EUMETSAT JASON i MTG sateliti - HAZU 2014 predavanje

Data · January 2014

1 author:

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Meteorological and Hydrological Service
34 PUBLICATIONS **4** CITATIONS
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EUMETSAT Jason i MTG sateliti 0,5 stoljeća

dr Bojan Lipovšćak
DHMZ

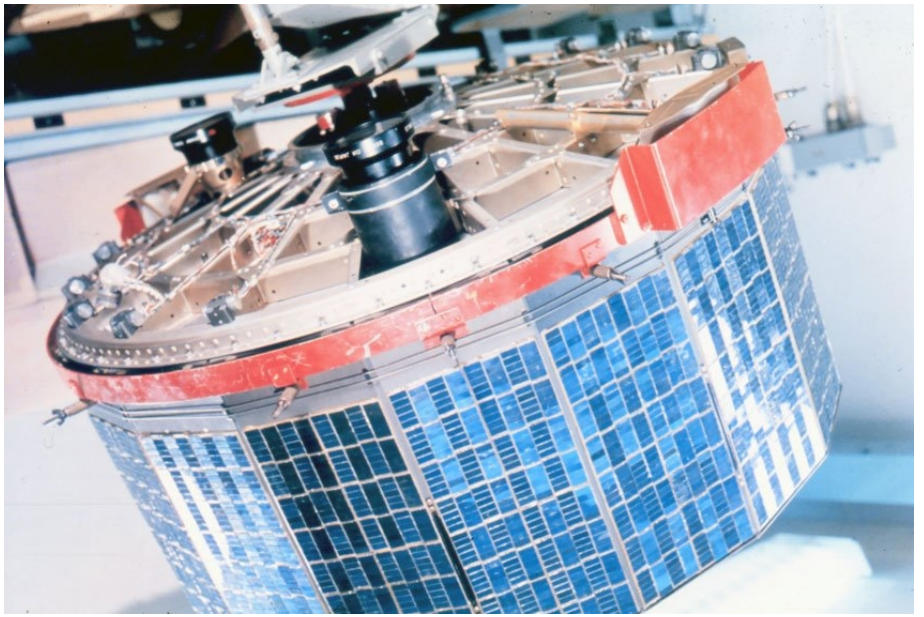
EUMETSAT

DHMZ

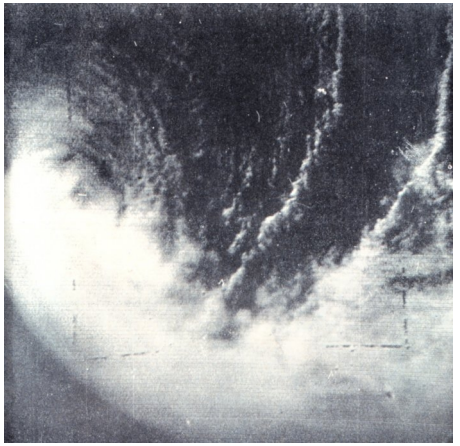
- kada je počelo i kako se EU organizirala
- kako od ideje do EUMETSATA ....
- koliko satelita toliko M € .....
- a gdje je CRO u tome .....

I rodila se ideja

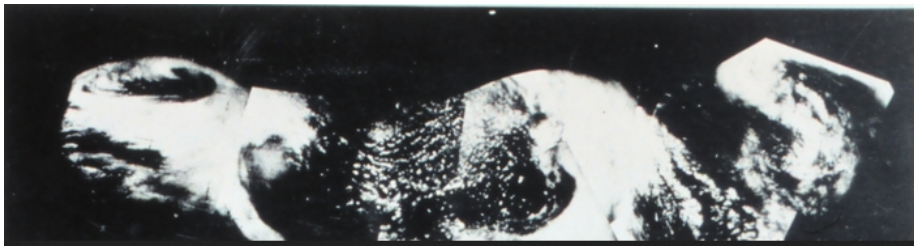
- 1960
- Satelitska slika s US polar-orbiting Television Infrared Observation Satellites (TIROS) raspoloživa u EU NMS-ima

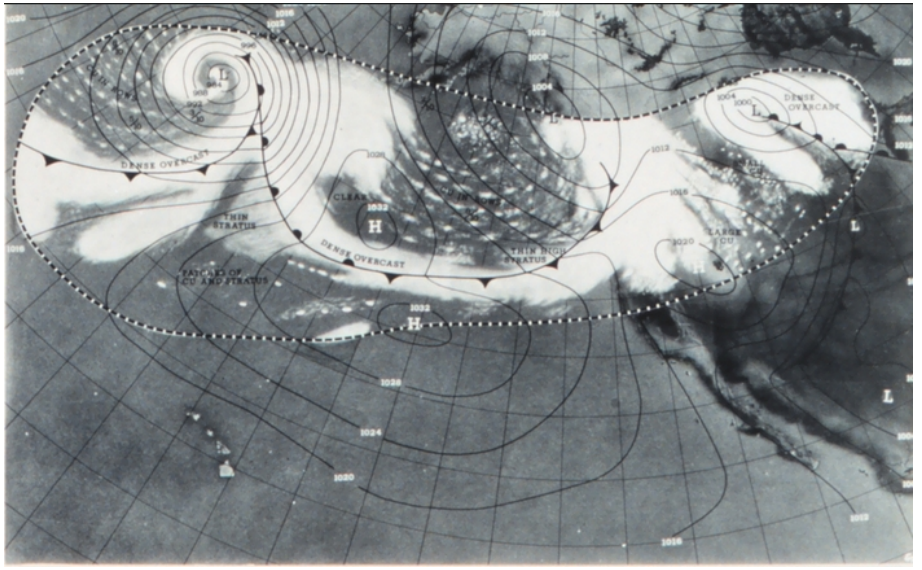


Tiros I



- 10. 04. 1960. prvi sat.snimka tropskog ciklona





od ideje do realizacije 1968-1972

Studeni 1968.

Na European Space Conference odlučeno da European Space Research Organisation (ESRO), razvija programe primjene satelita u meteorologiji.

Srpanj 1969.
ESRO predlaže razvoj satelita u polarnoj orbiti WMO-u.

Siječanj 1970. razvijen inicijalni koncept nazvan **"Meteosat"**,
s dvije misije :

a) opažanje oblačnog pokrova za potrebe kratkoročne prognoze vremena
b) mjerenje temperature atmosfere.

Srpanj 1970. prijedlog odbačen (nedovoljno kapaciteta u Europi)

Studeni 1971. preporuka za uspostavljanje središnje kontrole satelita i misije

Srpanj 1971. Ideja geostacionarnog meteorološkog satelita iznjedrila Francuska.

Svibanj 1972, posađeno sjeme za Meteorološki Informacijski Centar (MIEC)

Srpanj 1972. osam ESA članica potpisalo Ugovor kojim se formira MIEC.

1975 – 1983

Ožujak 1975. razmatra se formiranje nove organizacije za operativno korištenje meteoroloških satelita, ESRO upravlja preko programskog odbora.

