

Estimation on Comparison of DMSP nighttime lights from multiple years

DMSP Data Utilization Workshop

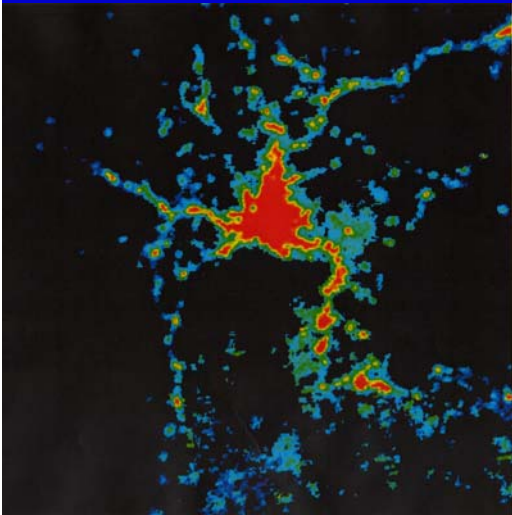
January 22, 2006 14:00-17:30, APN

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Why Asia ?

There have been a rapid population increase and economic growth in the Asian region, the population of which constitutes half the world population.

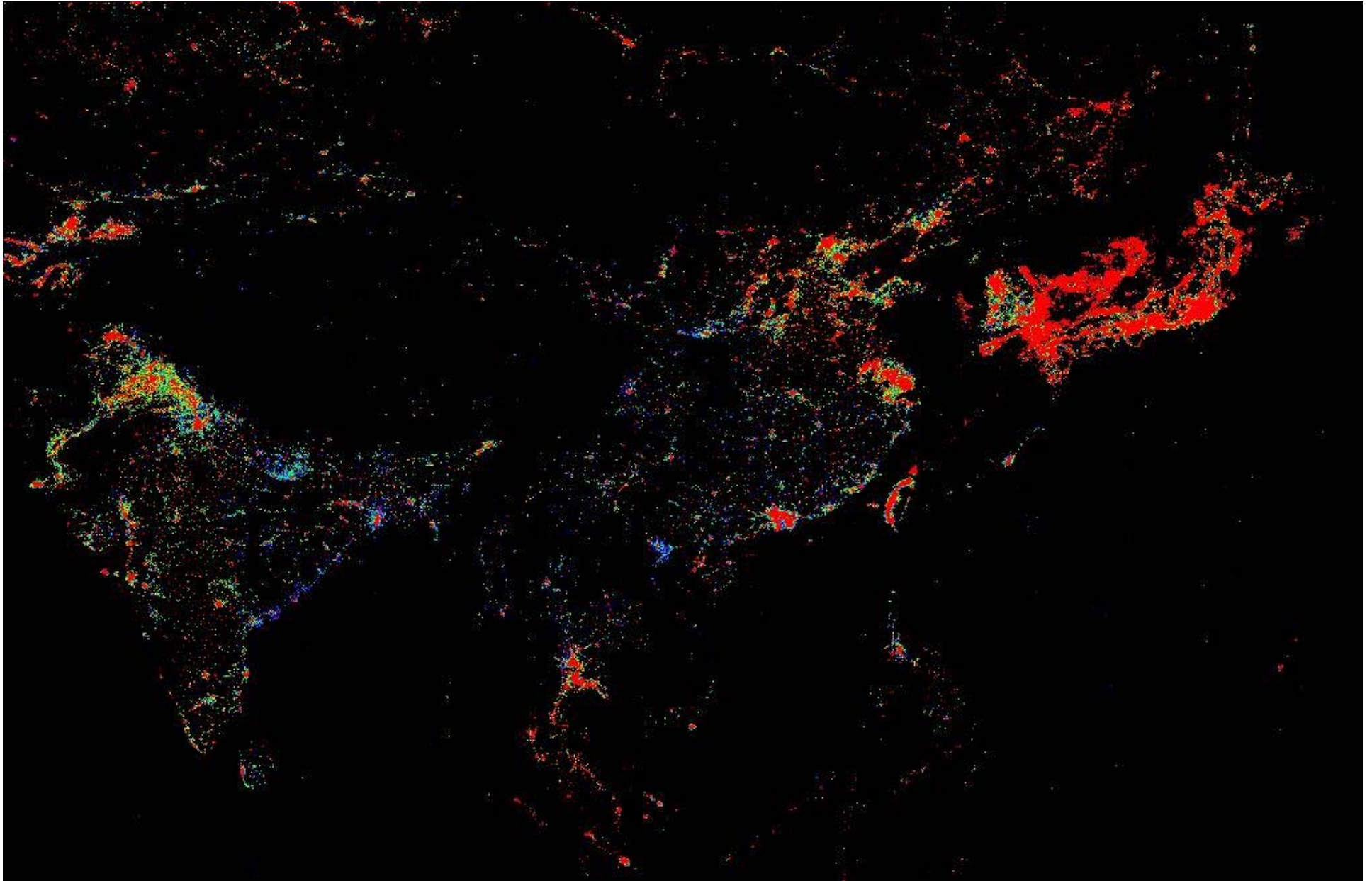
East Asian Summit in 2005

An ASEAN-centered joint statement was issued, and the ideal way of sustainable economic development in this region was discussed in 2005.

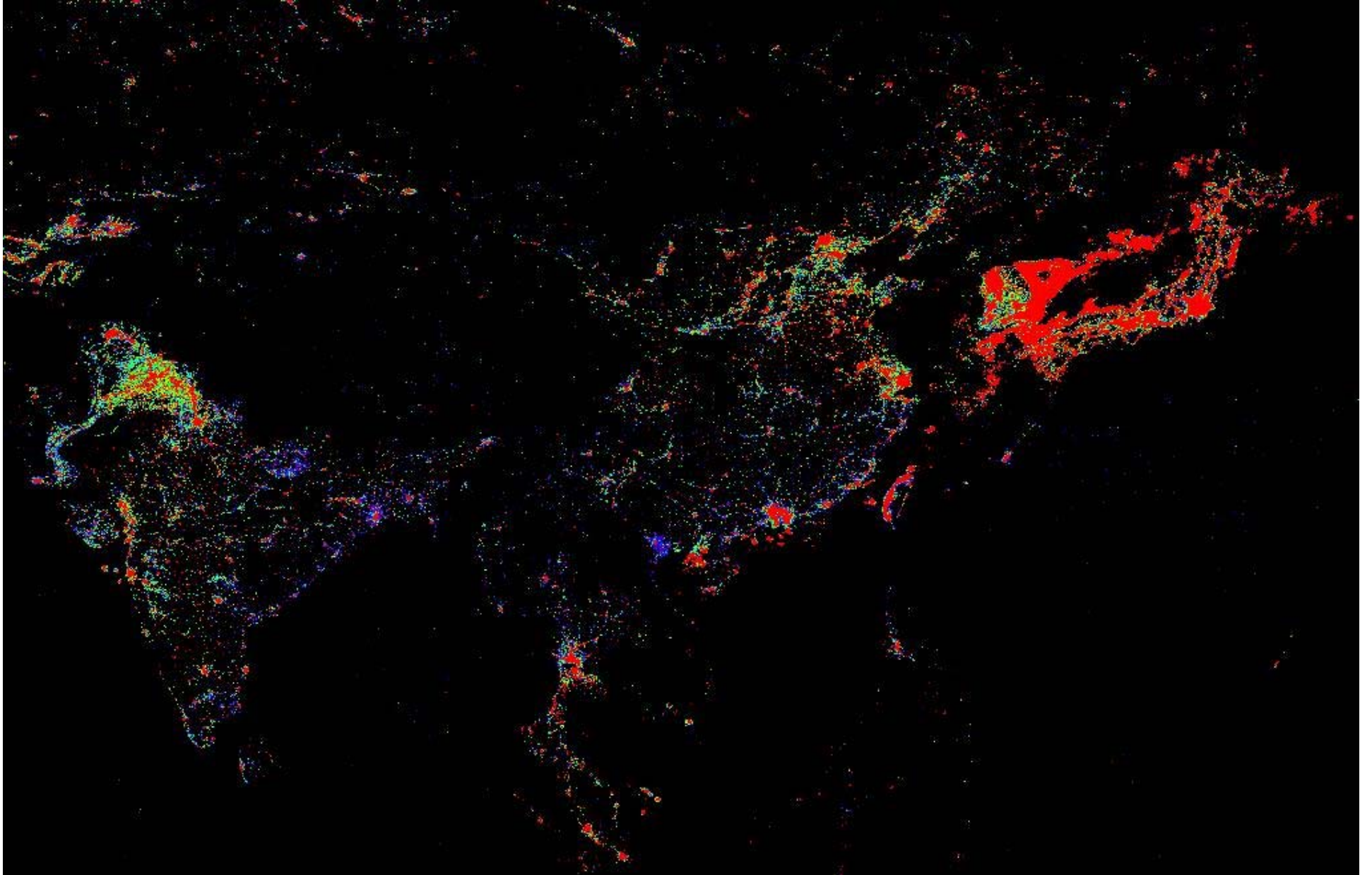
Previous Study

The study of Ichinose et al. (2002) can be cited as a past study on DMSP data and the applicability of the data to socioeconomic indicators in Asian region. In the study, nighttime light satellite image data set in 1992-1993, 1996 and 1998 was constructed in cooperation with NOAA, and it was suggested that nighttime light image might reflect the influence of Asian currency crisis caused in 1997.

