ASSESSMENT OF CLIMATE CHANGE TRENDS AT LONG XUYEN QUADRANGLE USING REMOTE SENSING IMAGE

Nguyen Chau My Duyen[aa], Nguyen Anh Duc[b] , Bui Ta Long[a]

[a]Assoc. Prof. Dr.S., University of Technology, Vietnam national university Hochiminh city, 268 Ly Thuong Kiet str., Dist. 10, Hochiminh city, Vietnam, Tel. 84 – 8 – 38647256,
E-mail: longbt62@hcmut.edu.vn
[b]Ph.D, Vietnam Mekong River Commission, 23 Hang Tre, Hoan Kiem, Ha Noi, Vietnam, Tel. 884 – 04 – 3825 8917,
E-mail: nganhduc@yahoo.com

ABSTRACT

Long Xuyen Quadrangle (LXQ) is located in the western region of the Mekong River Delta (MRD) and is located of the three provinces: An Giang, Kien Giang and Can Tho City. Four sides are conterminous: Vietnam-Cambodia border, Hau river, Cai San channel and Beach West. Long Xuyen quadrangle has nature area 489,000 hectares, in which about 52% of An Giang province, 46% of Kien Giang province and the rest of San Cai northern, Vinh Thanh district, Can Tho city. After more than 20 years of reclamation, LXQ has become key areas of the Mekong Delta food and water. According to statistics, by the end of 2011, LXQ get the yield over 4.73 million tons, more accounting for 20% of the rice production in the Mekong Delta. Based on the results of the report "Scenarios of climate change and sea level rise for Vietnam" published by the Ministry of Natural Resources and Environment in 2012, the rainfall trends to increase in the coming decades, from 2020 to 2100.

Water resources is one of the serious part affected by the impacts of climate change. With this influence is expressed through changes in rainfall regimes with sea levels rise could cause flooding in the wet season and drought in the dry season, making difficult to supply water, water storage. This difficulty will directly affect the agricultural which accounts for a large proportion of the Long Xuyen quadrangle.

The purpose of report is understand, identify trends change in water resources by effect climate change through rainfall, the basis for management, as well as a precondition for more deep research about the environment and water resources of Long Xuyen quadrangle.

Key words: remote sensing, GIS, ArcGIS, rainfall, water resources.

1 INTRODUCTION

Long Xuyen tetragon region TGLX belongs to 3 provinces of An Giang, Kien Giang, Can Tho city. Based on the data before 1988, TGLX has the uncultivated land size over 50,000 ha by alum pollution, has not had yet the irrigation system for cleaning alum: the food productivity of this region (including An Giang, Kien Giang provinces) is only about 600,000 tons. Up to 2005, the productivity gained over 3.45 millions tons. In 2011, because of the irrigation system development, the rice output gained 4.73 millions tons, occupying over 20% the rice output of whole Mekong delta; the annual rice and seafood over 1.7 millions tons. Long Xuyen tetragon becomes the main food production region of whole country, is the great center of producing the hulled rice, cultivation, catching, processing seafood, contributing greatly to export, ensuring the national food security. In the latest years, the growth speed of this region was fairly high than

many other provinces in the area. The economic growth speed in An Giang gained 12.5% in the phase of 2011-2020; GDP average per head to 2015 gains 2,200 USD, in 2020 at 3,540 USD. Striving the export turn-over to 2015 at 1.2 billion USD and 1.8 - 2 billions USD in 2020. In 2012, the economic growth speed of Kien Giang gains 11.81%, third rank in the provinces of Mekong delta, GDP average per head in 2012 at 2026 USD/person/year. In 2011, the economic growth speed of Can Tho city gains 14.64%, income of average per head gains 2346USD/person/year.