Studeni 23, 1977. lansiran Meteosat-1, korištena US Delta raketi iz Cape Canaverala. U roku od mjesec dana postaje operativan.

Siječanj 1981. Međnarodna Konferencija Europskih zemalja u Parizu, dogovara formiranje međunarodne organizacije za korištenje meteoroloških satelita pod imenom **EUMETSAT.** 17 EU zemalja podržalo ideju. Istovremeno u okviru ESA dogovorena je inicijativa za MOP (Meteosat Operational Programme) nastavak programa geostacionarnih osmatranja.

Lipanj 19, 1981, lansiran Meteosat-2 korišten je Ariane-1 nosaču iz Francuske Guajane / Space Centre Kourou.

Listopad 1982. objavljena EUMETSAT konvencija,

Ožujak 1983 Međunarodna Konferencija Europskih zemalja u Parizu dogovara financijski plan i okvir za lansiranje tri satelita koji će voditi EUMETSAT.

1983 – 1993

- Svibanj 1983 EUMETSAT Konvencija pripremljena i otvorena za potpisivanje i ratifikaciju te pripremljena za proširenje i uključenje stalih EU zemalja.

- Lipanj 19, 1986 EUMETSAT konvencija stupa na snagu kao međunarodni dogovor 16 Europskih zemalja članica .
Održan je prvi sastanak vijeće EUMETSAT-a u Parizu te je dogovoreno novo sjedište organizacije u Darmstadt-u.
- Rujan 1987 5th EUMETSAT Council odobrava EUMETSAT ov prvi dugoročni razvojni plan koji obuhvaća:
nastavak geostacionarnog programa,
proširenje zemaljskih operacija,
novi polarno orbitalni program,
preseljenje MIEC u EUMETSAT po dovršetku nove zgrade.

- Prosinac 1987 sklopljeni ugovori o suradnji s **WMO i ECMWF**

- Lipanj 15, 1988 Meteosat-3 lansiran (prototip P2 model) odmah mijenja Meteosat 2 koji odlazi u mirovinu.

Meteosat-4, -5 i -6 lansirani u razdoblju 1989 do 1993.

1991 - 2011

- Svibanj 1991 EUMETSAT Council odlučuje da se zamjeni stari ESA sustav uspostavljen 1977. Te pokrene Meteosat Transition Programme (MTP), koji prerasta u Meteosat Second Generation program.

15. Studenog 1995 kontrola operacija prelazi u EUMETSAT.

2006 Hrvatska postaje punopravni član.

2011 Započinje novi investicijski ciklus s pripremama za MTG, EPS SG i Jason 3

Geostacionarni

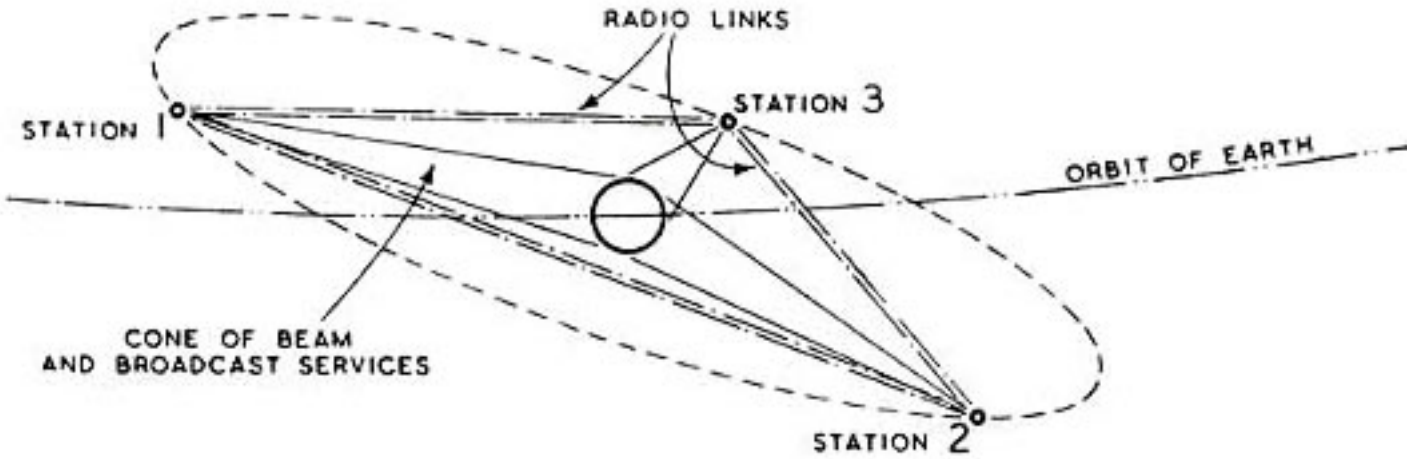
Geosinhroni, period 23h 56m 4s, orbita kružna u ekvatorijalnoj ravnini

- Parametri
  visina nad ekvatorom 35,786 km
  radius 42,155 km
  orbitalna brzina 3.07 km/s
- Herman Potočnik (1892 Pula, 1929 Beč)

$$\frac{a^3}{T^2} = k$$

Koliko geostacionarnih treba?

- Teorijsko pokrivanje je do 81° i pokriva više od 40% površine Zemlje.
- Za telekomunikacijske satelite u primjeni 75°, a za meteorološke 70° ili cca 1/3 površine.
  EUMETSAT za dobivanje meteoroloških podataka koristi 60°.
  Treba najmanje tri geostacionarna satelita za pokrivanje Zemlje (bez polarnih regija).



Originalni prikaz Clarkeove vizije iz članka objavljenog u Wireless World 1945. godine

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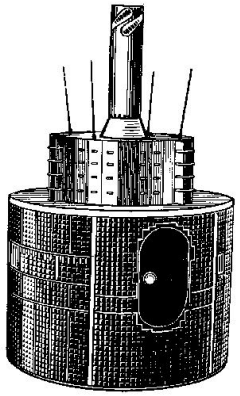
Meteosat 1



- Height above equator 35,786 km
- Orbit radius 42,155 km
- Orbit circumference 264,869 km
- Arc length per degree 736 km
- Orbital velocity 11,066 km/h = 3.07 km/s