1992-93 NRCALI



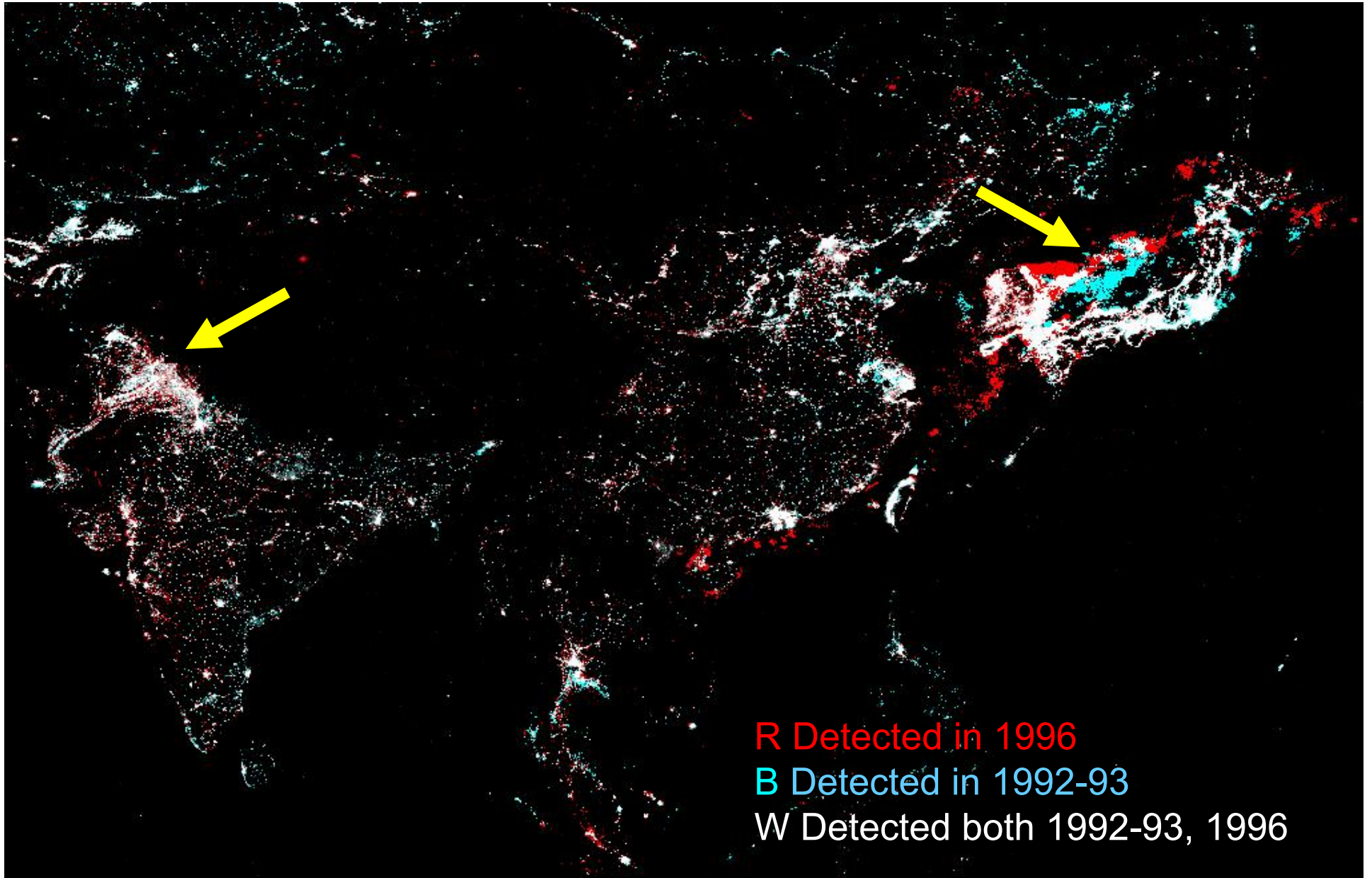
1996 NRCALI



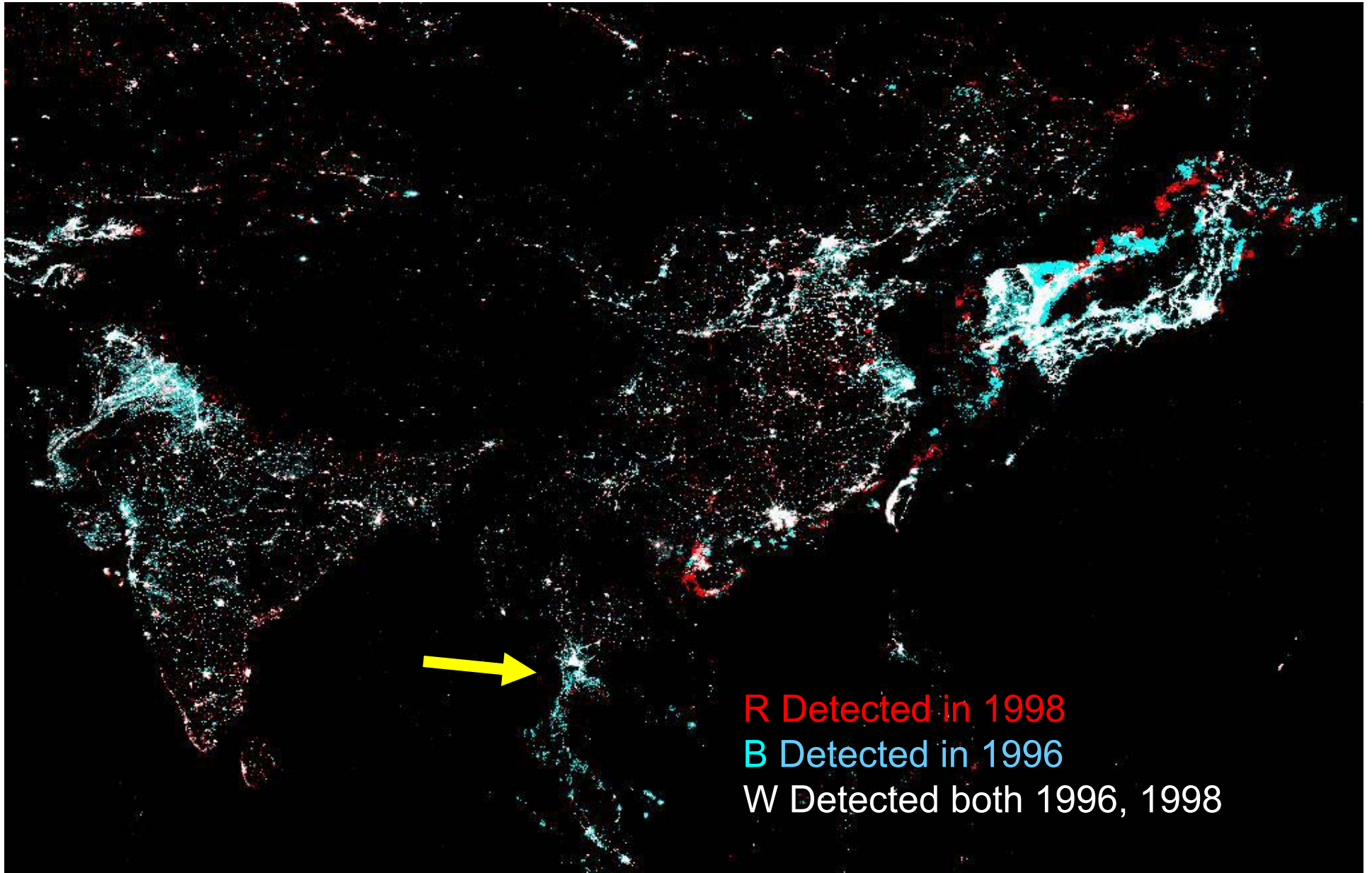
1998 NRCALI



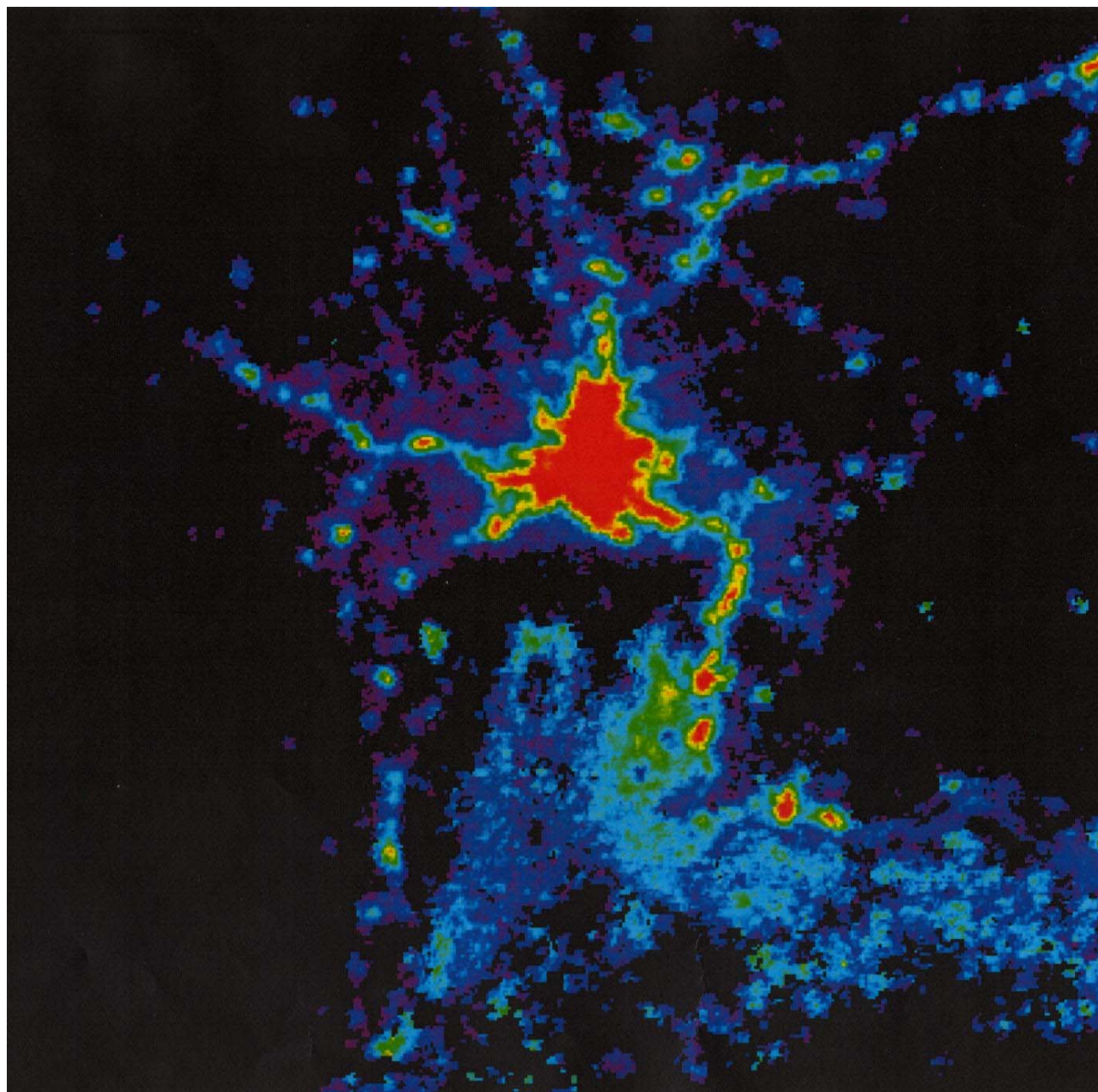
Comparison 1992-93 & 1996



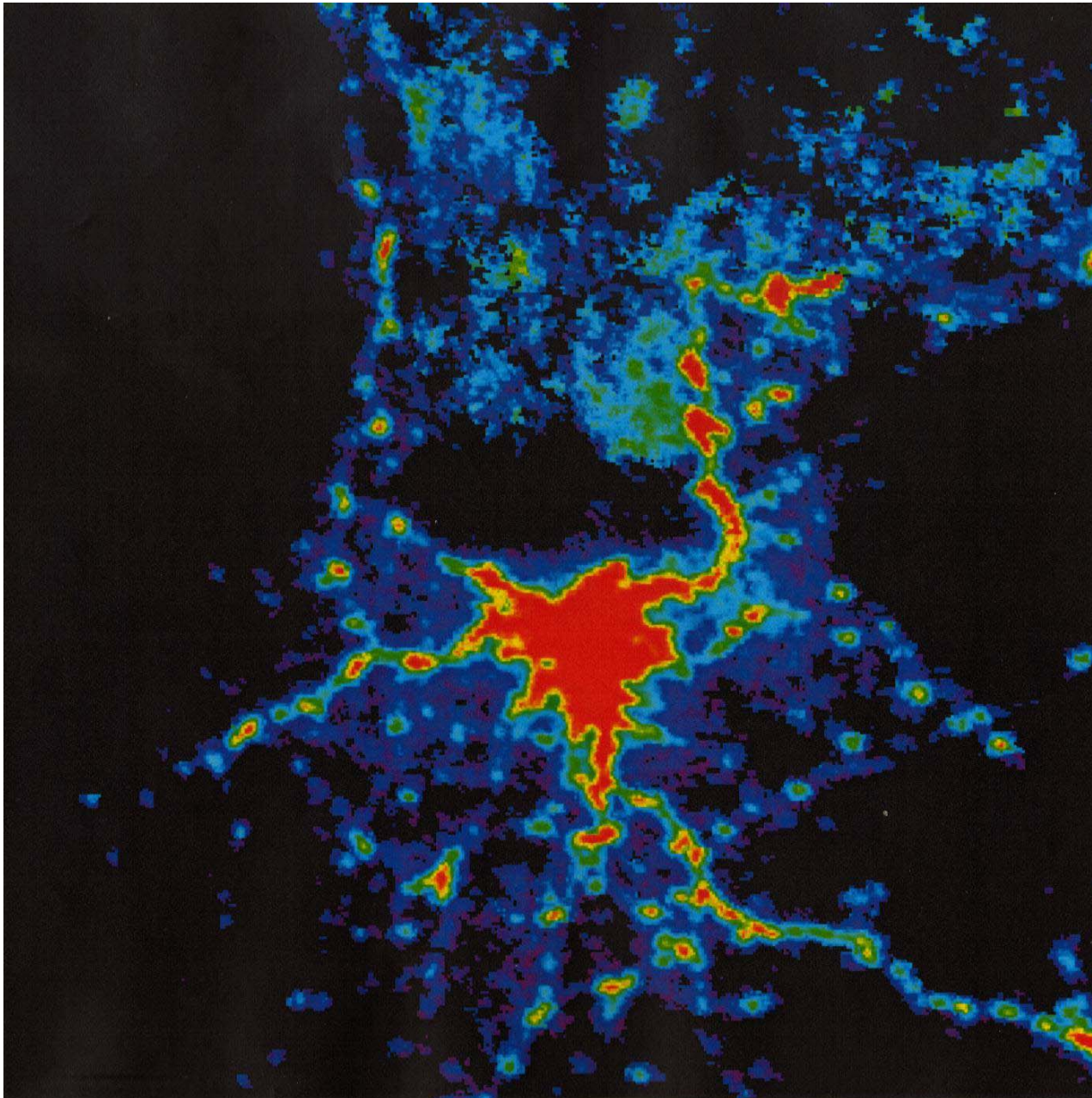
Comparison 1996 & 1998



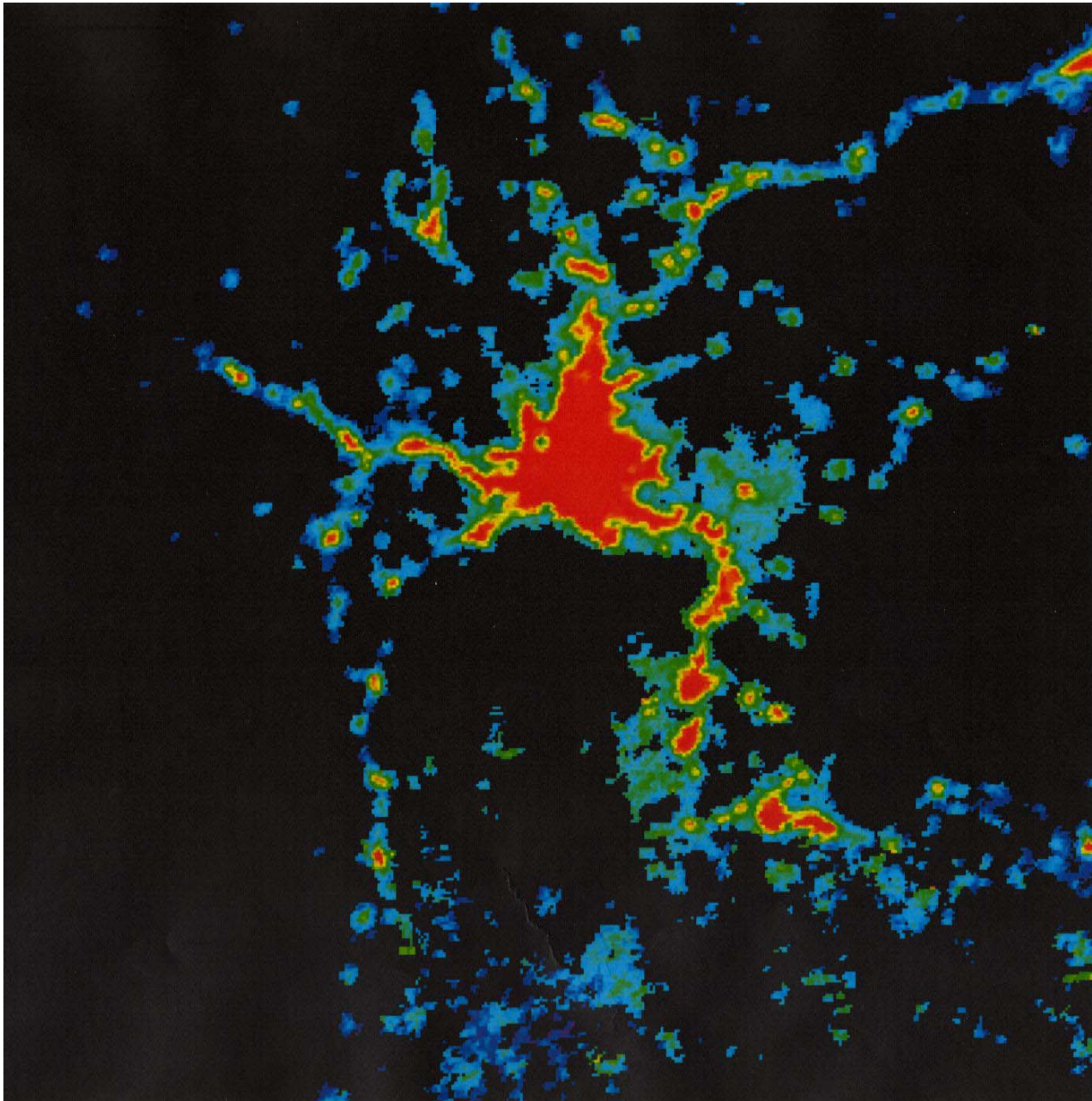
1992-93 Bangkok



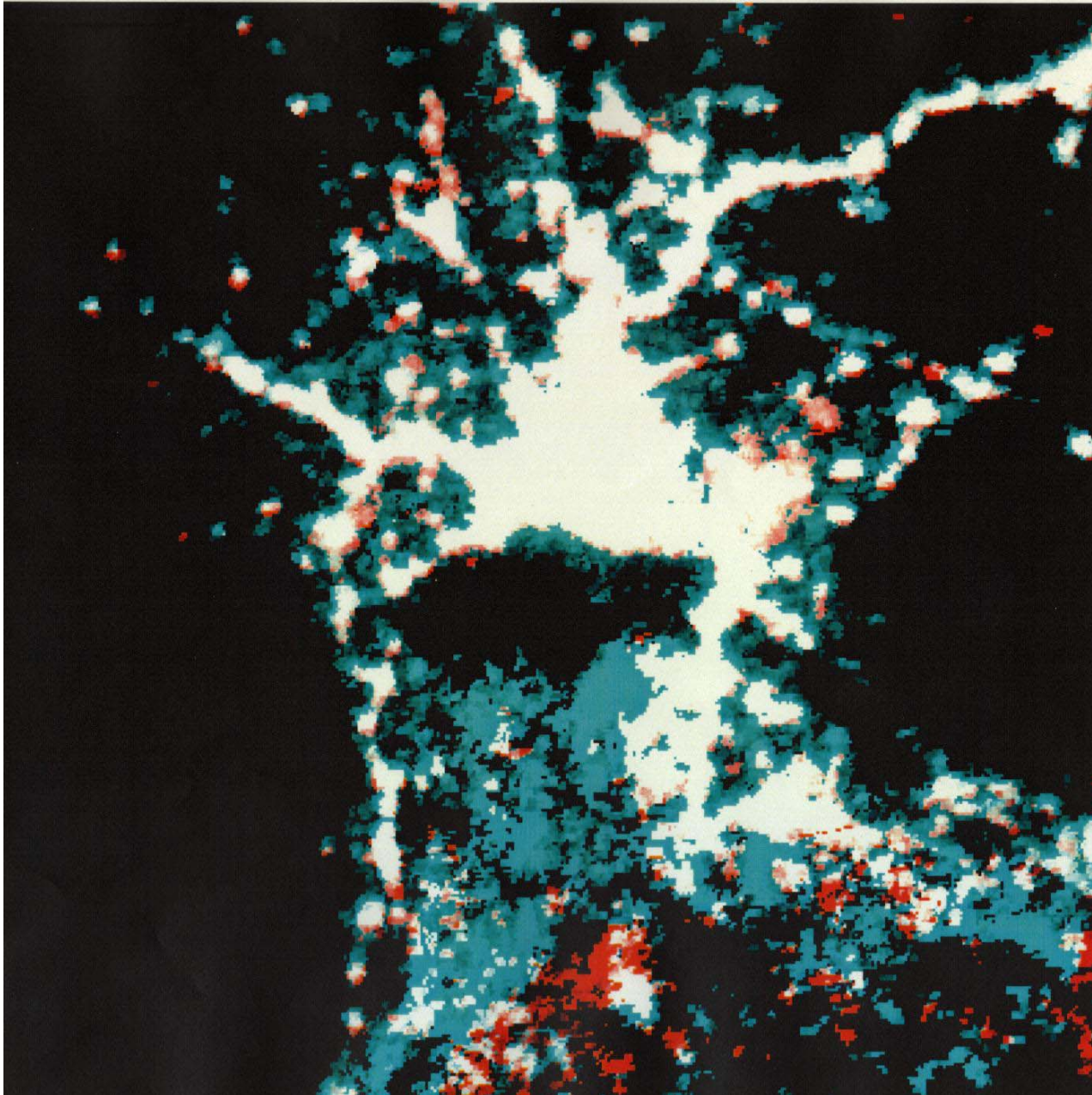
1996 Bangkok



1998 Bangkok



Comparison 1996 & 1998



R: Detected in 1998

B: Detected in 1996

W: Detected both
1996, 1998

Abandoned construction in a suburban of Bangkok, Dec. 1999



By Yasutomi Nakano

Purpose of Study

We compared data set obtained through dividing the Defense Meteorological Satellite Program (DMSP) data in 1992(F10), 1998(F14) and 2003(F15), newly constructed by National Oceanic and Atmospheric Administration according to boundary information with socioeconomic index data in each region, and thereby examined the applicability of the nighttime light satellite image data as indicators in each Asian country.

DMSP Data Sets

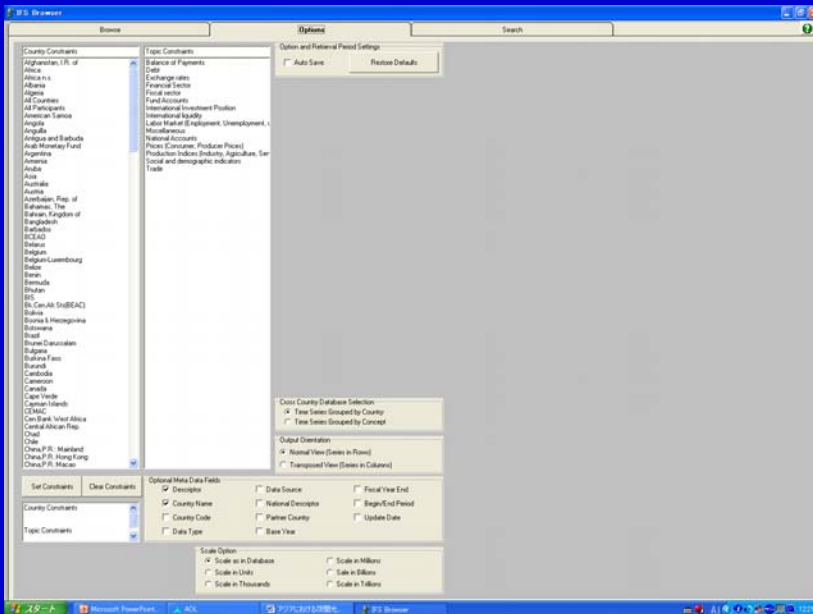
by using the data set in the years 1992, 1998 and 2003 constructed through an algorithm newly developed by NOAA, we derived the progressions of light area and light amount data on a country-by-country basis, compared them with socioeconomic index data, and thereby studied the applicability of the DMSP data.

Administrative Boundary Data

DMSP data was divided according to administrative boundaries by using Polygon data within the database named "Arc World" which was published by ESRI company in 2002. For example, Japan is divided into ten regions. This database provides us with the estimated population data and area information as of the year 1994 classified by administrative unit.

Socioeconomic Index Data

GDP, population and exchange-rate data in 1992, 1998 and 2003 are constructed on a region-by-region basis by using International Monetary Fund data.