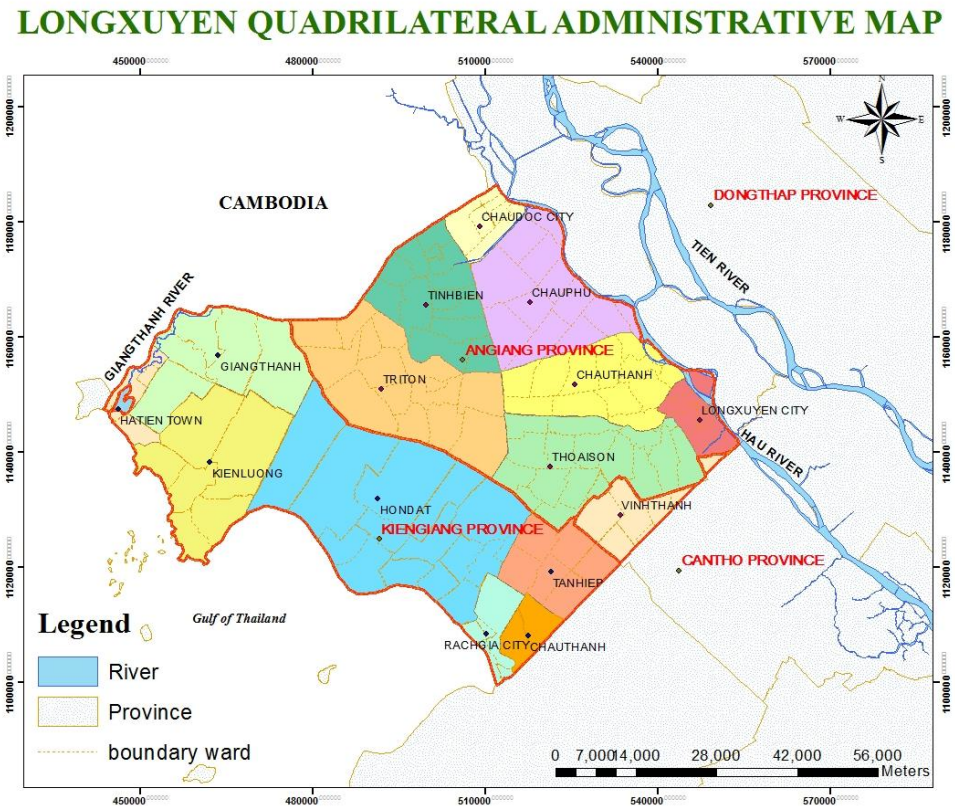

Figure 1. Long Xuyen quadrilateral administrative map

In An Giang, the rainy season of this region begins in May and extends to November, occupying 90% of rain volume of whole year with total annual average rain volume about 1200 mm, highest value at 2100 mm/year and lowest 900mm/year. An Giang surface water source only relies on 2 main rivers – Tien river and Hau river with the great water flow along with the tangled natural channel canal system, with total length 5,500km, with the density 1.6km.km^{-2}. The annual average flow of Tien river, Hau river is about 13,500m^3.s^{-1}, the flow in the flood season 24000 m^3.s^{-1} and the exhausted season 5020m^3.s^{-1} . In general, with the channel canal system network distributing widely on whole province, the fresh water source of An Giang province can provide all year round for life, production and irrigation, easy to develop agriculture, seafood.

In Kien Giang, the rainy volume distribute unevenly on the time. Total annual average rain volume is 2714.2mm. The rainy season begins from May to the end of November, the rainy volume occupies average 91% of total annual rainy volume. The dry season begins from December to the end of April of the next year, the rainy volume only occupies average 9% of

total rain volume in the year. The main surface water source of Kien Giang is from the rainy water and the water of Hau river provided via the channels and canals. Whole province has 3great rivers passing including Cai Lon river, Cai Be river, and Giang Thanh river. Two great rivers Cai Lon and Cai Be have the source from Hau river and pouring into Rach Gia gulf, Giang Thanh river begins from Cambodia and pouring into Thailand gulf. Apart from the natural river system, Kien Giang province has a development canal system. The canal system has the function leading the fresh water, rushing alum, draining flood, and traffic.

The water resource is one of the important elements for this region, however, this is the object incurring many effects by the clime changes. With the effects via change of the rainy mode and the sea water level rise can cause flood in the rainy season, and drought in the dry season, raising difficulties in supplying water, storing water, and increasing the contradictions in using water. This difficulty will affect directly to the agriculture, occupying the great rate of Long Xuyen tetragon region. The object of this research is to study, define the water resource change trend incurring effects of the climate change via the rainy volume, as the base for the management, and premise for the deeper researches about the environment and the water resource of Long Xuyen tetragon region.