METEOSAT prva generacija

Meteosat First Generation Satellites

SATELLITE	PRIME DATE	RETIREMENT DATE	DETAILS
Meteosat-6	21/10/1996	15/04/2011	0 degree coverage, IODC (08/01/2007–15/04/2011)
Meteosat-5	02/05/1991	16/04/2007	0 degree coverage, IODC (01/07/1998–16/04/2007)
Meteosat-4	19/06/1989	04/02/1994	0 degree coverage
Meteosat-3	11/08/1988	31/05/1995	0 degree coverage, ADC (01/08/1991–27/01/1993), XADC (21/02/1993–31 /05/1995)
Meteosat-2	16/08/1981	11/08/1988	0 degree coverage
Meteosat-1	09/12/1977	25/11/1979	0 degree coverage

trenutačno u orbiti geostacionarni

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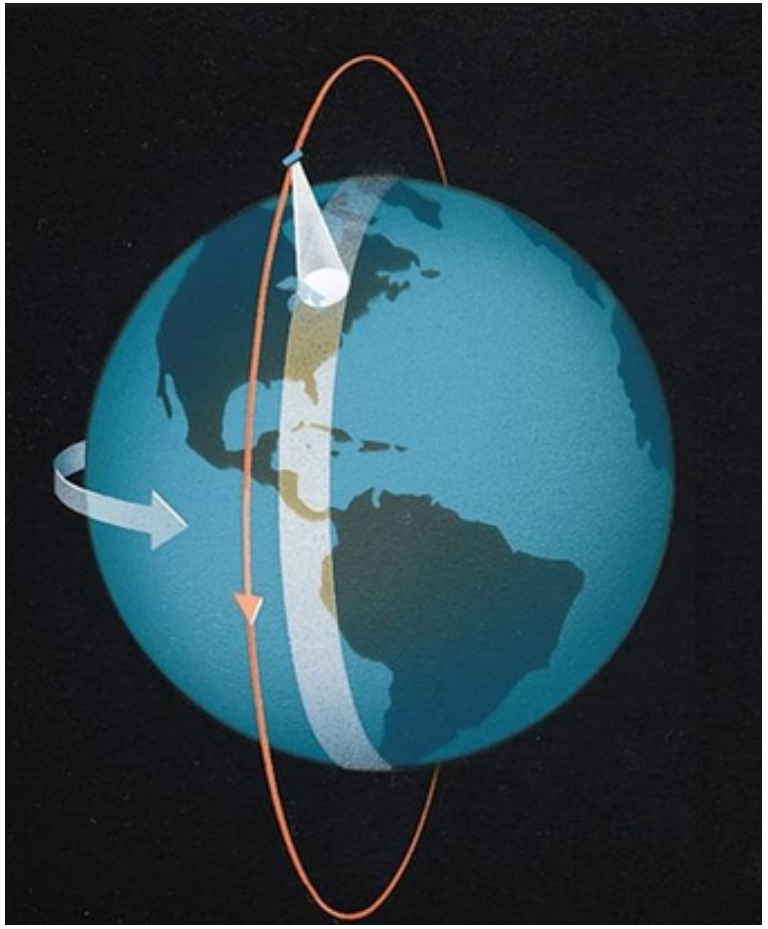
Current Meteosat Satellites

SATELLITE	LIFETIME	POSITION	SERVICES
Meteosat-10 (MSG)	05/07/2012 – Nominal fuel lifetime is until 2022	0°/36,000 km	0° SEVIRI Image Data. Real-time Imagery
Meteosat-9 (MSG)	22/12/2005 – Fuel lifetime is expected to be extended until 2021	9.5° E/36,000 km	Rapid Scan Service from 9 April 2013. Real-time Imagery
Meteosat-8 (MSG)	22/08/2002 – Fuel lifetime is expected to be extended until 2019	3.5° E/36,000 km	Backup service for 0°, plus RSS from 9 April 2013
Meteosat-7 (MFG)	02/09/1997 (IODC since 01/11/2006) – 2016	57° E/36,000 km	Indian Ocean Coverage. Real-time Imagery

Polarno orbitalni (LEO)



Metop je u sun-synchronoj near-polar orbiti .

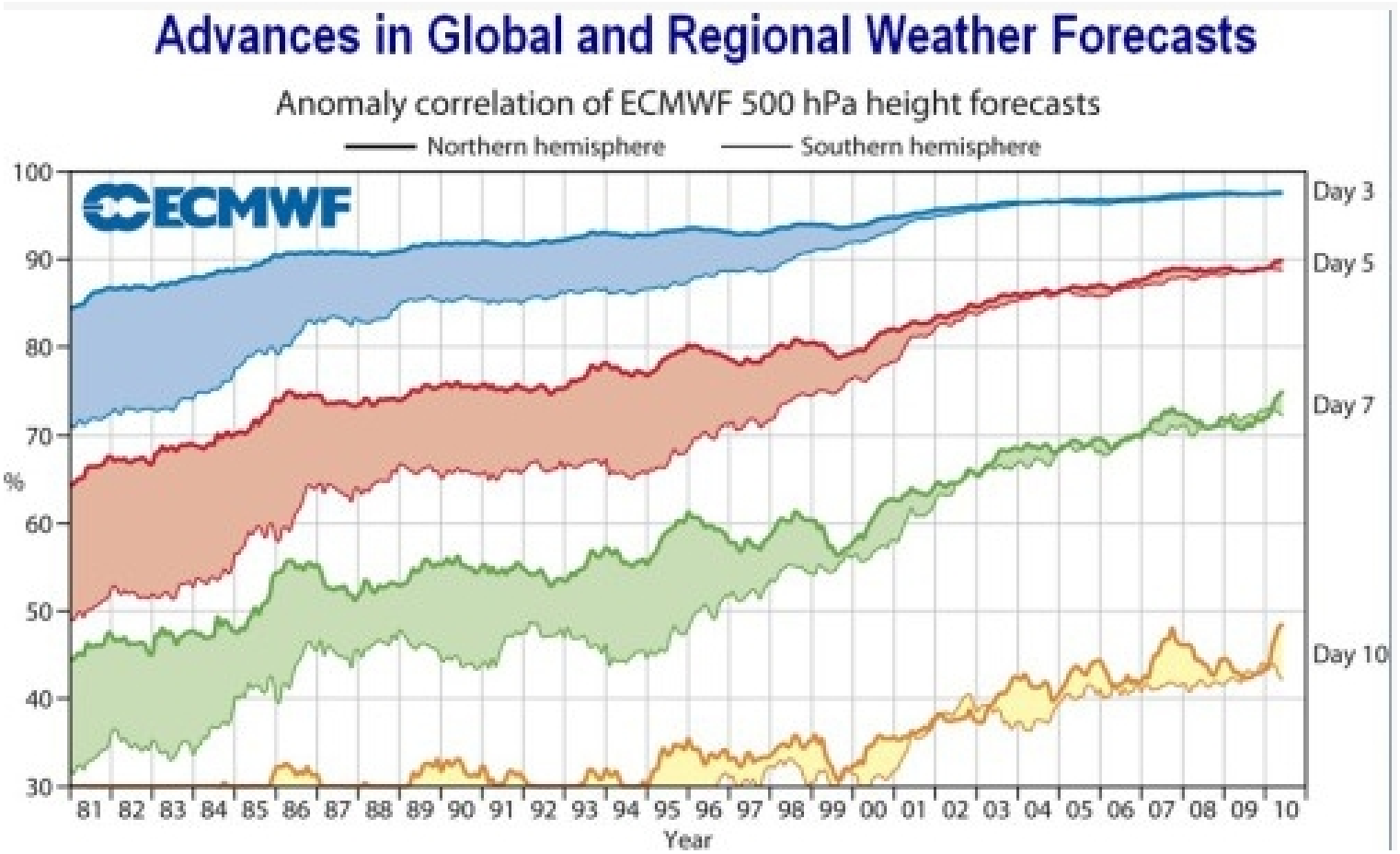
- Polarna orbita inklinacija 98,7° prema ekvatorijalnoj ravnini.
- Orbita je podešena tako da je kut između orbitalne ravnine satelita i Sunca konstantan, uvijek ista rasvjeta, uvijek prelazi po istom lokalnom solarnom vremenu.
- Visina 850 km i period 100 minuta.
  Pokriva cca 3000 km širine traga na površini.
  14 orbita dnevno za dvostruko pokrivanje.