The screenshot shows a table of data from the IMF Browser. The table has columns for 'Country', 'Table Title', 'Series Code', 'Unit/Freq', 'Database', 'M4_Headline', 'Description', and 'Country'. The table lists various economic indicators for Japan, such as 'Yen per SDR End...', 'MARKET RATE', 'MARKET RATE', 'MARKET RATE', 'Index Number Q2', 'EXCHANGE RATE', 'MARKER FROM IZ', 'FREE BASED ON...', 'QUOTA', 'SDR HOLDINGS', 'RESERVE POSIT', 'OUTSTANDS LGD', 'TOTAL RESERVE', 'RESERVE POSIT', 'FOREIGN EXCH', 'GOLD IN HOLD', 'GOLD NATIONAL', 'BANKS EXTERNAL', 'BANKS EXTERNAL', 'FOREIGN ASSETS', 'CLAIMS ON GOVE', 'CLAIMS ON PRIV', 'CLAIMS ON DEPT', 'RESERVE POSIT', 'CURRENCY OUTS', 'FOREIGN ASSETS', 'GOVERNMENT D', 'OTHER ITEMS IN...', 'RESERVES', 'FOREIGN ASSETS', 'CLAIMS ON GOVE', 'CLAIMS ON PRIV', 'CLAIMS ON DEPT', 'CLAIMS ON NON-F', 'CLAIMS ON PRIV', 'KENNEDY DEPOS', 'THE DEPOSITS', and 'CERTIFICATES OF...'. The table is filtered for 'Japan' and shows data for various series codes and units.

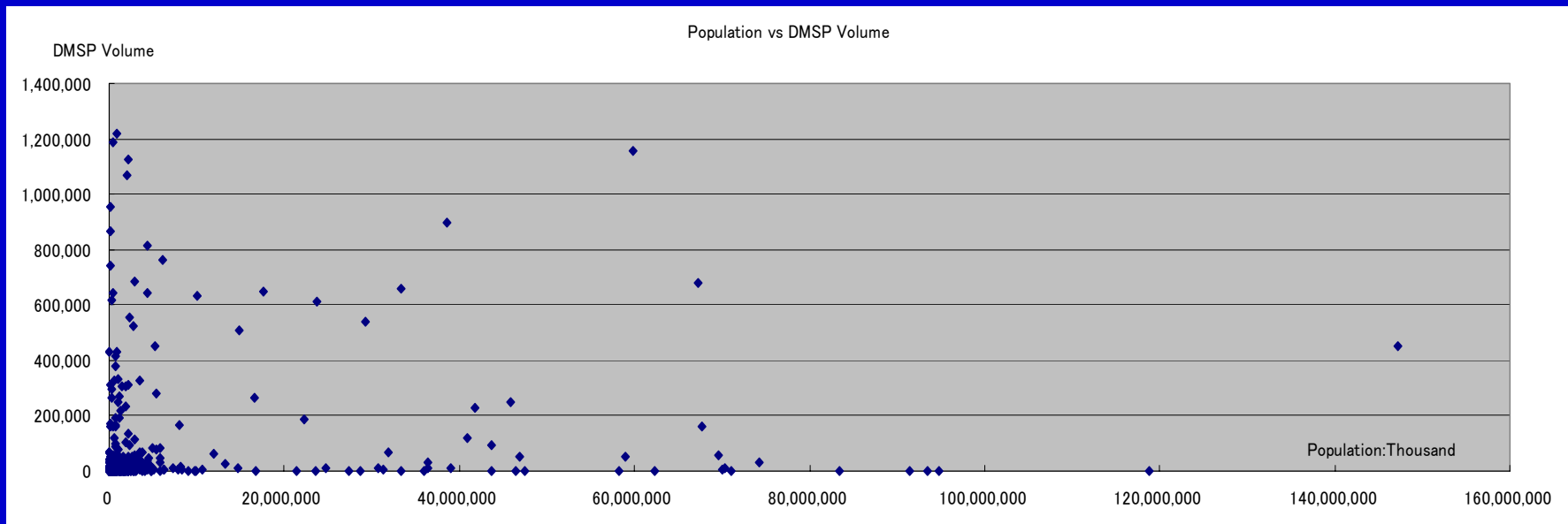
Calculation of Data on Total Amount of Light

The sum total of Non Radiance-Calibrated Data is calculated as the total amount of light by administrative region through the use of data for administrative region.

Comparison of Population and DMSP Data

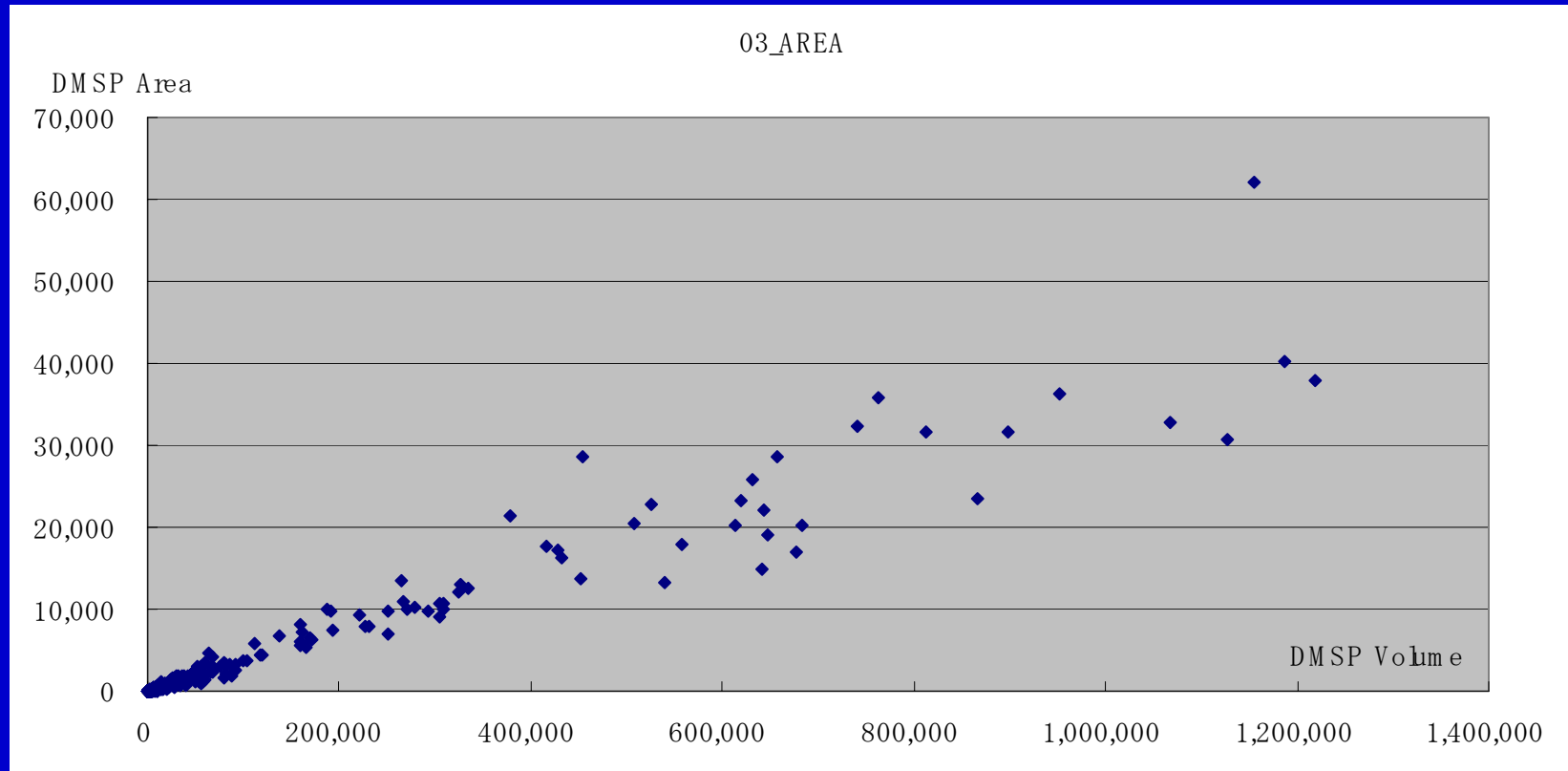
Comparison of population data by administrative unit as of 2004 and DMSP data as of 2003 is made as to the targeted countries in Asia. Comparisons of population versus light area and light amount shown below respectively.

Population & DMSP Volume by Administrative Unit



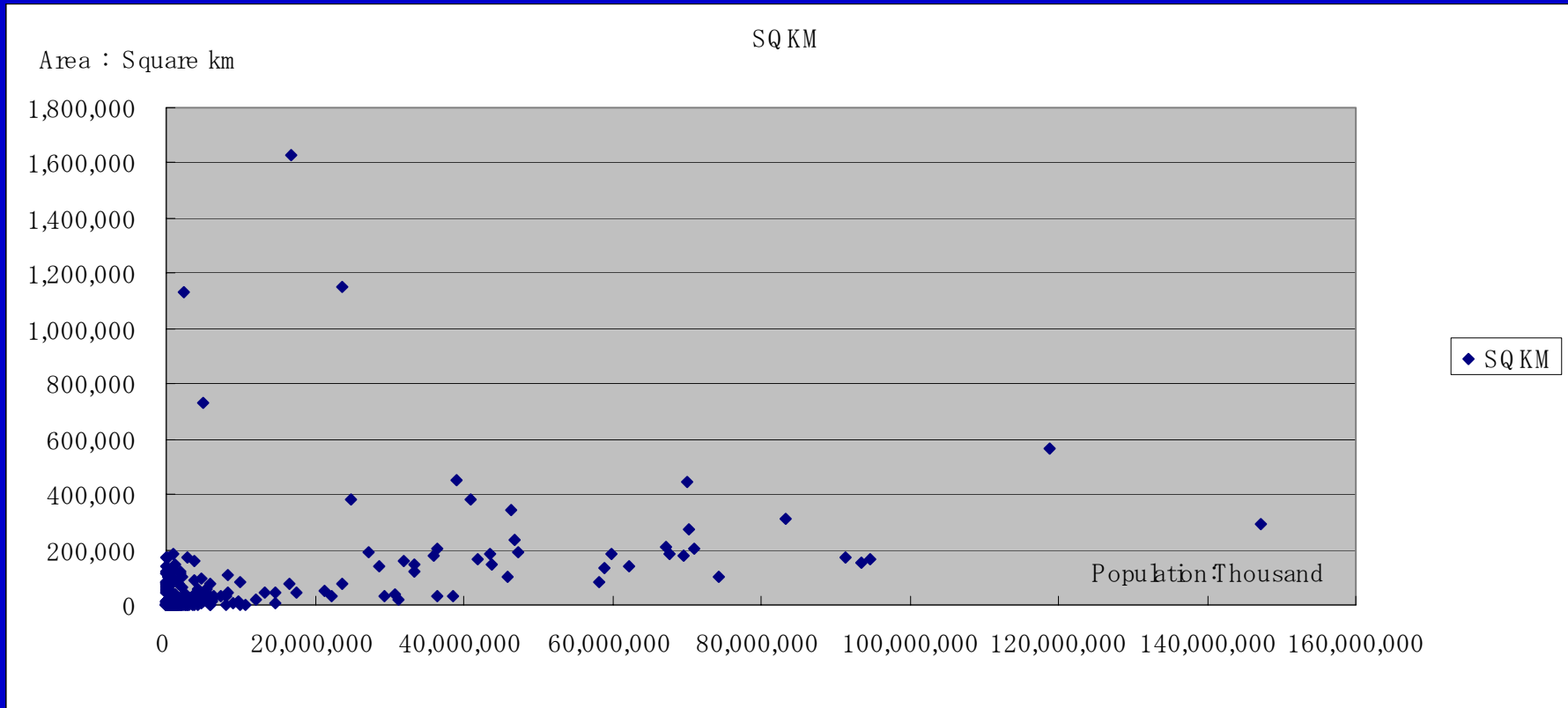
Horizontal and vertical axes represent population and DMSP Volume data respectively. There seems to be no correlation between the size of population and the DMSP Volume by administrative unit.

DMSP Volume and Area by Administrative Unit



Horizontal and vertical axes represent DMSP Volume and DMSP Area data respectively. There seems to be correlation between the DMSP Volume and the DMSP Area by administrative unit.

Population and Area Size by Administrative Unit



Horizontal and vertical axes represent Population and Area size respectively by administrative unit. There seems to be no correlation.

Regional Disparities in the Total Amount of Light

Afghanistan	36.6
Bangladesh	8.8
Bhutan	689.9
Cambodia	208.1
China	31.8
India	39.4
Japan	6.3
Kazakhstan	4.4
Laos	64.1
Malaysia	3.5
Mongolia	59.8
Myanmar	78.5

Regional Disparities in the Total Amount of Light

Nepal	32.2
North Korea	89.7
Pakistan	3.0
Philippines	4.3
Russia	*Few Data on Population
Singapore	*1 Province
South Korea	19.6
Sri Lanka	3.3
Taiwan	11.2
Tajikistan	*No Data on Population
Thailand	23.6
Uzbekistan	1.9
Vietnam	33.0

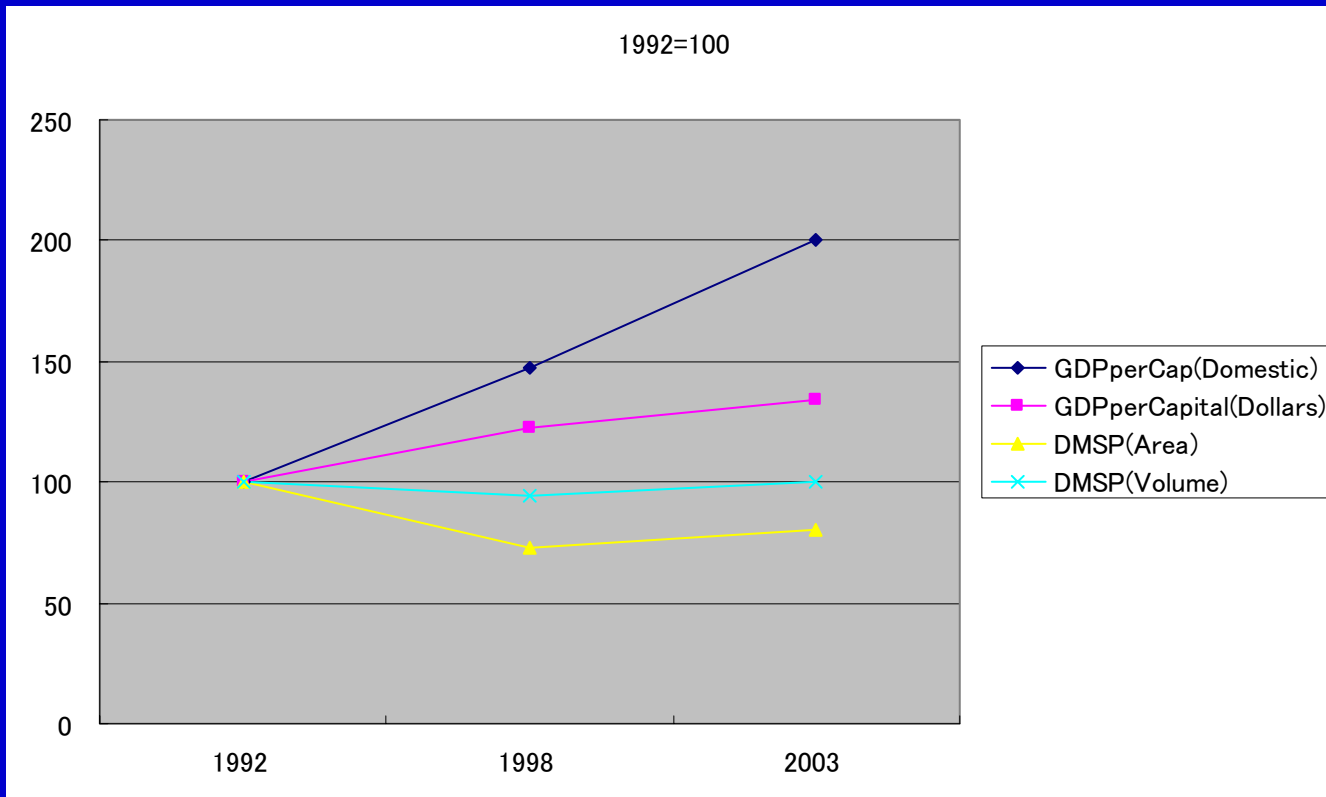
Time series of DMSP Data and Socio Economic Data in Each Country

We derived the progressions of light area and light amount data on a country-by-country basis, compared them with socioeconomic index data such as Gross Domestic Product (Domestic) and Gross Domestic Product (US dollars)

DMSP Data and GDP (Bangladesh)

Bangladesh	GDPperCapital (Domestic)	GDPperCapital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	10,975	282	9,546	258,965
1998	16,156	344	6,969	243,804
2003	21,995	378	7,688	260,443

DMSP Data and GDP (Bangladesh)



