun sowing wheat, so in satellite imagery of this study areas very little vegetation, and vice versa to the most common area of open soil.

Table 1

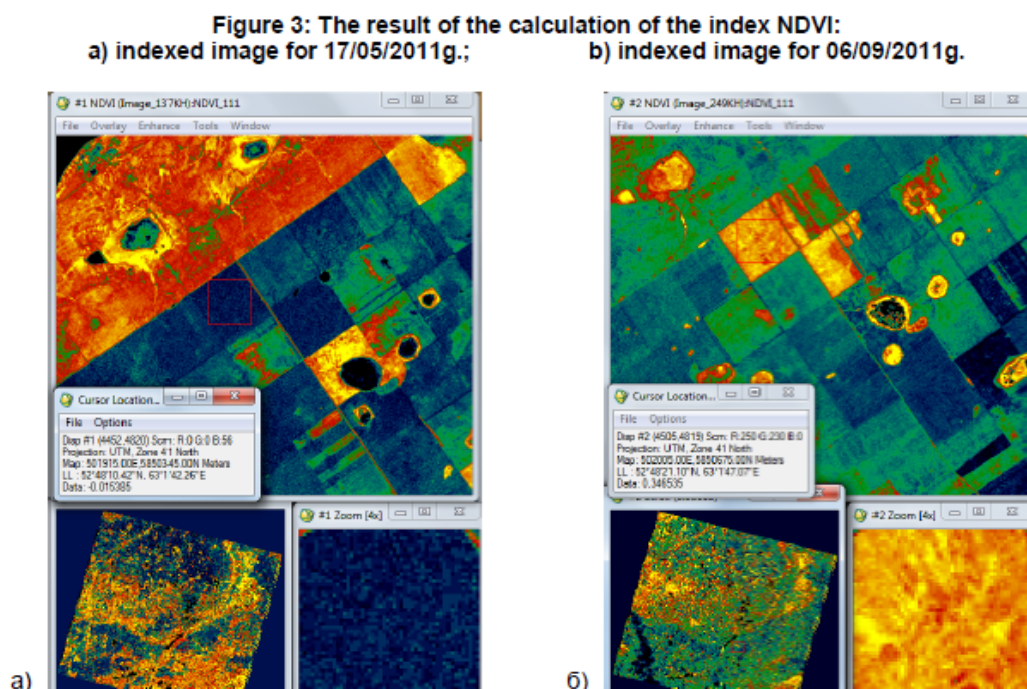


The data source: Institute of space research, RK

If we compare the calculated NDVI for the months of May and September, seen a huge difference. If, for example, in May, where the value of NDVI was equal - 0,01-0,025, in September, they are already equal 0.34-0.38 (Figure 3).

Conclusion

The main advantage of vegetation indexes is the ease for their preparation and a wide range of solved problems with them. Thus, NDVI is often used as a tool during the more complex types of analysis, which may be the maps of forest productivity and agricultural land, maps of landscapes and natural areas, soils, arid, phyto hydrological, phenological and other environmental and climatic maps. Also based on it is possible to obtain quantitative



data for use in calculations assessing and predicting the yield and productivity, biodiversity, the degree of disturbance and damage of natural disasters, industrial accidents, etc. /7/.

In conclusion, it should be noted that any vegetation indexes do not provide absolute quantitative study the properties and their values depend on the characteristics of the sensor (the width of the spectral bands, resolution), shooting conditions, lighting, atmospheric conditions. They give only a relative assessment of the properties of vegetation, which can be interpreted with the assistance of field data converted to absolute. And it should be noted that using the software can be solved issues in the field of agriculture. Further studies are needed to compare other features ENVI in different branches of science.

References

1. Dvorkin B.A. and Abrosimov A.V. (2009). Perspective application of remote sensing data for agricultural efficiency enhancement in Russia, *GEOMATICS*, №4, 2009.
2. <http://www.stat.kz>
3. <http://kazcosmos.gov.kz/ru/press-office/doklady-i-vyistupleniya/doc/vyistuplenie-predsedatelya.html?action=refreshCalendar&month=1&year=2012>
4. V. Antonov, L. Sladkih. (2009). Crop monitoring and spring wheat yields forecasting basing on remote sensing data, *GEOMATICS*, №4, 2009.
5. Tokareva O.S. (2010). The processing and interpretation of remote sensing dataThe processing and interpretation of the remote sensing data. Tomsk: Edition of the Tomsk Polytechnic University, 2010 – 148 pp.
6. Vinogradov B.V. The transformed Earth. Moscow: Мысль, 1981- 295 pp.
7. Cherepanov A.S. and Druzhinina E.G. (2009). Spectral characteristics of vegetation and vegetation indexes, *GEOMATICS*, №3, 2009.