Metop

Metop 3 satelita koji čine EUMETSAT Polar System (EPS).

- orbite im se podudaraju s orbitama NOAA satelita
- EPS program od 2006 do 2020.
- temperatuar, vlaga, brzina i smjer vjetra atmosferski ozon.
- Glavni korisnik numerička prognoza vremena (NWP).
- Dnevni i noćni rad.

eps doprinos prognozi



Metop

Metop Satellites

SATELLITE	LIFETIME	POSITION	SERVICES
Metop-A	From 19/10/2006	Low Earth Orbit	Global Data Service. Regional Data Service. Direct Readout Service. Real-time Imagery
Metop-B	From 17/09/2012	Low Earth Orbit	Global Data Service. Regional Data Service. Direct Readout Service. Real-time Imagery
Metop-C	Due to be launched in 2017	Low Earth Orbit	-

Eumetsat sateliti status

EUMETSAT satellite launches

SATELLITE (GENERATION)	LAUNCH DATE	DETAILS
Metop-B	17/09/2012	LEO
MSG-3 (Meteosat-10)	05/07/2012	0 degree coverage (once operational in 2013)
Jason-2	20/06/2008	OSTM
Metop-A	19/10/2006	LEO
Meteosat-9 (MSG)	22/12/2005	0 degree coverage
Meteosat-8 (MSG)	28/08/2002	0 degree coverage
Meteosat-7 (MFG)	02/09/1997	IODC (since 1/11/2006)
Meteosat-6 (MFG)	20/11/1993	Retired
Meteosat-5 (MFG)	02/03/1991	Retired
Meteosat-4 (MFG)	06/03/1989	Retired
Meteosat-3 (MFG)	15/06/1988	Retired
Meteosat-2 (MFG)	19/06/1981	Retired
Meteosat-1 (MFG)	23/11/1977	Retired

MEMBER STATES

COOPERATING STATES

WIGOS


Space-Based Component of WMO Integrated Global Observing System
ENVISAT
"A-Train"
JASON
MTSAT
(Japan)
140°E
GOES-W
(United States)
135°W
COMS
(South Korea)
128°E
GOES-E
(United States)
75°W
METEOR
TRMM
FY-2
(China)
105°E
NOAA
INSAT
(India)
93.5°E
GOES-SA
(United States)
60°W
FY-3
FY-3
FY-2
(China)
86.5°E
METOP
KALPANA
(India)
74°E
METEOSAT
(EUMETSAT)
0°
METEOSAT-IO
(EUMETSAT)
57.5°E

Jason

- 2001 lansiran Jason 1
  2008 lansiran Jason 2
  Jason 3 ili Sentinel planiran 2017.
- Jason program povezuje (EUMETSAT, NOAA, CNES i NASA).
- Ocean Surface Topography Mission - osnovni zadatak.
- 71% površine je pod morem , 2/3 populacije živi 60 km od obale, 1/2 velikih gradova su na utoku rijeka u more.
- altimetar mjerenje visine vala, brzine vjetra i topografija površine oceana
- uključen u modele ECMWF-a,
- deset godišnji niz podataka koristi se za globalne analize i za fenomene kao što su El Niño i La Niña.

Jason CS (Sentinel)

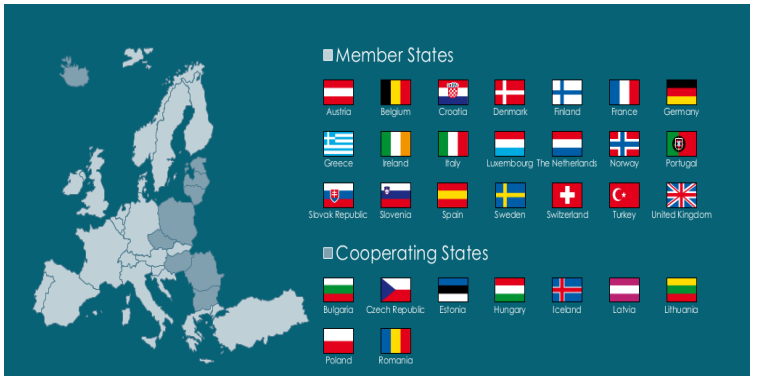
Parametri

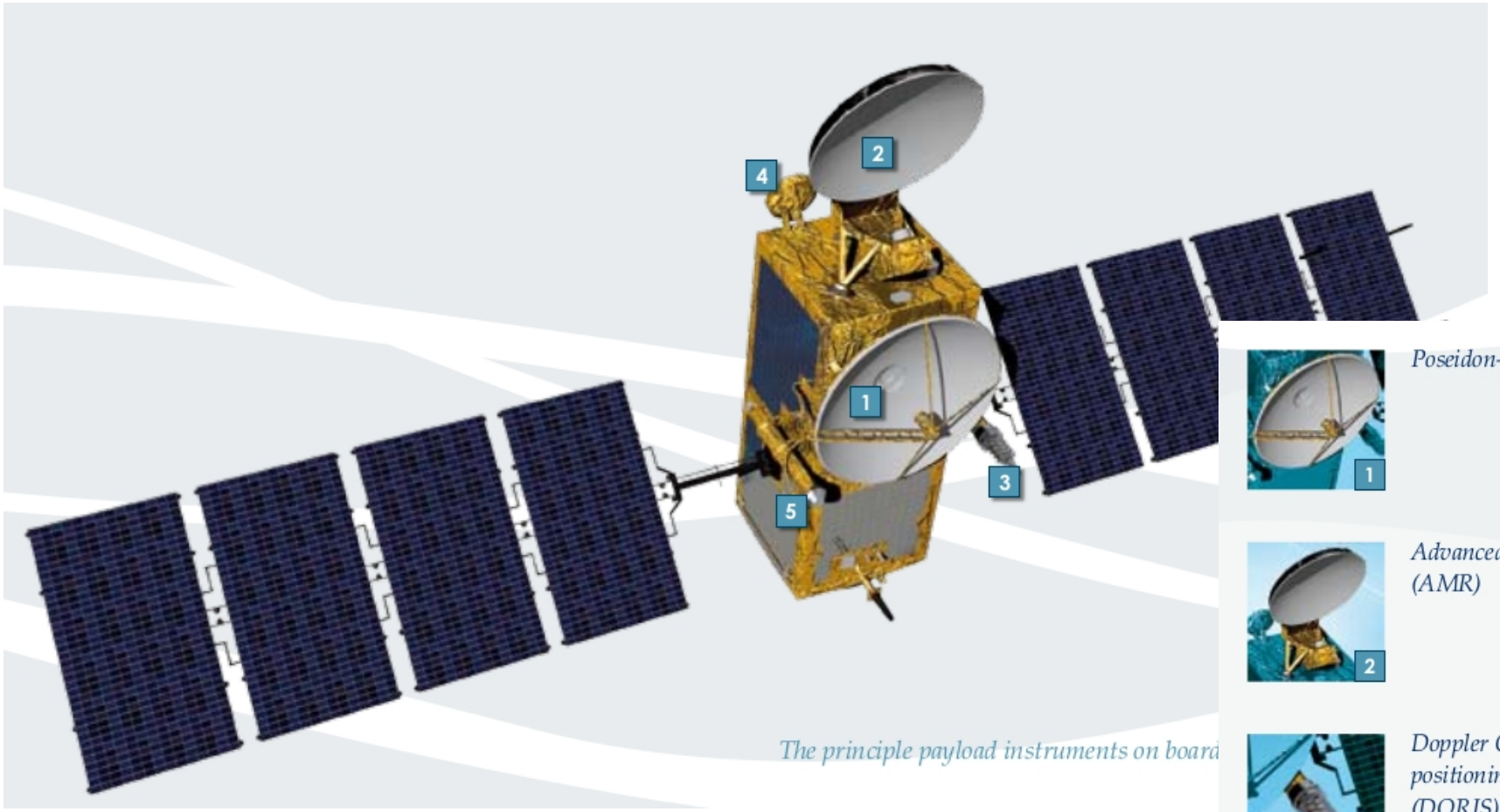
Semi-major axis: 7714.4278 km
Eccentricity: 0.000095
Inclination (non-sun-synchronous) 66.039°