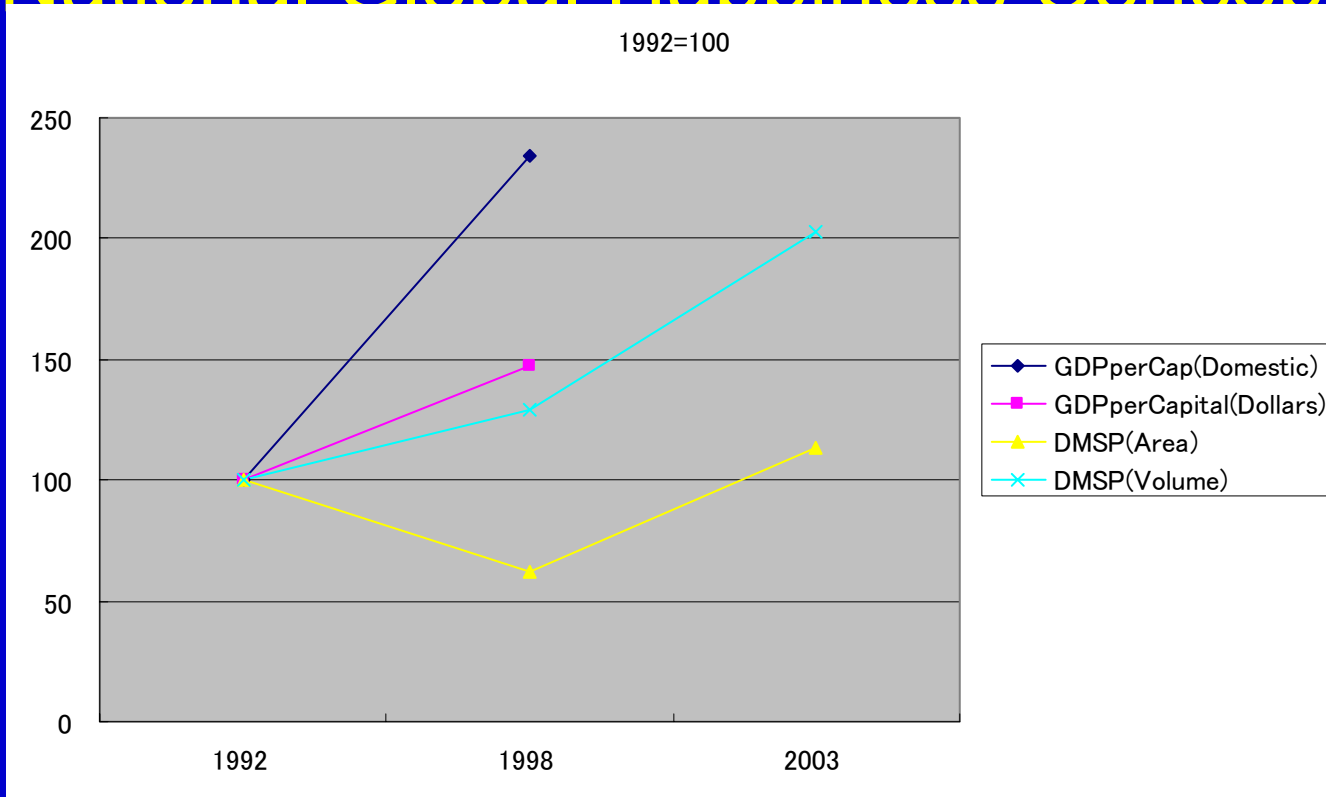
DMSP Data and GDP (Bhutan)

National Global Happiness Concept

Bhutan	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	3,780,635	145,869	116	1,827
1998	8,844,340	214,359	72	2,364
2003	No Data	No Data	132	3,710

DMSP Data and GDP (Bhutan)

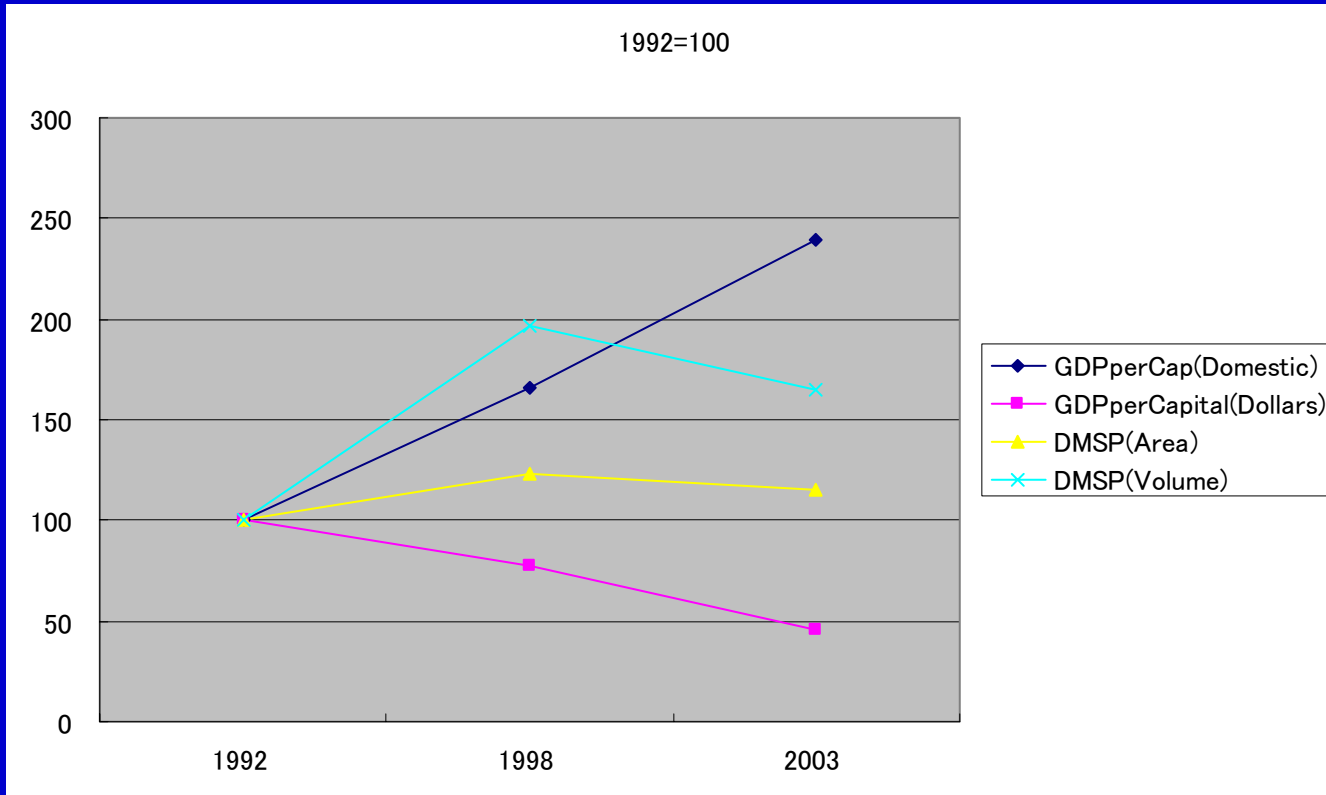
National Global Happiness Concept



DMSP Data and GDP (Burundi)

Burundi	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	38,237,102	183,565	986	21,599
1998	63,434,538	141,669	1,219	42,412
2003	91,617,200	84,625	1,138	35,646

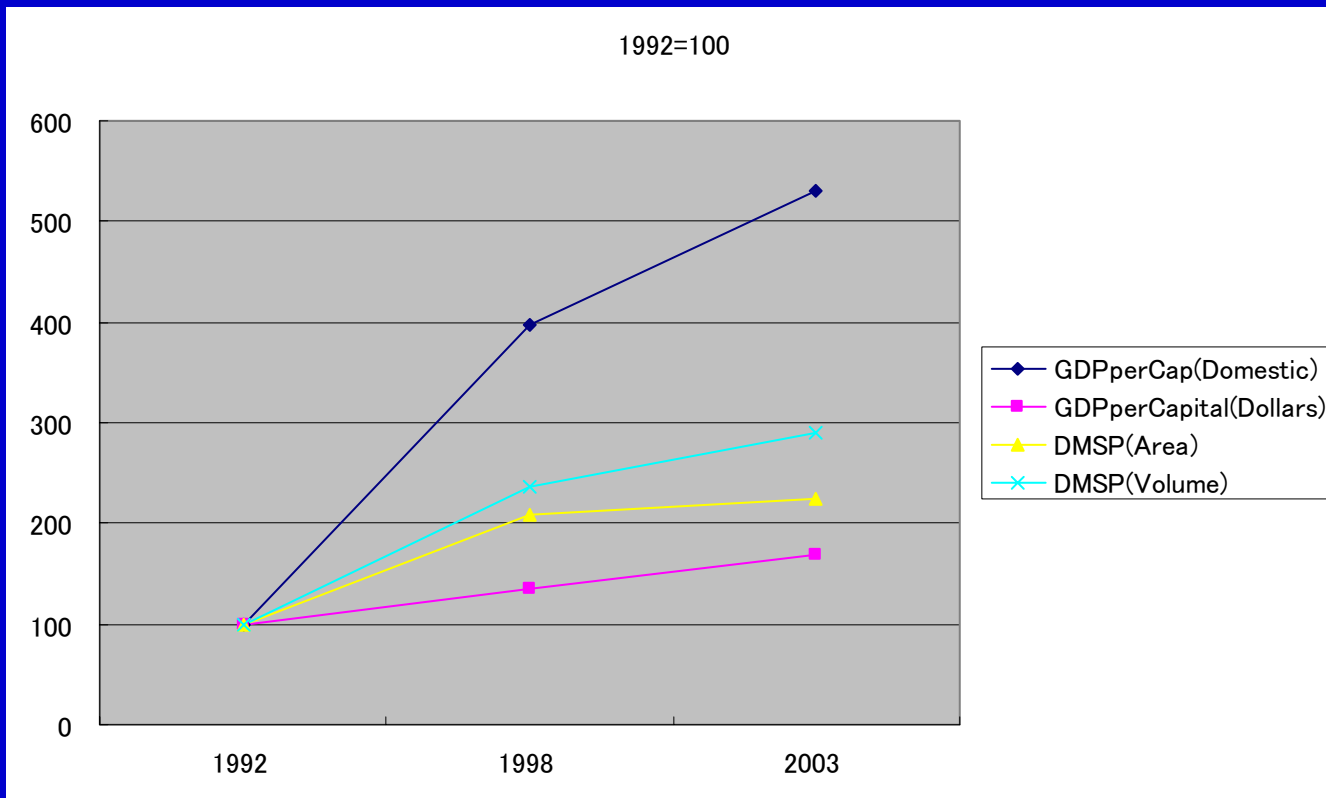
DMSP Data and GDP (Burundi)



DMSP Data and GDP (Cambodia)

Cambodia	GDP per Capital (Domestic)	GDP per Capital (Dollars)		DMSP (Area)	DMSP (Volume)
1992	240,987		190	174	4,073
1998	959,401		256	363	9,652
2003	1,279,293		322	392	11,799

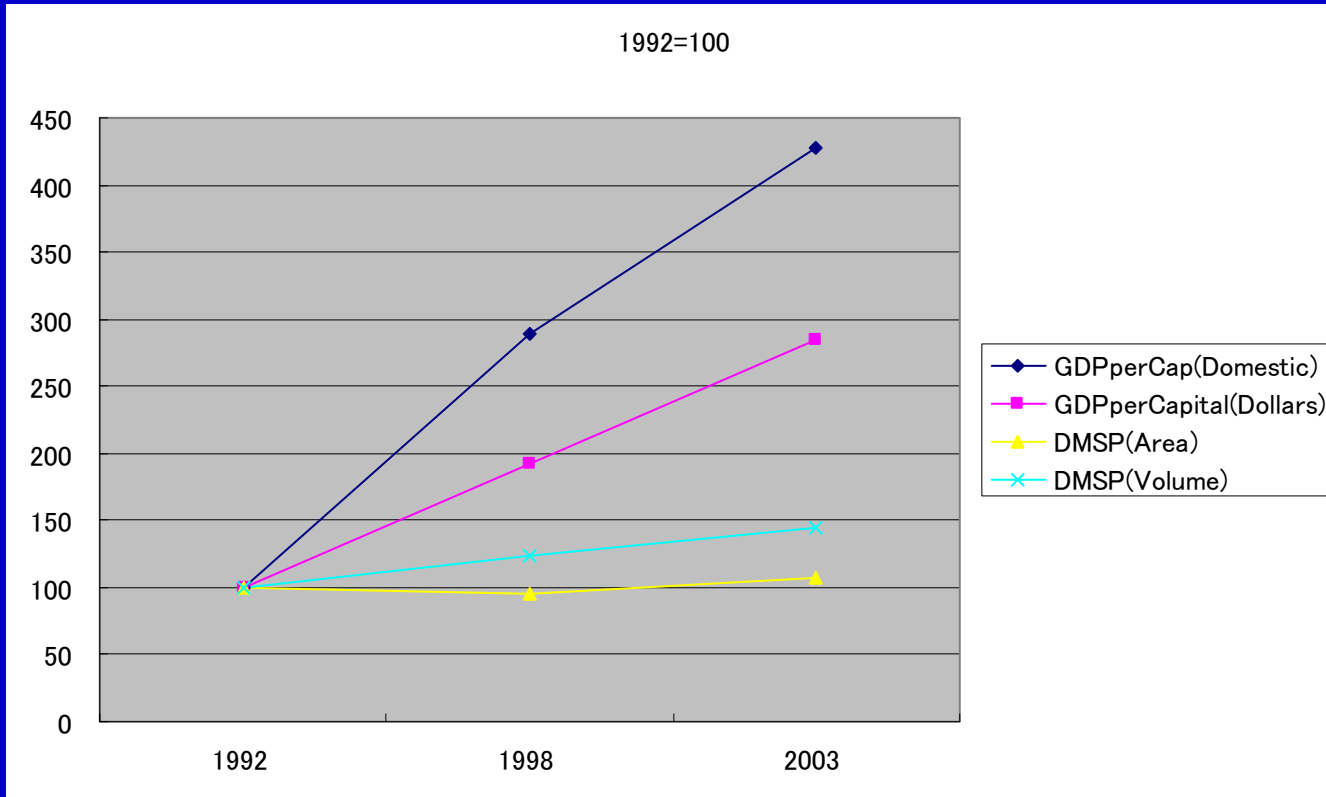
DMSP Data and GDP (Cambodia)



DMSP Data and GDP (China Main)

ChinaMain	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	2,186	396	406,426	8,316,154
1998	6,303	761	386,320	10,290,528
2003	9,347	1,129	436,951	12,054,317

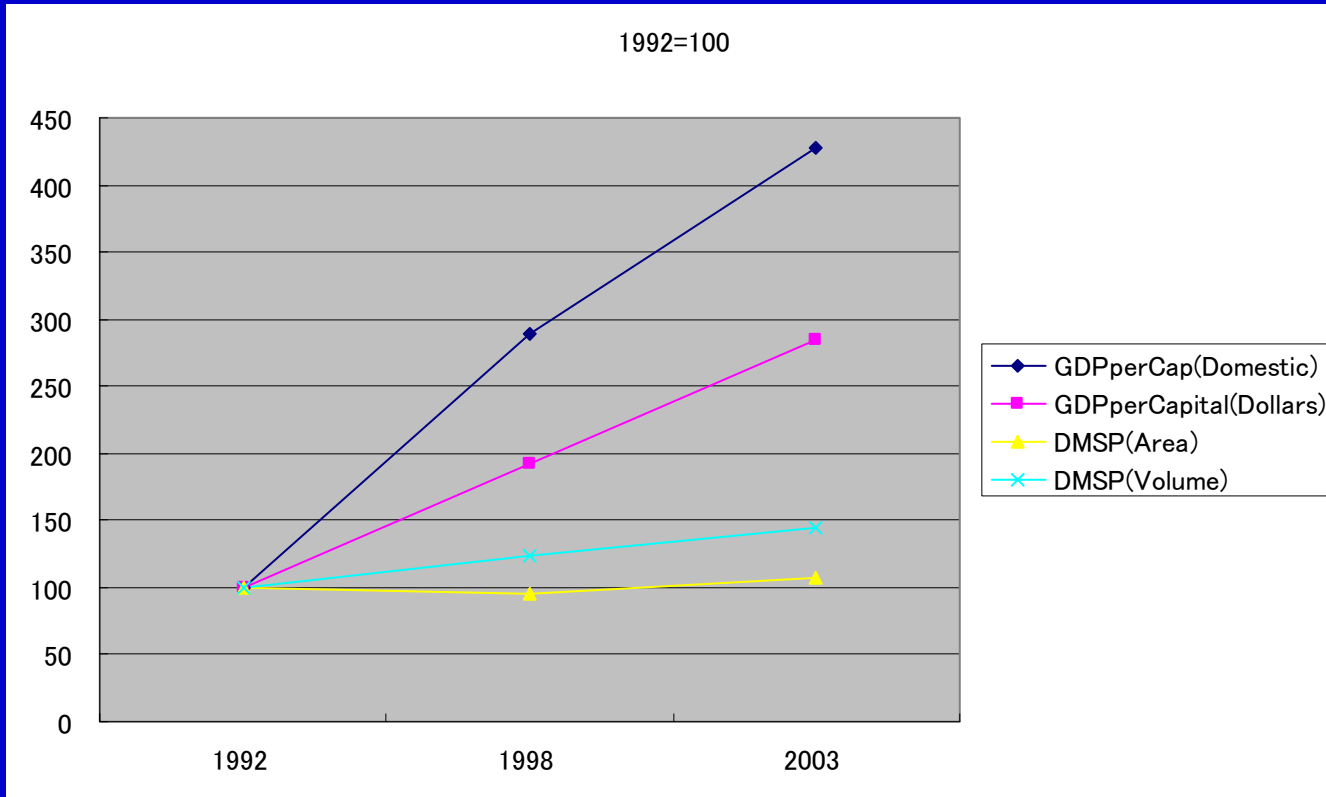
DMSP Data and GDP (China Main)



DMSP Data and GDP (Hong Kong)