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2 RESEARCH METHODOLOGY

The project implementation method is shown in the works such as Aristeidis G. Koutroulis et. Al., 2013 and Samuel Kusangaya et. Al., 2013.

2.1 Remote sensing method

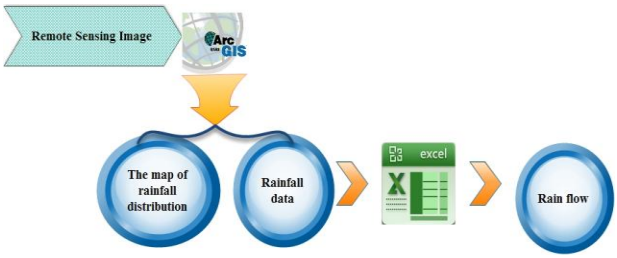


Figure 2. Remote sensing method

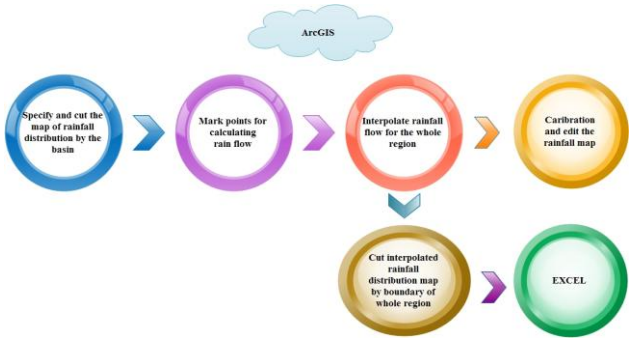


Figure 3. Process mapping and calculating rainfall by ArcGis

To build the map and estimate the rainy flow for TGLX region, there are 2 following phases: phase for building the map distributing the rainy volume by ArcGis and phase for estimating the rainy flow.

2.2 Building the rainy volume distribution map by ArcGis

The input data is the remote sensing images free downloaded on the website: http://mirador.gsfc

nasa.gov/cgibin/mirador/presentNavigation.pl?tree=project&project=TRMM.

The image data have the continuous property and provide fairly exactly the rainy volume value. In this report, the image data are used in 15 years, detailed from 1998 to 2012.

2.3 Estimating the rainy volume

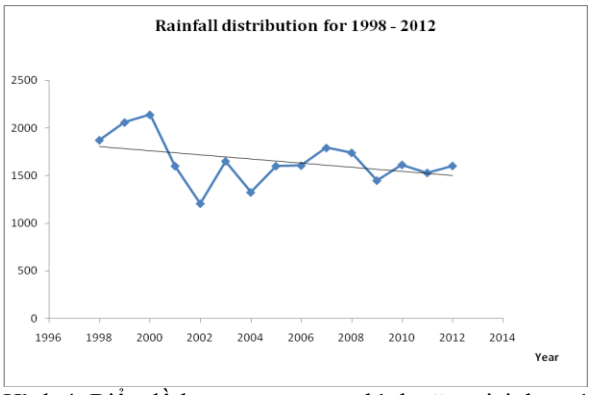
After using ArcGIS for marking the points estimating the daily average rainy volume for the remote sensing image, we estimate the monthly rainy volume of a point by the formula:

Monthly average rainy volume of a point = [GRID_CODE] x 25.4 x 30

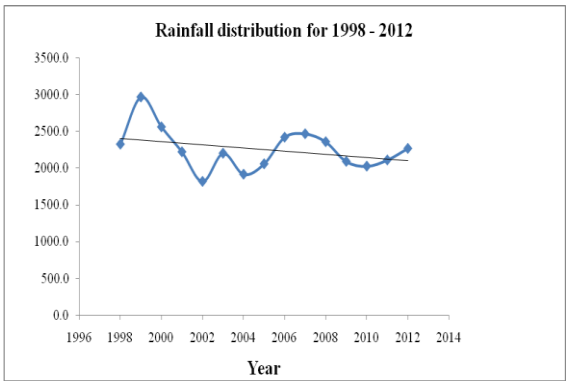
In which: [GRID_CODE]: the rainy volume value data on each point estimated by ArcGIS with the inch unit: 25.4: converted unit from inch into mm; 30: we convent taking average 30 days per month.