- And resulting characteristics are:
- Reference altitude (equatorial): 1,336 km
- Nodal period: 6,745.72 seconds (112'42" or 1h52')
- Repeat cycle: 9.9156 days
- Number of passes per cycle: 254
- Ground track separation at Equator: 315 km
- Acute angle at Equator crossings: 39.5°
- Orbital velocity 7.2 km/s
- Ground scanning velocity 5.8 km /s

Jason CS (Sentinel)

- - Near Real Time Altimetry Service (ALT-NRT)
  oceanografija i
  pomorska meteorologija;
- - Short Time Critical Altimetry Service (ALT-STC)
  oceanografija;
- - Non Time Critical Altimetry Service (ALT-NTC)
  monitoring klime;
- - Near Real Time (RO-NRT) i Non Time Critical (RO-NTC) Radio Occultation product Services
  monitoring klime i
  prognoza vremena.





The principle payload instruments on board

Poseidon-3 dual frequency altimeter

Advanced Microwave Radiometer (AMR)

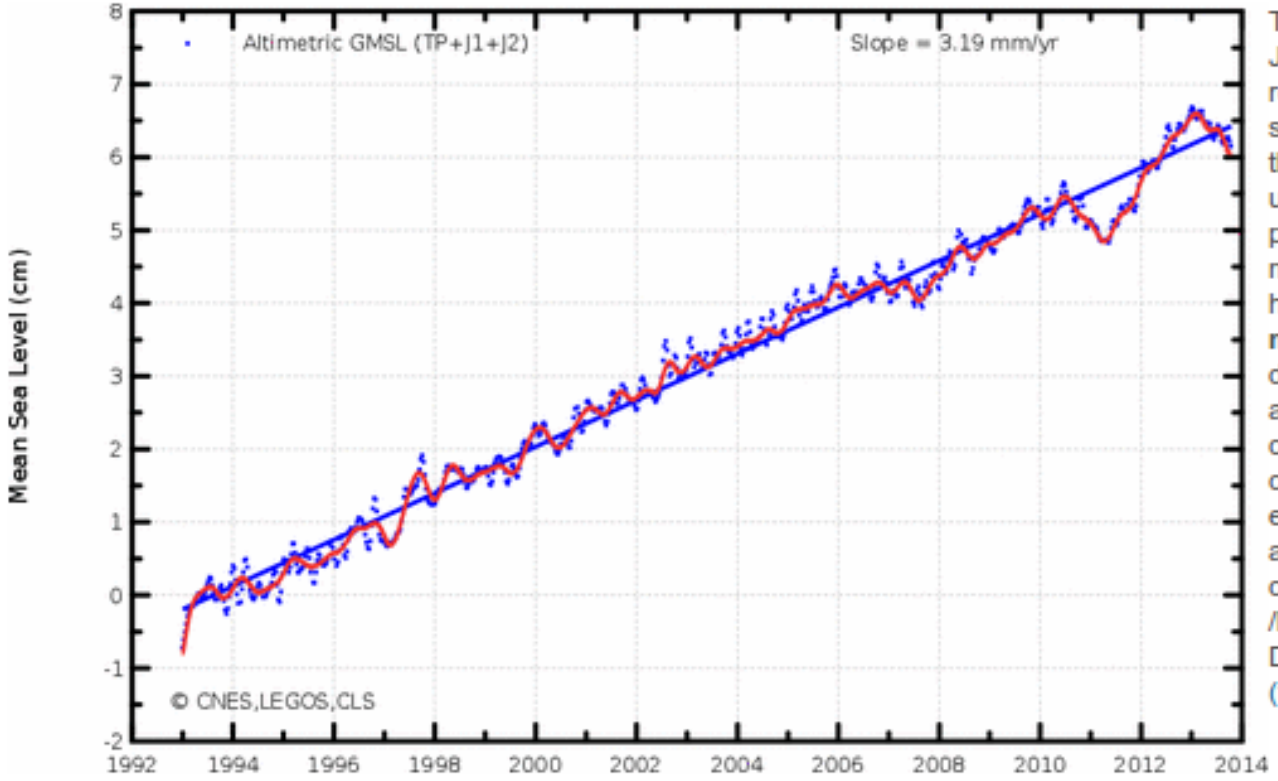
Doppler Orbitography and Radio-positioning Integrated by Satellite (DORIS)

Global Positioning System Payload (GPSP)

Laser Retroreflector Array (LRA)

HAZU 16.01.2014.