HongKong	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	134,643	17,394	1,280	58,795
1998	197,992	25,563	1,233	55,894
2003	175,470	22,534	1,244	58,447

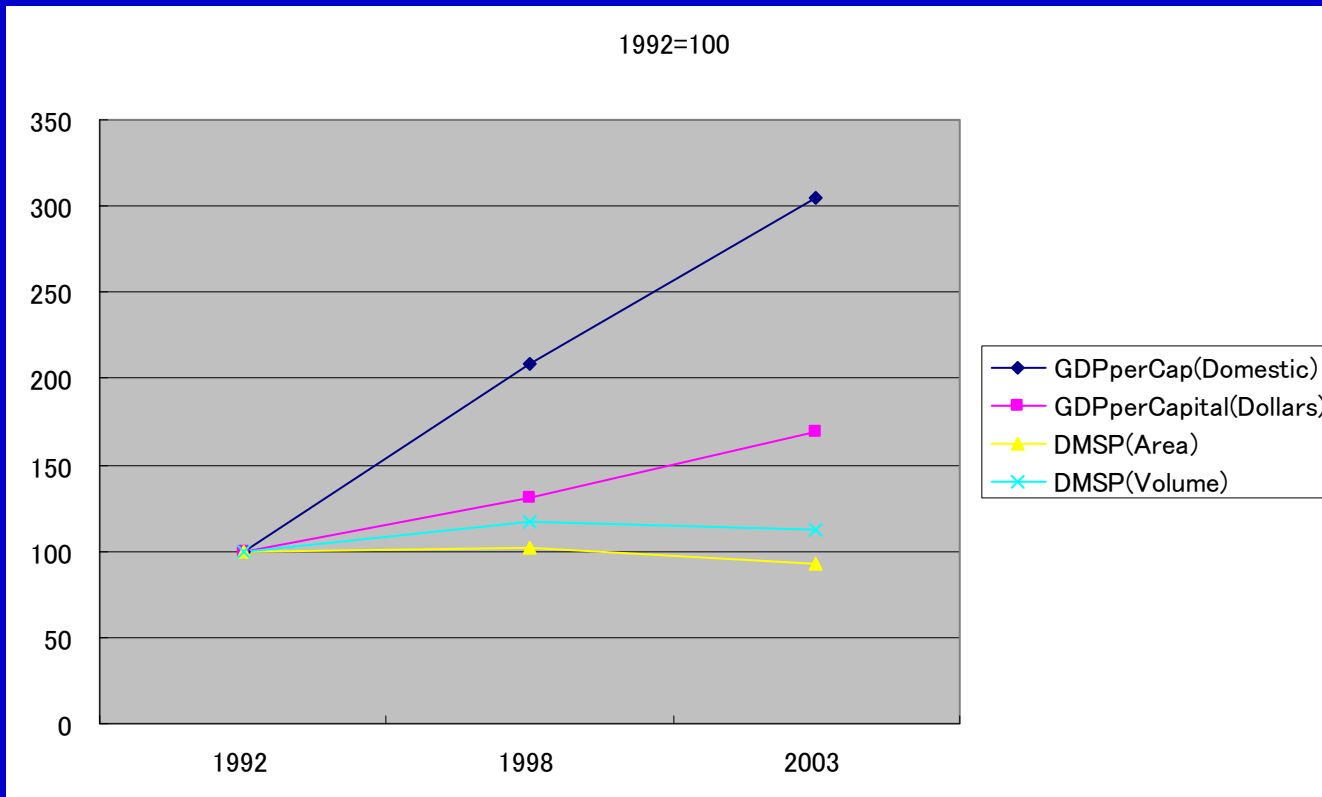
DMSP Data and GDP (Hong Kong)



DMSP Data and GDP (India)

India	GDP per Capital (Domestic)	GDP per Capital (Dollars)		DMSP (Area)	DMSP (Volume)
1992	8,468		327	284,867	7,090,018
1998	17,636		427	291,382	8,303,638
2003	25,775		553	265,174	7,954,275

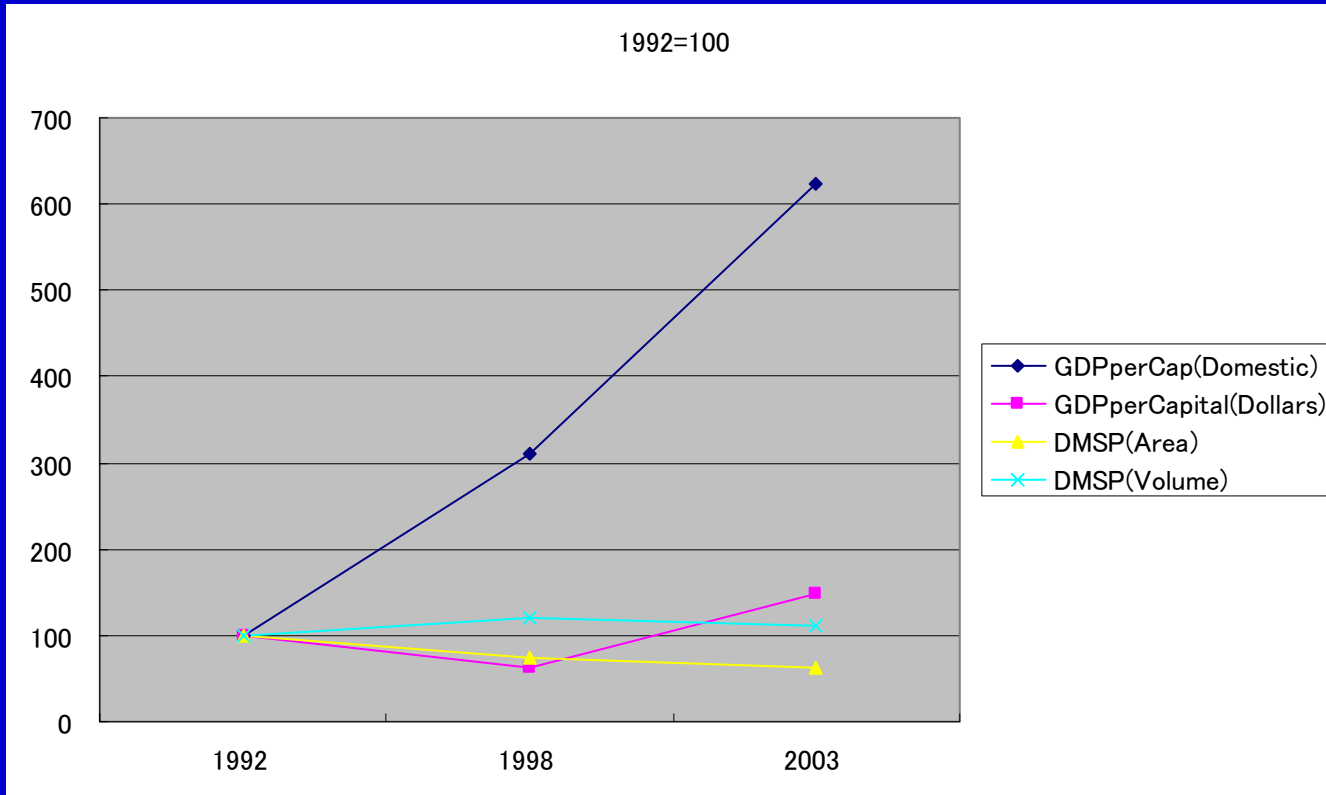
DMSP Data and GDP (India)



DMSP Data and GDP (Indonesia)

Indonesia	GDP per Capital (Domestic)	GDP per Capital (Dollars)		DMSP (Area)	DMSP (Volume)
1992	1,508,343		743	2,200	39,725
1998	4,690,053		468	1,628	48,067
2003	9,412,525		1,097	1,365	43,855

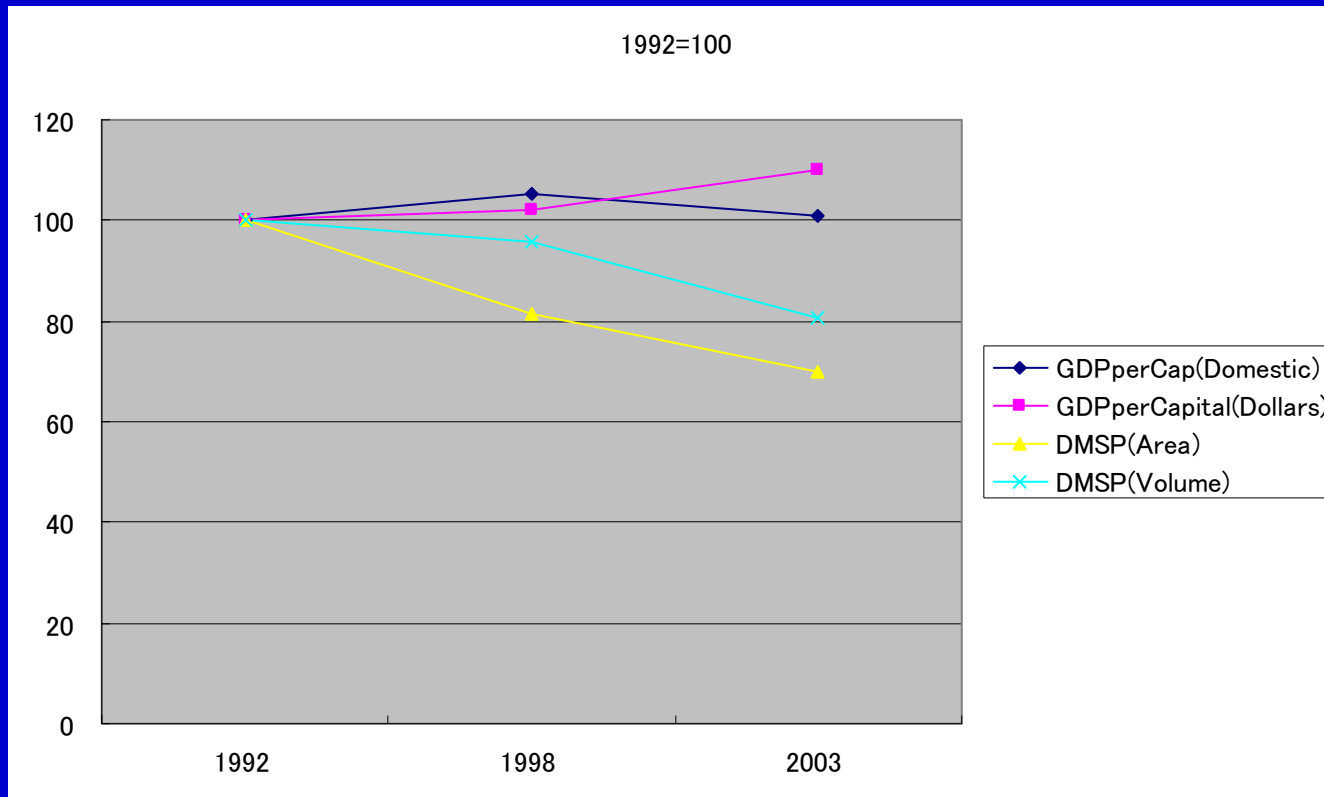
DMSP Data and GDP (Indonesia)



DMSP Data and GDP (Japan)

Japan	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	3,863,283	30,503	270,668	6,264,526
1998	4,071,565	31,103	219,967	5,997,373
2003	3,897,085	33,615	189,508	5,047,485

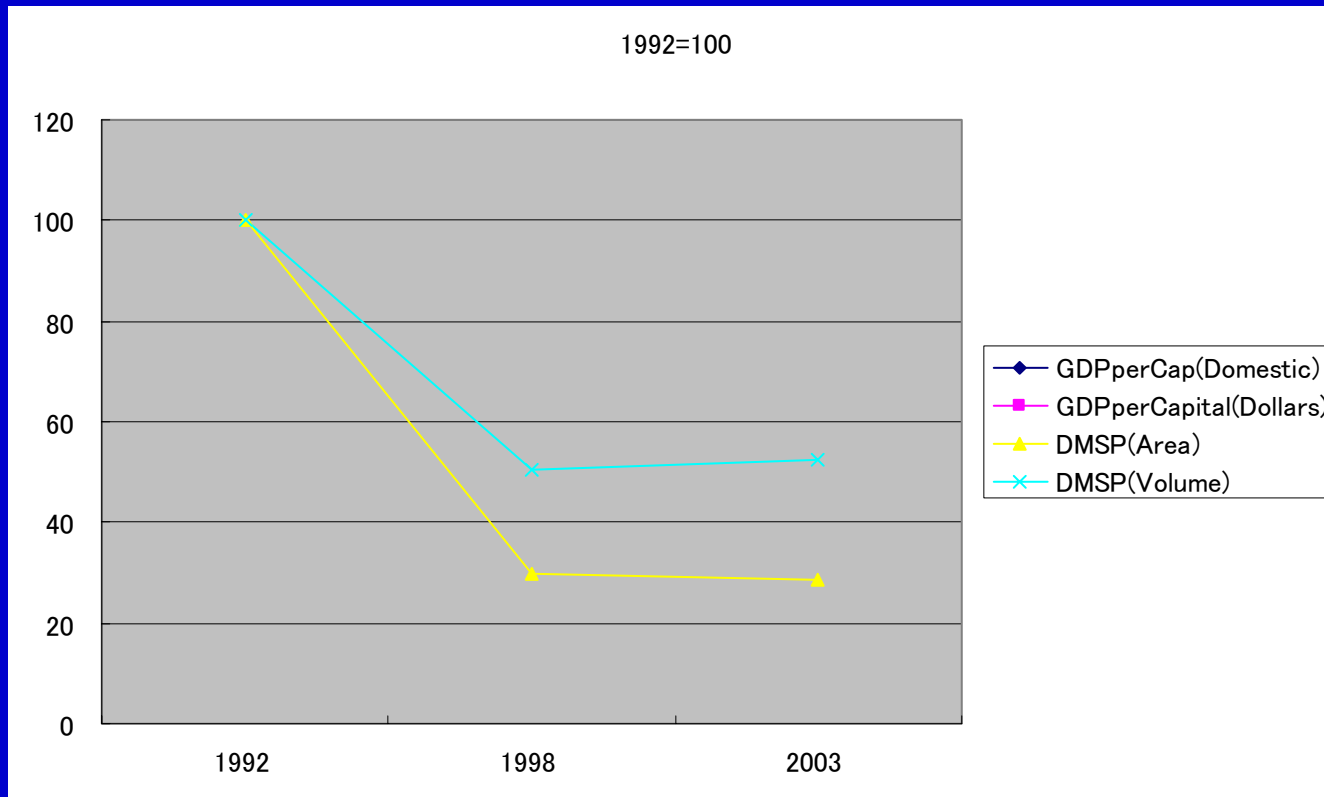
DMSP Data and GDP (Japan)



DMSP Data and GDP (Kazakhstan)

Kazakhstan	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	0	#DIV/0!	73,148	1,016,873
1998	107,887	1,378	21,762	512,964
2003	302,168	2,020	20,905	531,546

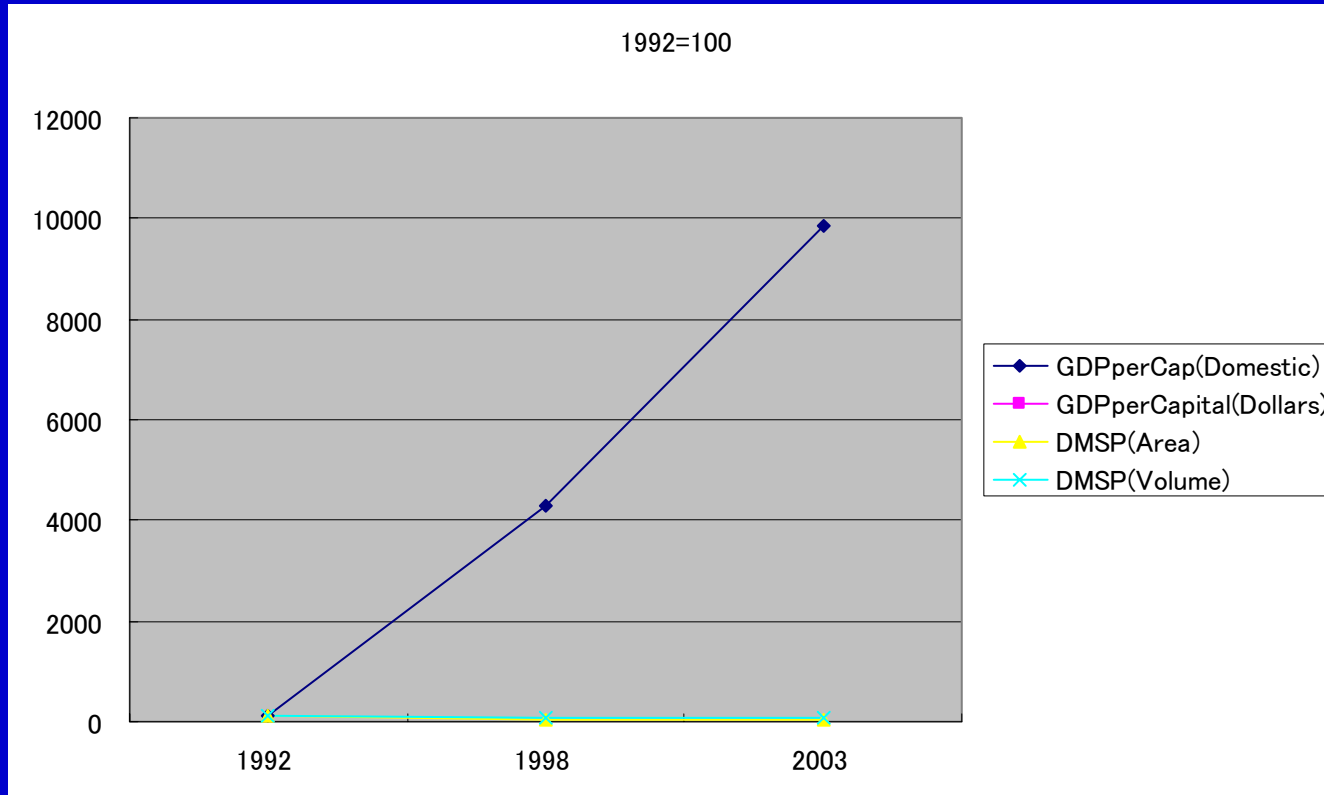
DMSP Data and GDP (Kazakhstan)