The monthly average rainy volume estimation result for each point on the remote sensing image exported to Excel under text file form. From the above data, we estimate the monthly average rainy volume on whole province by Average function in Excel.

3 RESULTS AND DISCUSSION



Hình 4. Biểu đồ lượng mưa trung bình năm giai đoạn 1998 – 2012 tại tinh An Giang



Hình 5. Biểu đồ lượng mưa trung bình năm giai đoạn 1998 – 2012 tại tinh Kiên Giang

3.1 Rainy volume distribution in An Giang

Based on the remote sensing image treatment result, the collection data shown in figure 4 that in 2000 as the year with total greatest rainy volume in 15 years from 1998 – 2012, with the flow as 2140.3mm. And total smallest rainy volume in 2002 with the volume at 1206.4mm. This shows that from the beginning of decade of 2000-2010, there was the differential about the rainy volume between the last years. The average rainy volume of 15 years in this phase is 1653mm. Based on the map of figure 4, the rainy volume has the change via years, but the general trend of the rainy volume is decreasing. In the phase from 1998 to 2012, the rainy volume decreased about 300mm.

Throughout the data about the rainy volume, we show that the dry season begins from December to April, the rainy season begins from May to November. In which, January and February are the months with great dry frequency, no rain.

The rainy volume concentrates in the rainy season, particularly the rainy season of year 1998 with total rainy volume in the rainy season at 1718.2 mm and in 2002 with total rainy volume in

rainy season as smallest at 1078.1mm. The month gaining the highest rainy volume in 15 years is July in 2003 with 413.7mm. The average rainy volume in the rainy season of the phase 1998 to 2012 at 1446mm. Based on the diagram of figure 4.2, we show that the rainy volume in the rainy season had many changes but the general trend as decreasing from 1998 to 2012. The years 2003, 2005, and 2009 are the years with the rain volume in the rainy season with the great differential between the months. June and July in 2003 differential 289mm, July and August in 2005 differential 200mm, May and June in 2009 differential 216mm. In 3 latest years, 2010, 2011, 2012 the annual average rainy volume had the decreasing trend.

3.2 Rainy volume distribution in Kien Giang

Based on the collected data in table 4.2, we show that in 1999 as the year with total greatest rainy volume in 15 years from 1998 to 2012, with the rainy volume at 2964.1mm. And total smallest rainy volume in 2002 with the volume at 1817.8mm. This shows that from the end of decade 2000 to 2010, there was the differential about the rainy volume between the last years. The average rainy volume of 15 years in this phase is 2252.4mm. Based on the diagram of figure 5, the rainy volume has the change via years, but the general trend of the rainy volume is decreasing. In the phase from 1998 to 2012, the rainy volume decreased about 57.8mm.

Throughout the data results about the rainy volume, we show that the dry season begins from December to April, the rainy season begins from May to November. In which, January and February are the very dry frequent months, no rain.

The rain volume concentrates much in the rainy season, particularly the rainy season in 1999 with total rainy volume in the rainy season at 1723.86mm and 2002 with total rainy volume in the rainy season smallest at 1723.86mm. The month with the highest rainy volume in 15 years is September in 2012 at 553.84mm. The average rainy volume of total rainy volume of the rainy months in the phase of 1998-2012 at 1994.88mm. Based on the diagram of figure 5, we show that the rainy volume in the rainy season has many changes, but the general trend as decreasing from 1998 to 2012.

The years 2001, 2003, 2006, 2007, 2009 and 2012 are the years with the rainy volume in the rainy season as the great differential between the months. The differential volume over 300mm.

4 CONCLUSION

Based on the result reports of “Script of climate change, rising sea water for Vietnam” issued by Resources and Environment ministry in 2012, the rainy volume with the rising trend in the next decades, from 2020 to 2100.

However, based on the remote sensing image analysis, the rainy volume in Long Xuyen tetragon region down from the phase 1998 to 2012. And the the survey data from the stations measuring the rain, we show that the rainy volume is decreasing. Therefore, we acknowledge the unexpected changes of the rainy volume occurring in this region.

The rainy volume estimation result not only shows the change about quantity and but also the unusual about the distributing the rainy volume in the months in the year and dry season and rainy season..

5 REFERENCES

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