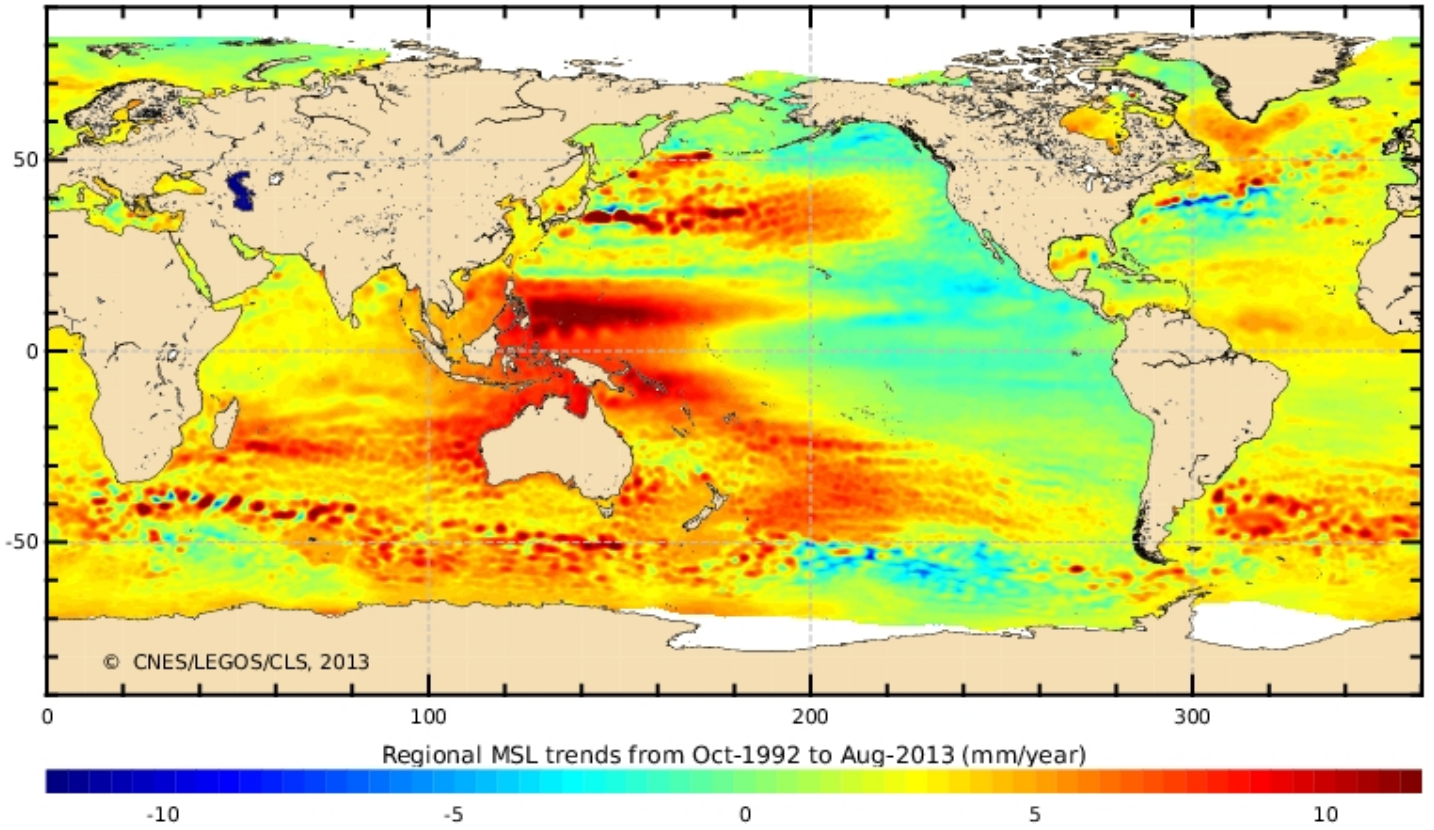
razina mora



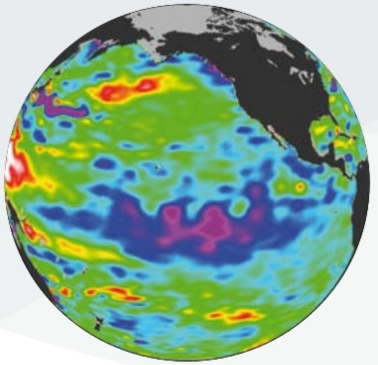
The reference mean sea level since January 1993 (left) is calculated after removing the annual and semi-annual signals. A 2-month filter is applied to the blue points, while a 6-month filter is used on the red curve. By applying the postglacial rebound correction (-0.3 mm/year), the rise in mean sea level has thus been estimated as **3.19 mm/year** (mean slope of the plotted data). Analysing the uncertainty of each altimetry correction made for calculating the GMSL, as well as a comparison with tide gauges gives an error in the GMSL slope of approximately **0.6 mm/year** with a 90% confidence interval. (Credits CLS/Cnes /Legos)

Download the data (NetCDF or Ascii (txt)).