DMSP Data and GDP (KyrgyzRep)

KyrgyzRep	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	165,585	#DIV/0!	12,759	161,946
1998	7,122,965	341,832	7,276	155,334
2003	16,304,363	373,539	5,334	125,738

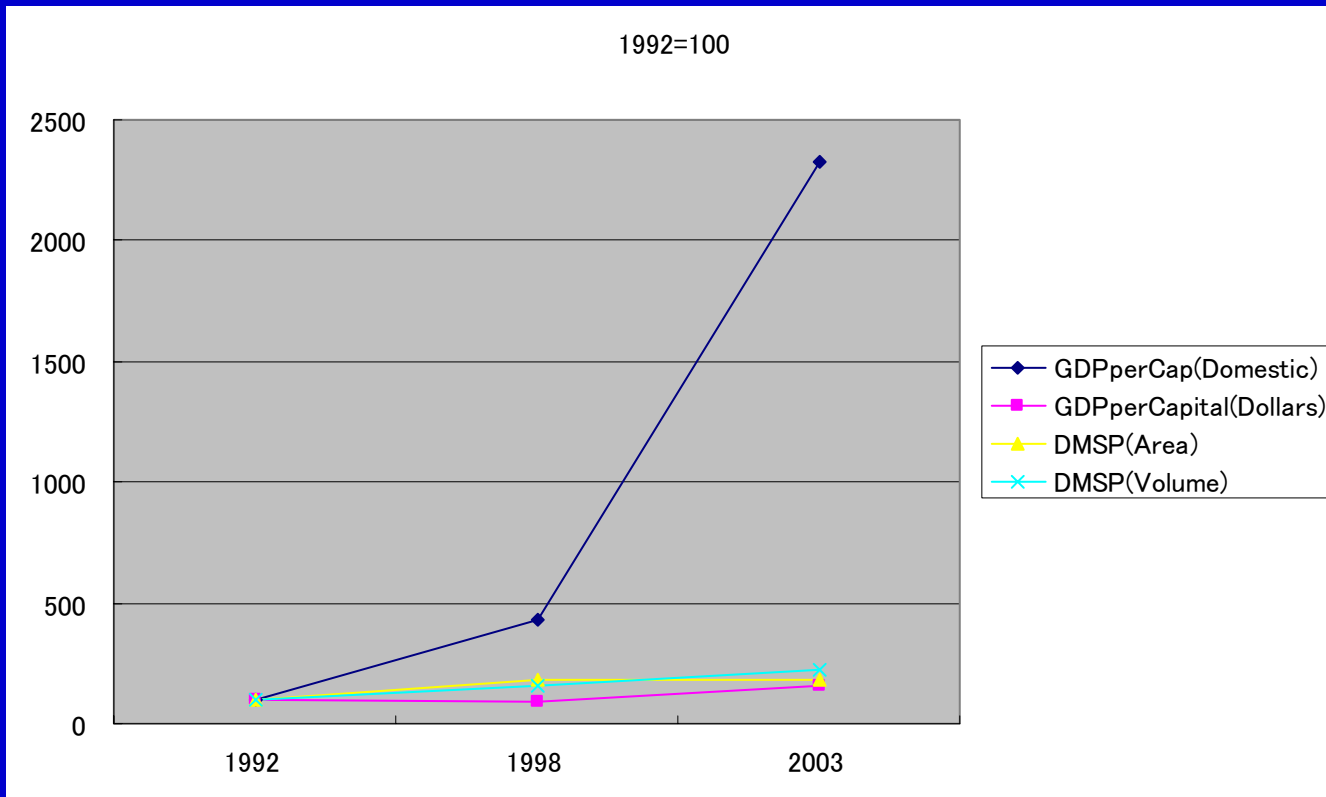
DMSP Data and GDP (KyrgyRep)



DMSP Data and GDP (Laos)

Laos	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	194, 115	271	355	7, 620
1998	841, 997	255	633	11, 957
2003	4, 522, 505	428	640	17, 146

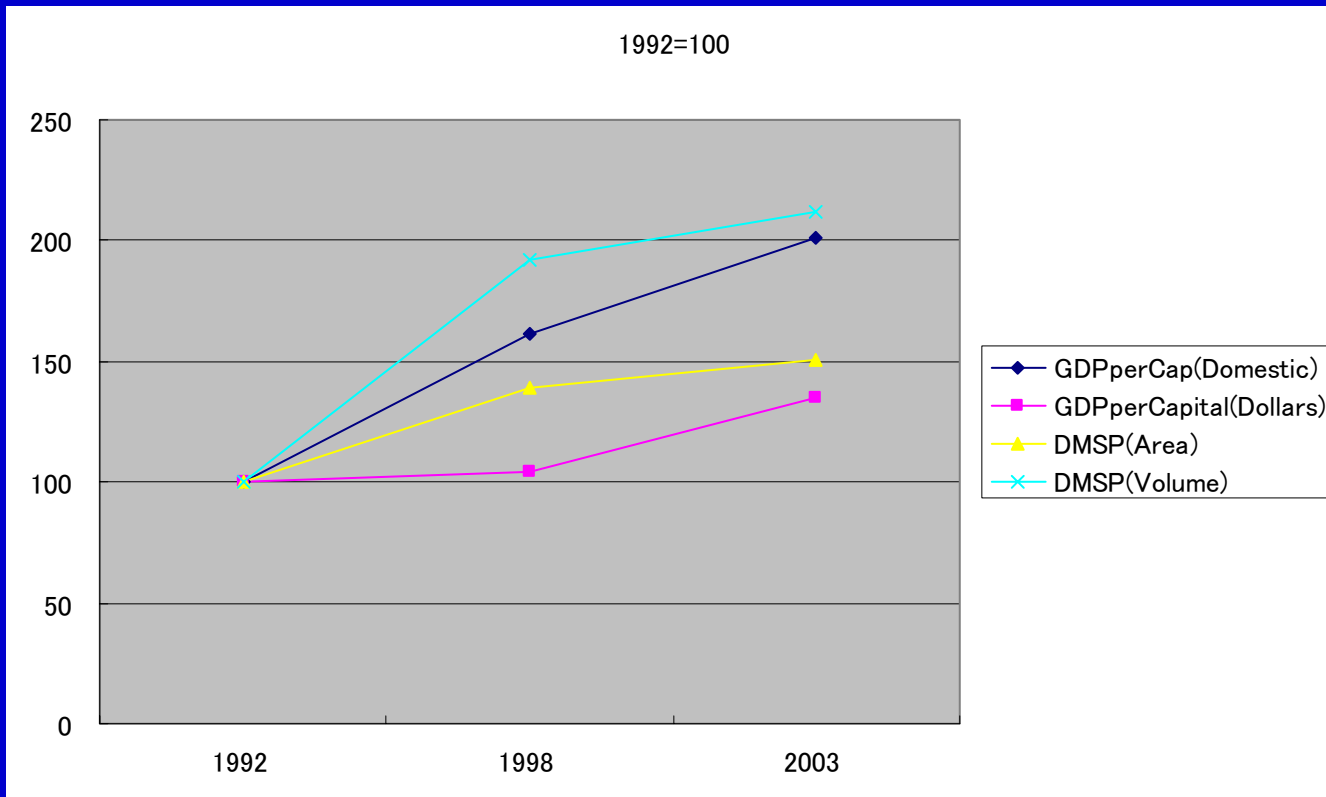
DMSP Data and GDP (Laos)



DMSP Data and GDP (Malaysia)

Malaysia	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	8,007,631	3,143,477	19,411	362,420
1998	12,897,839	3,286,593	27,059	695,436
2003	16,131,408	4,245,107	29,193	767,011

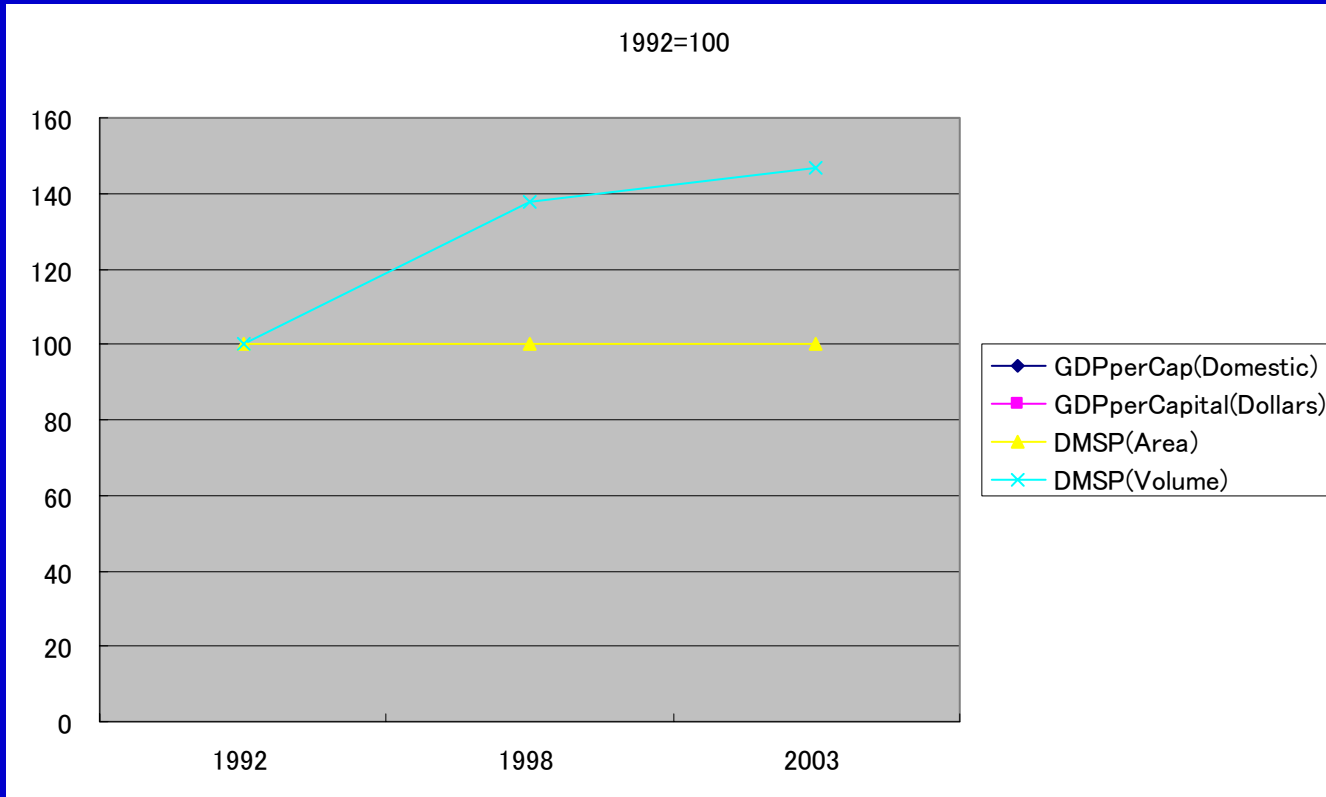
DMSP Data and GDP (Malaysia)



DMSP Data and GDP (Maldives)

Maldives	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	No Data	No Data	2	64
1998	No Data	No Data	2	88
2003	No Data	No Data	2	94

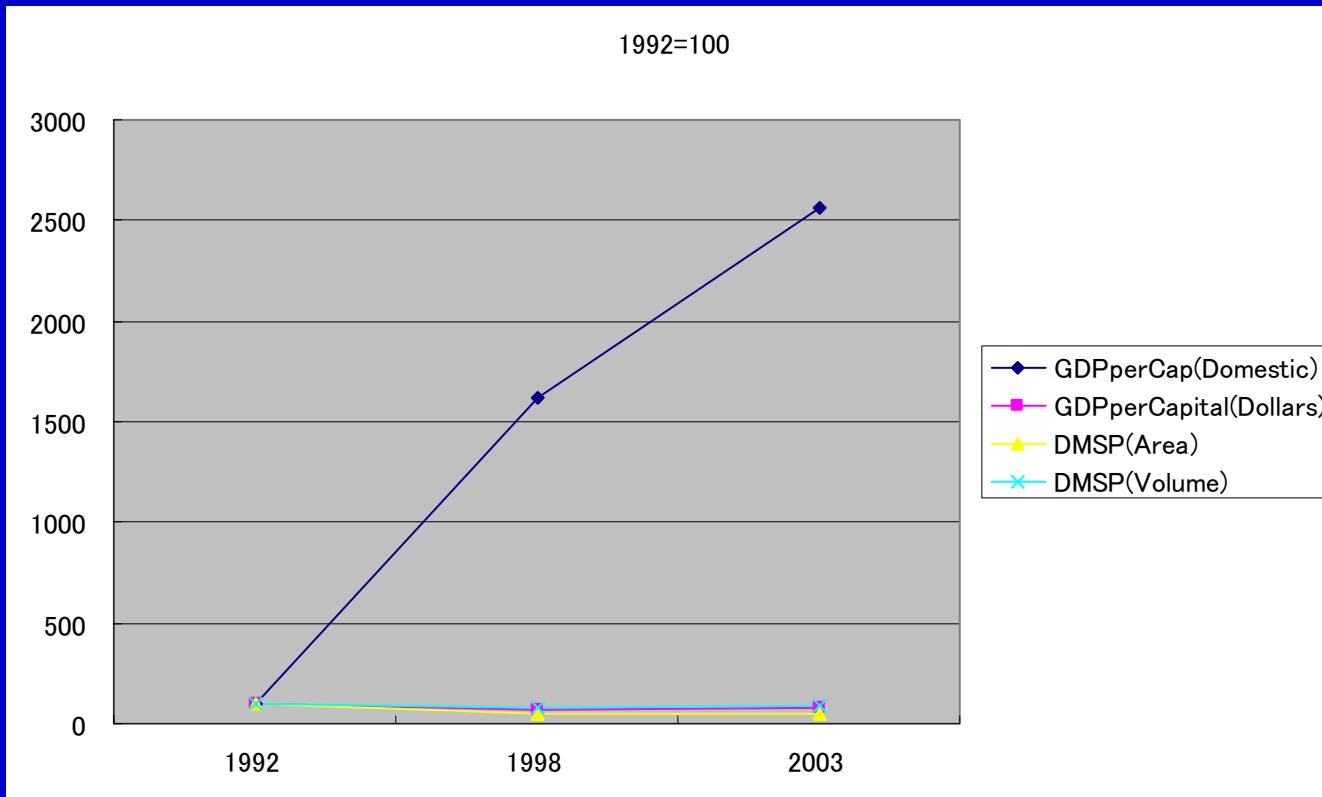
DMSP Data and GDP (Maldives)



DMSP Data and GDP (Mongolia)

Mongolia	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	20,550,677	573,508	3,364	49,323
1998	333,133,495	396,197	1,657	41,612
2003	527,481,549	460,064	1,710	43,595

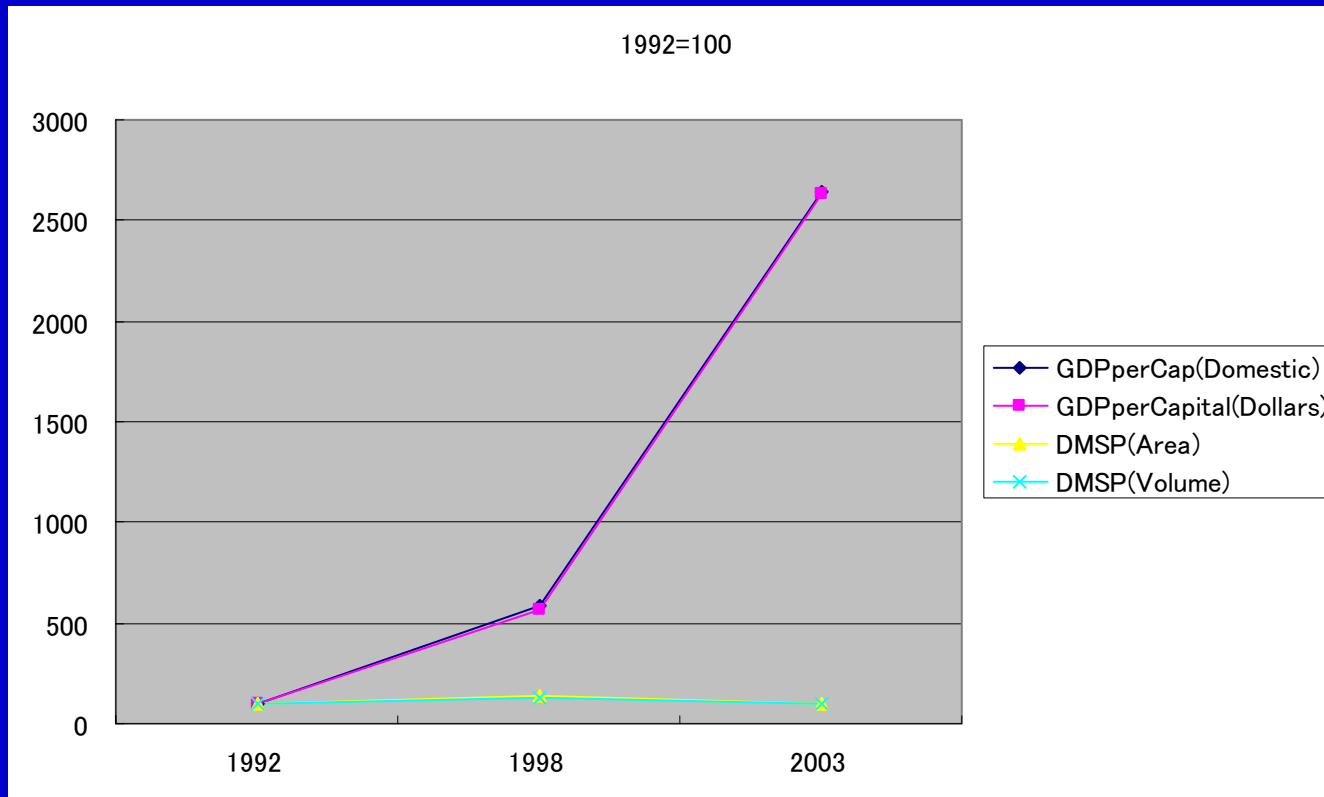
DMSP Data and GDP (Mongolia)



DMSP Data and GDP (Myanmar)

Myanmar	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	5,901,513	976,621	2,787	62,253
1998	34,622,052	5,518,470	3,896	81,456
2003	156,006,979	25,674,329	2,633	62,861

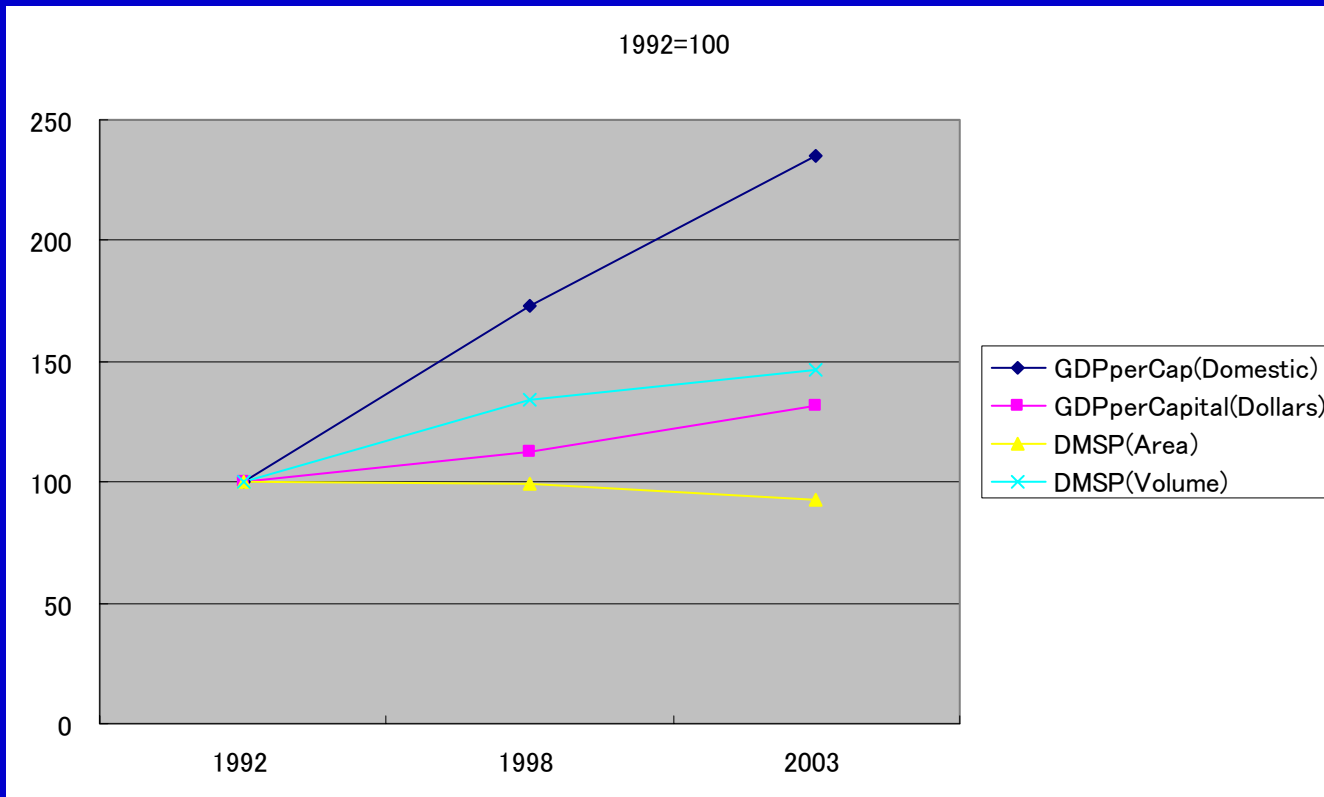
DMSP Data and GDP (Myanmar)



DMSP Data and GDP (Nepal)

Nepal	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	7,438,545	174,133	1,486	29,113
1998	12,895,752	195,462	1,473	39,014
2003	17,462,000	229,336	1,378	42,773

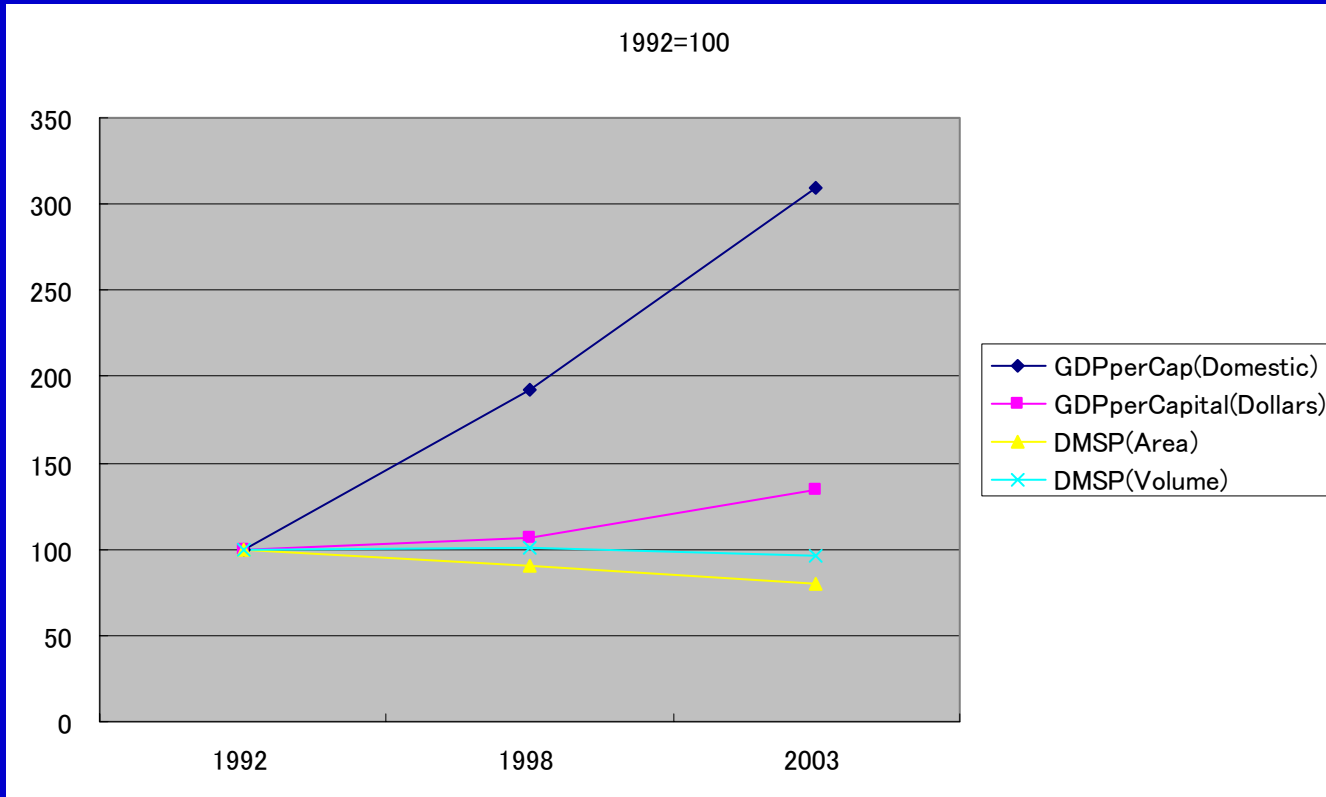
DMSP Data and GDP (Nepal)



DMSP Data and GDP (Pakistan)

Pakistan	GDP per Capital (Domestic)	GDP per Capital (Dollars)		DMSP (Area)	DMSP (Volume)
1992	10,253	409	113,409	1,885,898	
1998	19,689	437	102,005	1,891,567	
2003	31,768	550	90,848	1,822,369	

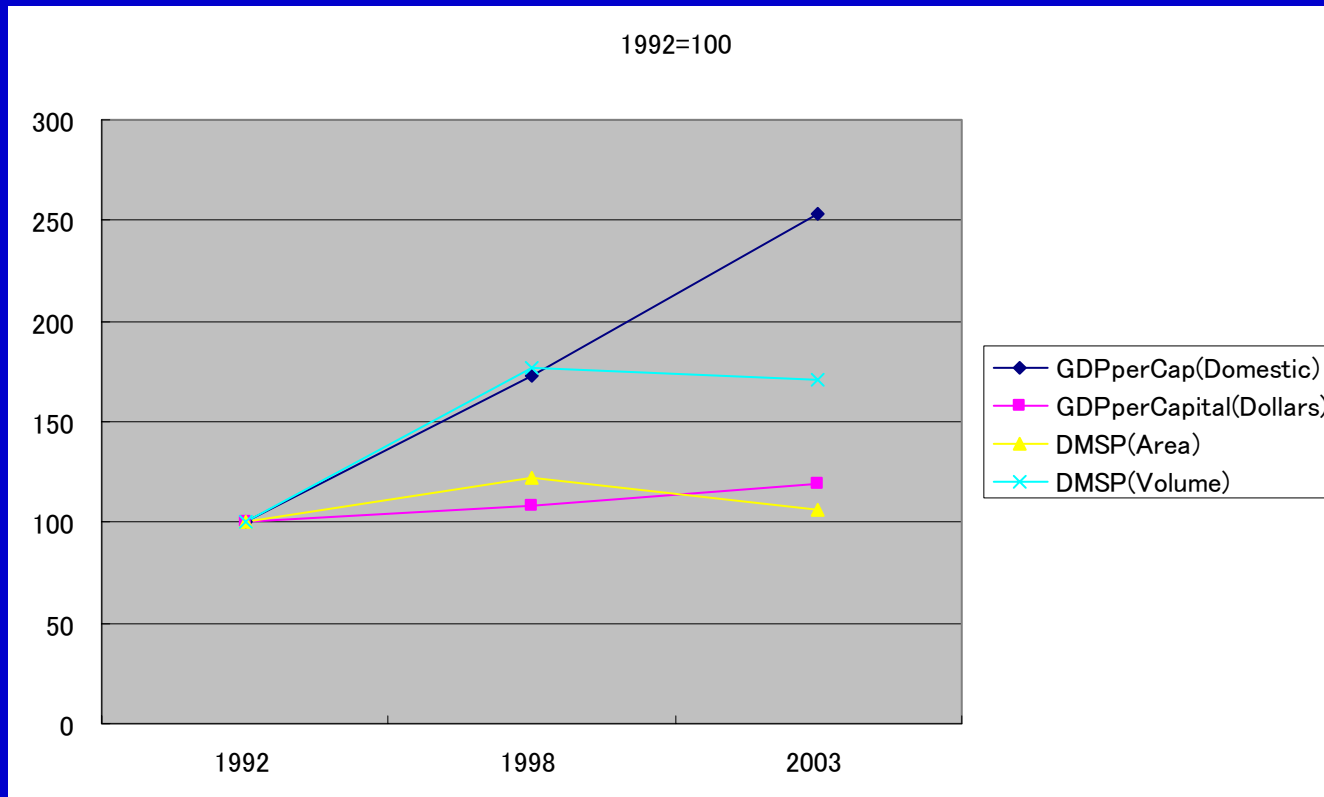
DMSP Data and GDP (Pakistan)



DMSP Data and GDP (Philippines)

Philippines	GDP per Capital (Domestic)	GDP per Capital (Dollars)		DMSP (Area)	DMSP (Volume)
1992	21,122		828	10,587	204,858
1998	36,598		895	12,935	361,760
2003	53,552		988	11,278	349,594

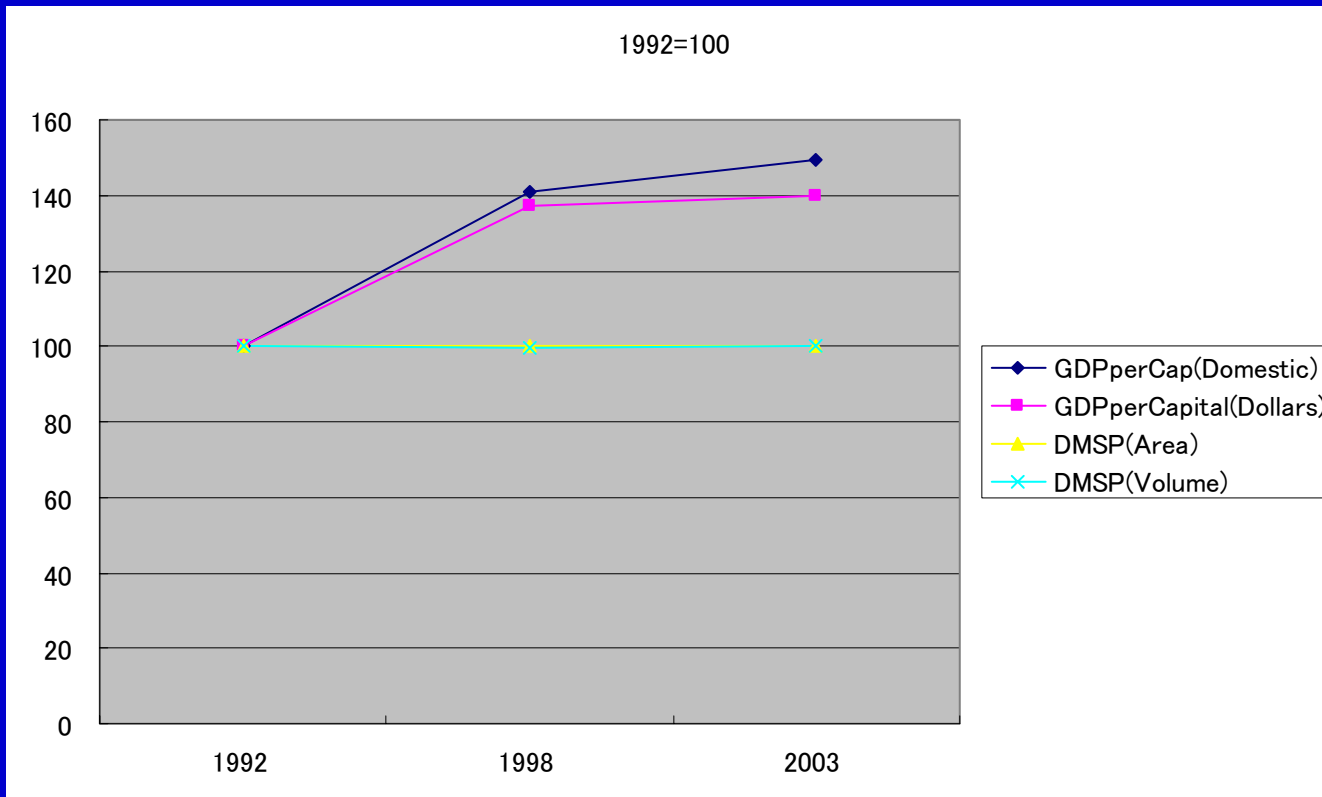
DMSP Data and GDP (Philippines)



DMSP Data and GDP (Singapore)

Singapore	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	25,527,288	15,670,815	646	39,873
1998	35,979,198	21,498,087	646	39,747
2003	38,135,457	21,889,504	646	39,860