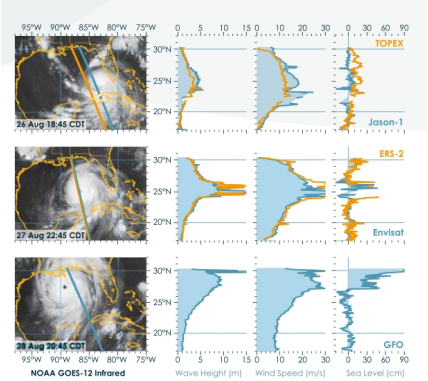
razina mora 1992/2013



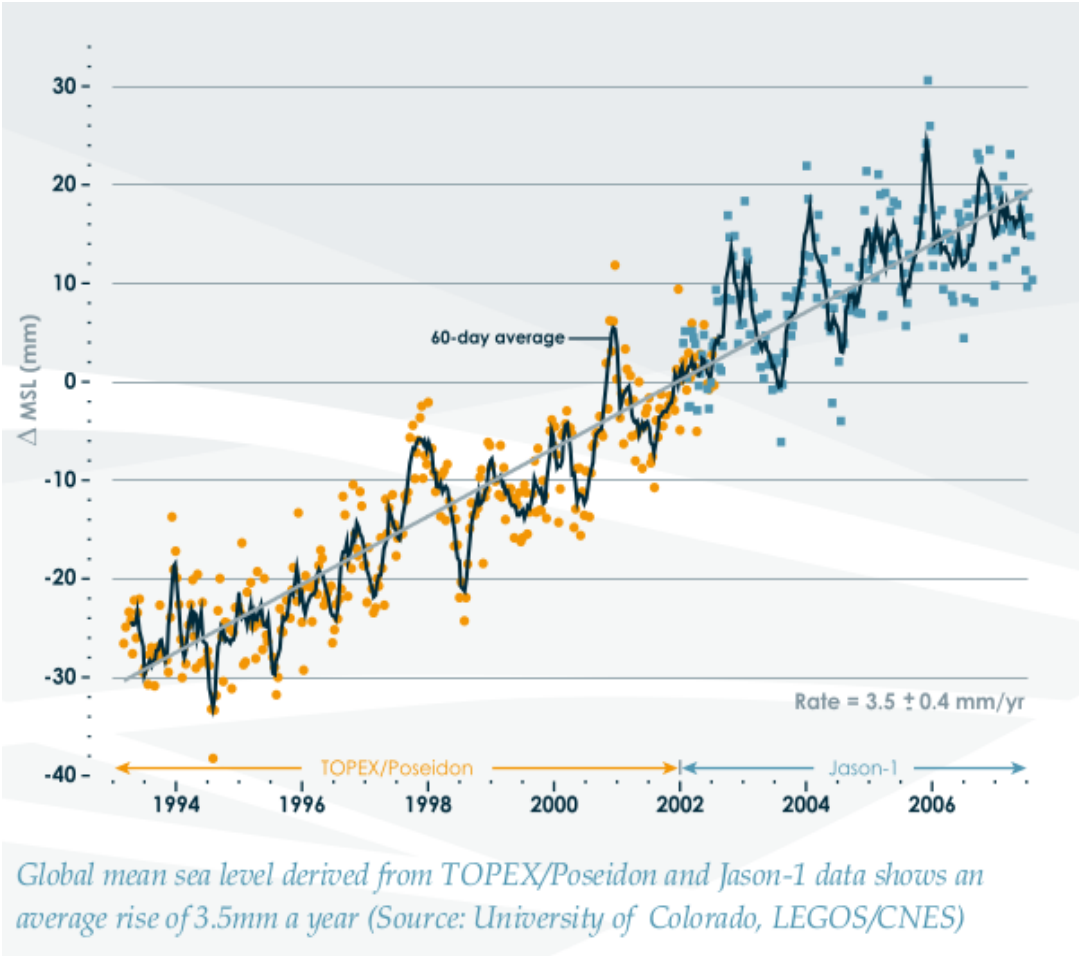
jason



Jason sea-level height anomaly data from February 2008 (Source: NASA)

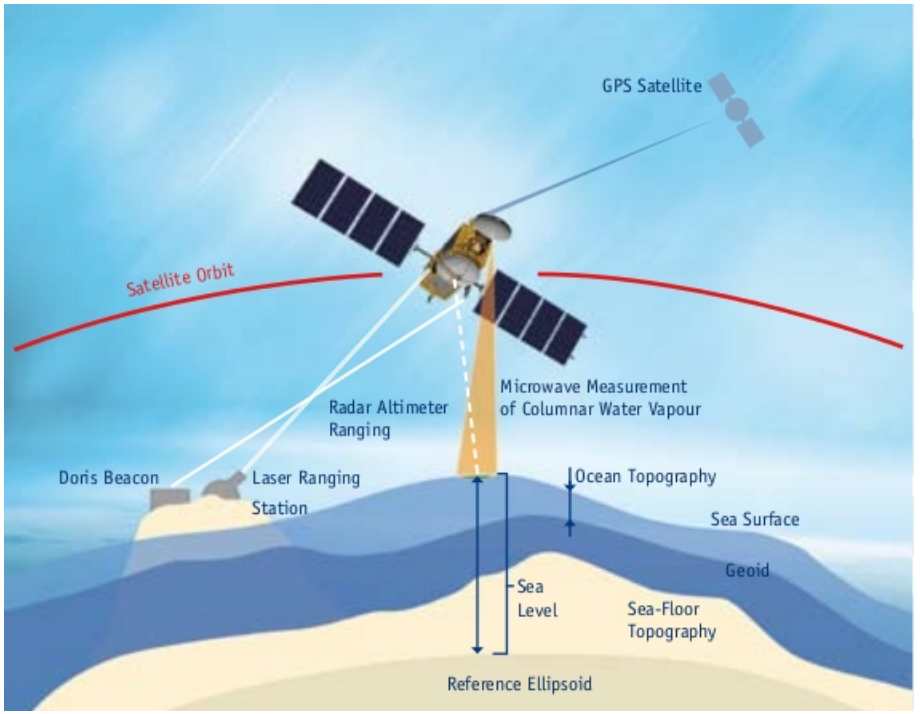


NOAA GOES-12 infrared images (left) and wind speed, wave height and sea level anomalies as observed by different altimetry satellites during Hurricane Katrina (Source: NOAA/Altimetrics LLC)



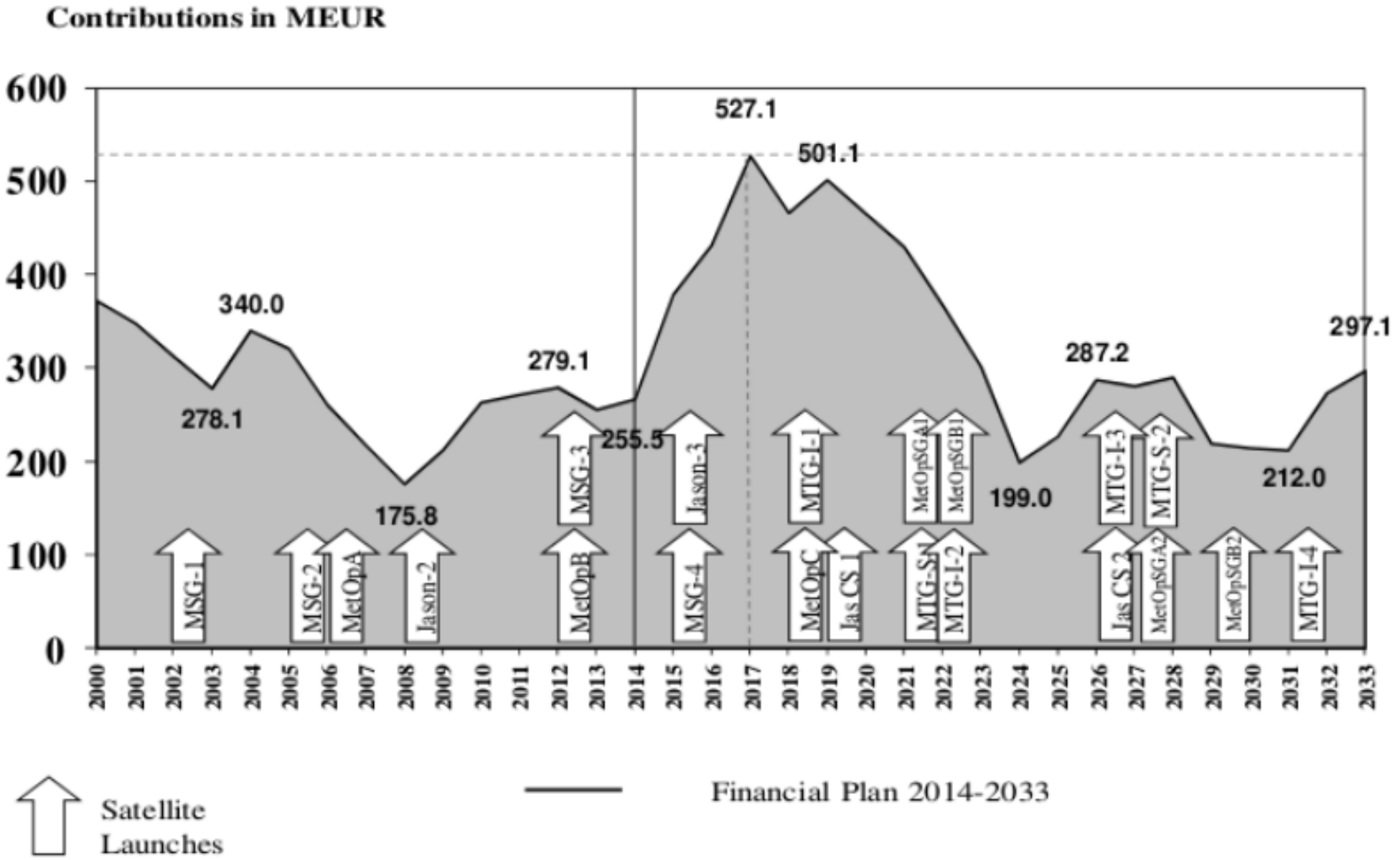
Global mean sea level derived from TOPEX/Poseidon and Jason-1 data shows an average rise of 3.5mm a year (Source: University of Colorado, LEGOS/CNES)