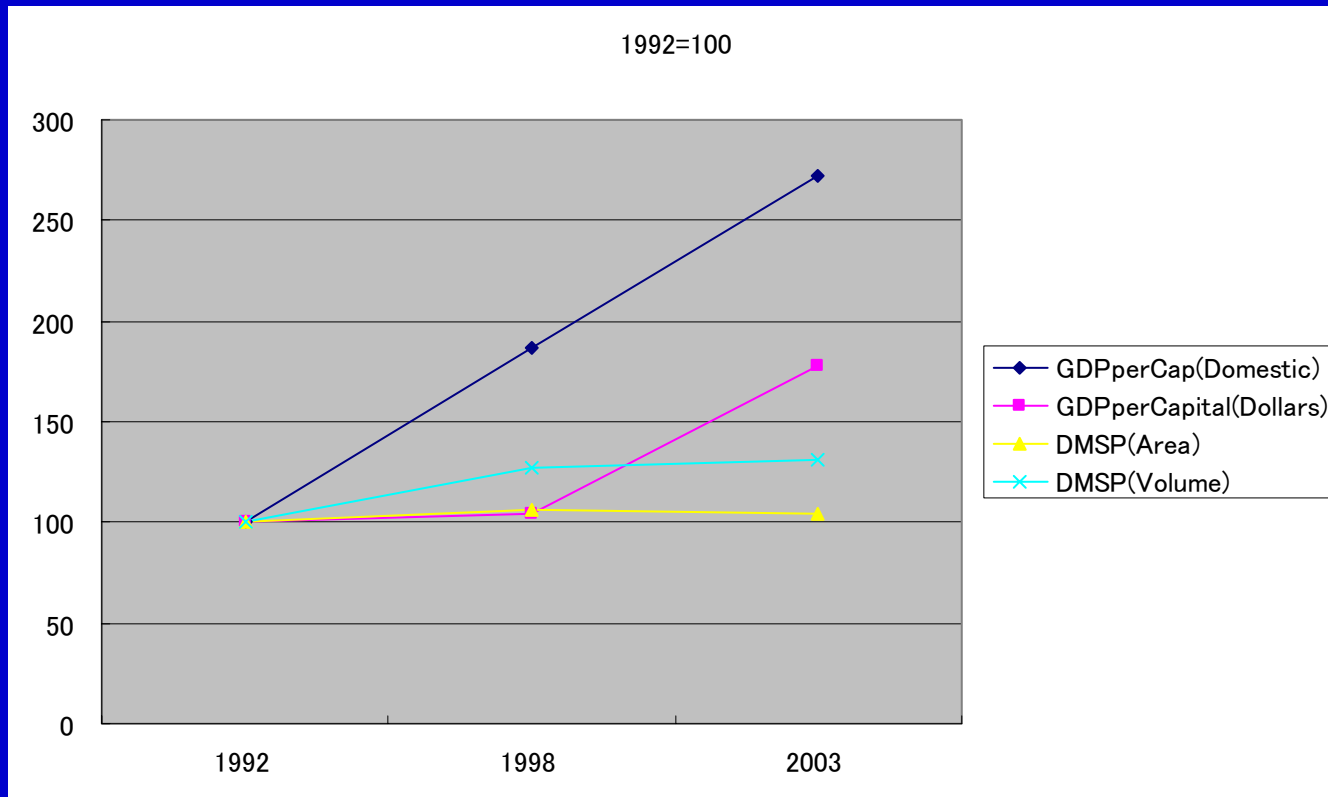
DMSP Data and GDP (Singapore)



DMSP Data and GDP (Korea)

Korea	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	5,619,211	7,198	76,914	1,440,529
1998	10,489,909	7,485	82,131	1,832,804
2003	15,268,080	12,813	79,873	1,888,686

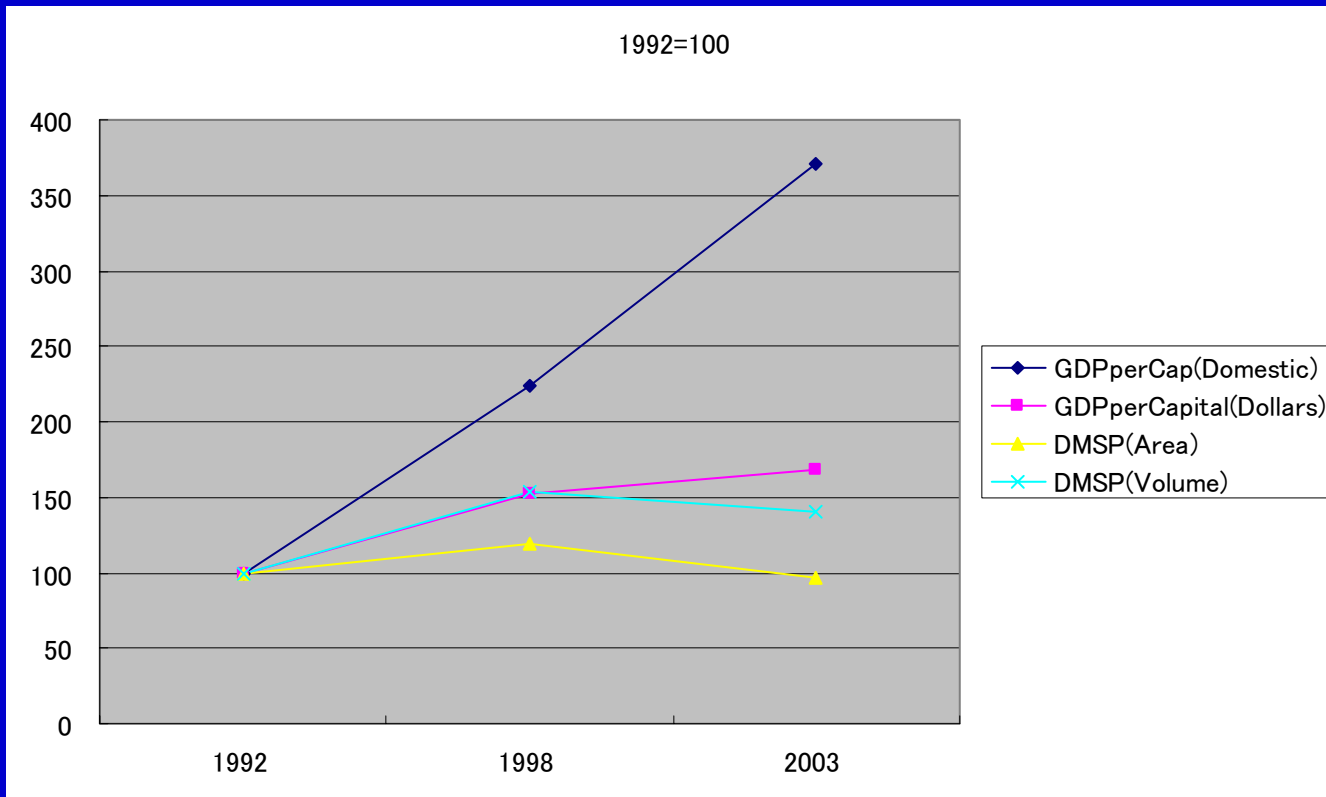
DMSP Data and GDP (Korea)



DMSP Data and GDP (Sri Lanka)

SriLanka	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	23,303,433	531,683	6,153	122,221
1998	52,292,306	811,361	7,327	187,121
2003	86,355,925	894,685	5,971	172,074

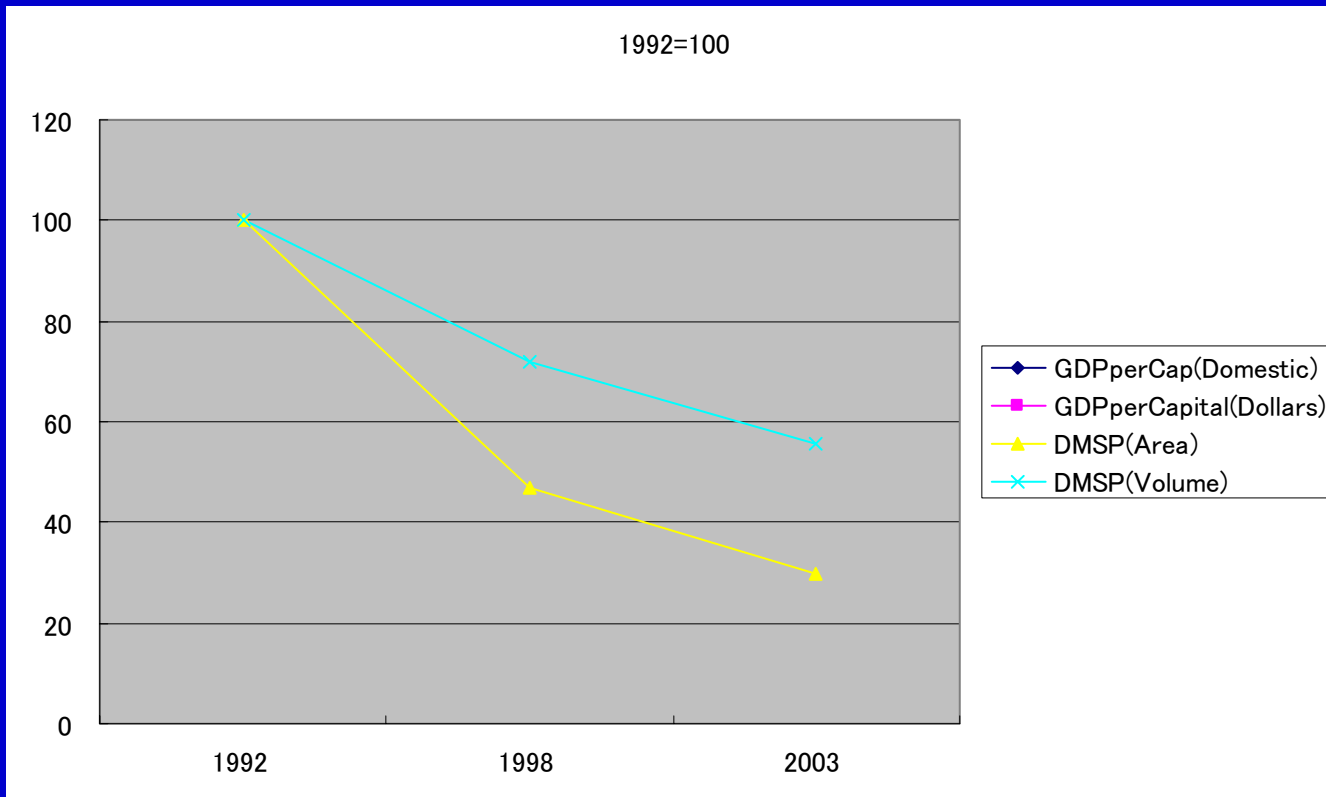
DMSP Data and GDP (Sri Lanka)



DMSP Data and GDP (Tajikistan)

Tajikistan	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	No Data	No Data	12,895	178,287
1998	No Data	No Data	6,068	128,035
2003	No Data	No Data	3,852	99,093

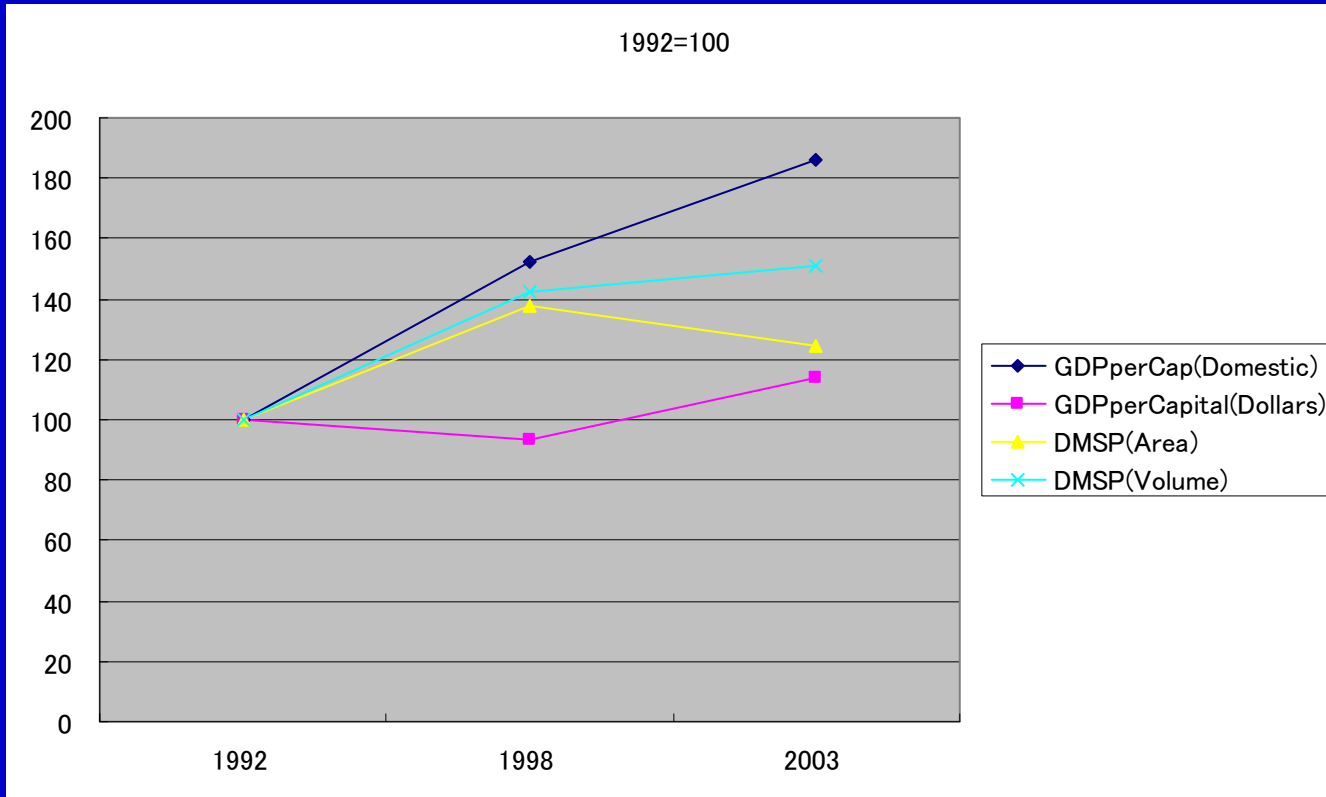
DMSP Data and GDP (Tajikistan)



DMSP Data and GDP (Thailand)

Thailand	GDP per Capital (Domestic)	GDP per Capital (Dollars)	DMSP (Area)	DMSP (Volume)
1992	50,395	1,984	37,460	737,050
1998	76,785	1,857	51,544	1,049,744
2003	93,917	2,264	46,652	1,113,091

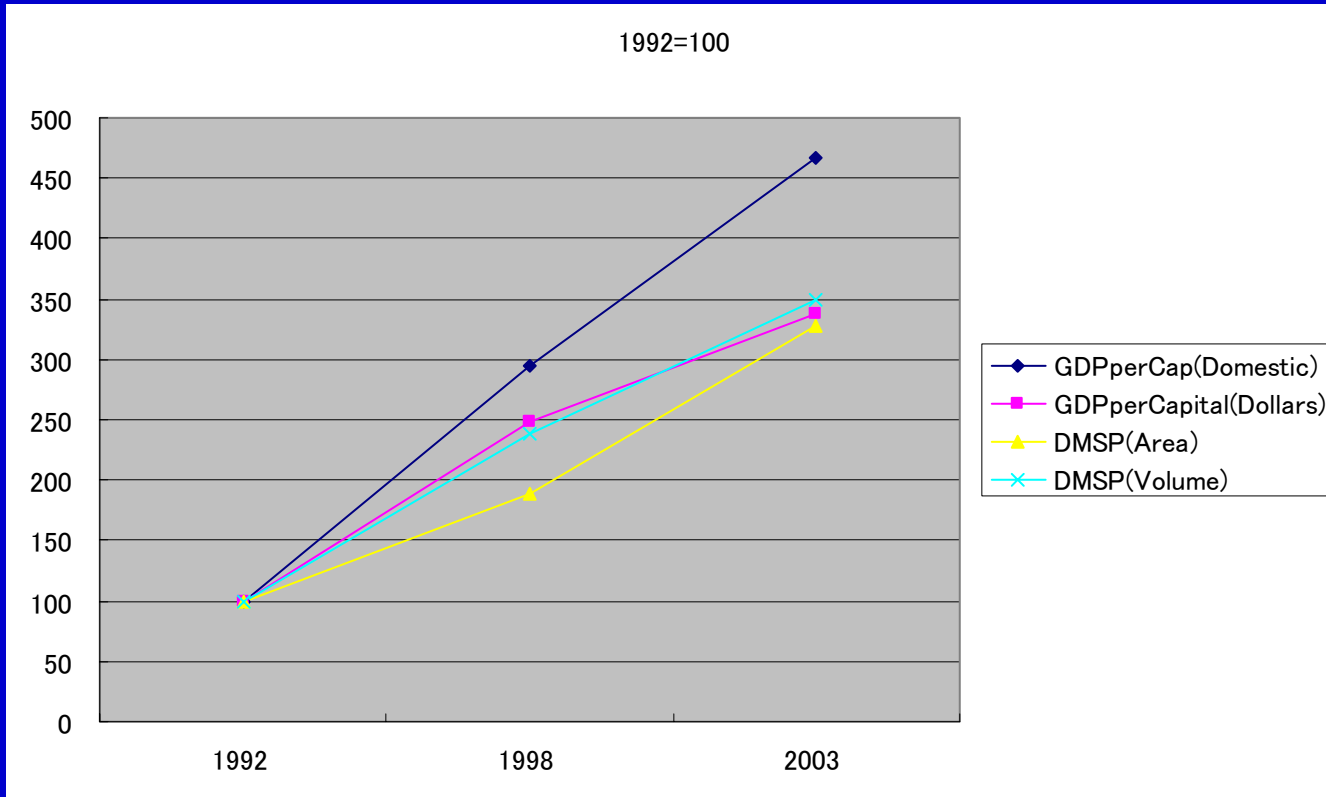
DMSP Data and GDP (Thailand)



DMSP Data and GDP (Vietnam)

Vietnam	GDP per Capital (Domestic)	GDP per Capital (Dollars)		DMSP (Area)	DMSP (Volume)
1992	1,599,632		143	5,612	151,400
1998	4,716,229		355	10,572	361,017
2003	7,480,994		482	18,355	528,318

DMSP Data and GDP (Vietnam)



Conclusion

Light area and light amount data on a country-by-country basis are obtained and compared them with socioeconomic index data and there seems us to be correlations among them.

Thanks to.....

☆ U.S Airforce Weather Agency

☆ NOAA Natinal Geophysical Data Center,
DMSP Research Group

☆ Graduate school of Agriculture Kyoto
University