jason 2



Jason-2 - a snapshot
Orbit: Circular, non-sun-synchronous, 66° inclination
Altitude: 1,336 kilometres
Global data coverage between 66°N and 66°S latitude
10-day repeat of ground track (±1-km accuracy)
Coverage of 95% of ice-free oceans every 10 days
Communication: via the Ground Network Tracking Stations at Poker Flats, Alaska, and Wallops Island, Virginia, as well as the European Earth Terminal located in Usingen, Germany
Structure: 3 metres high, 500 kilos at launch, 580 watts of power
Three-axis stabilisation and nadir pointing is maintained by reaction wheels and magnetic torque rods
Hydrazine propellant system provides orbital maintenance
Designed lifetime of about five years

2014 - 2033 .....


Contributions in MEUR
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MetOpA
Jason-2
MetOpB
MSG-3
MSG-4
Jason-3
MetOpC
MTG-I-1
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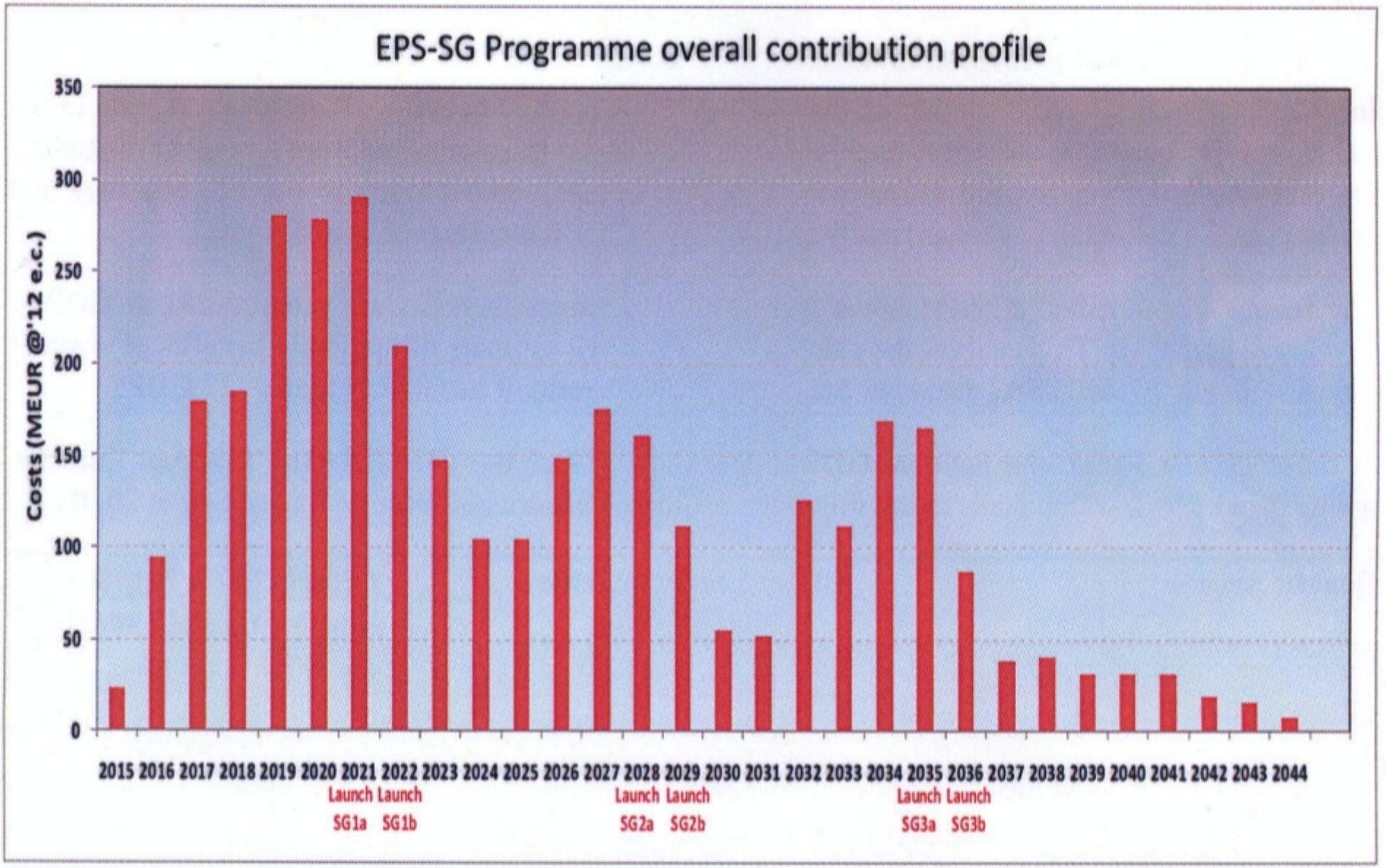
Satellite Launches
Financial Plan 2014-2033

trošak 2015 - 2044



Hrvatska 11,73 M€

EUMETSAT DHMZ

4.2 Planning of contributions of Croatia to EUMETSAT in the period 2014-2033

Based on current estimates and assumptions, the planned contributions of Croatia to all programmes (including EPS-SG) and to EPS-SG alone are as follows:

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	M€	M€	M€	M€	M€	M€	M€	M€	M€	M€
EPS SG	0.00	0.08	0.33	0.60	0.62	0.95	0.96	0.95	0.74	0.52
All programmes	0.89	1.27	1.42	1.74	1.54	1.67	1.56	1.45	1.24	1.01

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
	M€	M€	M€	M€	M€	M€	M€	M€	M€	M€
EPS SG	0.36	0.37	0.52	0.61	0.56	0.39	0.19	0.18	0.44	0.39
All programmes	0.67	0.76	0.96	0.94	0.98	0.74	0.72	0.71	0.92	1.00

korist

Benefit Area	EU 27 Likely benefits (billion / year)	Croatia likely benefits Likely (MEUR / year)
Protection of property and infrastructure	5.5	19.25
Added value to the economy	41	143.5
Private use by citizens	15	52.5
Total	**61**	**215.25**

nebo je granica .....

- 1960 ideja
- 1977 Meteosat 1
- 1982 konvencija EUMETSAT
- 1986 18 članica potpisalo konvenciju
- 1987 Darmstadt
- 2001 Jason 1
- 2006 Hrvatska član , METOP A
- 2015 – 2044 treba 3.487 M€ ukupno

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