Satellite eye for Galathea 3. Annual report 2007

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Satellite Eye for Galathea 3
Annual Report 2007

Charlotte Bay Hasager, Peter Brøgger Sørensen, Leif Toudal Pedersen, Jacob L. Høyer, Peter Viskum Jørgensen, Niels Kristian Højerslev, Michael Schultz Rasmussen, Jürg Lichtenegger, Ole Baltazar Andersen, Merete Bruun Christiansen, Lotte Nyborg, Karl-Erik Christensen, Torben P. Jensen, Karin Iversen, Rune Midjord Nielsen, Roberto Saldo og René Møller

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Technical University of Denmark
Roskilde, Denmark
March 2008

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Title: Satellite Eye for Galathea 3 Annual Report 2007
Department: Wind Energy Department

Abstract (max. 2000 char.):
Satellite Eye for Galathea 3 is a project funded by Egmont Fonden and the participating institutes – Risø DTU, DTU Space, ESA Eduspace, Niels Bohr Institute at University of Copenhagen, GRAS and DMI - in the period 2006 to 2008. During the Galathea 3 expedition around 10.000 satellite images were collected along the entire route. The expedition took place from 11th August 2006 to 25th April 2007. The satellite images were shown in near-real-time on Google Earth along with near-real-time ship observations. Based on the satellite images, the ship observations and through collaboration with many Galathea 3 research projects educational material for upper secondary schools were being prepared. A total of 41 educational projects were being developed. Most of this information was published at EMU, the Danish portal for schools during 2007 in Danish and English. In addition, a satellite image with a short text was published each week at the homepage www.satelliteeye.dk . During 2007 the Satellite Eye team jointly with Nature & science prepared an educational film 'Satellite Eye – Galathea 3 fra rummet'. This work is funded by The Danish Ministry of Education, Tips- og Lottopuljen. The film will be sent to upper secondary schools along with the Satellite Living Atlas. The latter will consist of the 40 weekly images and a series of satellite image animations that shows our living Earth from space.

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Preface

Galathea 3 was the third of the global ship expeditions headed by Denmark. Galathea 3 took place from 11th August 2006 to 25th April 2007.

The project Satellite Eye for Galathea 3 funded by Egmont Fonden kept an open eye on Vædderen - day and night - during the entire expedition through Earth observation satellites. The satellite images were displayed in near-real-time in Google Earth. This is a state-of-the-art visual tool that is easy to operate at computers in schools, at home, in offices and on-board Vædderen.

Educational material in form of projects, cases and weekly images were prepared for upper secondary school classes during the expedition. The satellite images were stored in a database.

Vædderen had a good internet connection and this enabled data flow both to and from the ship. During the expedition the near-real-time satellite images of ocean chlorophyll, sea surface temperature, ocean wind speed, ocean wave height, clouds and sea ice became important. This was both in relation to detailed planning of some science projects as well as for safe navigation near Antarctica.

Acknowledgements

The Satellite Eye for Galathea 3 project was realized through the financial support of Egmont Fonden of DKK 3.9 million and the financial support of the participating institutes Risø DTU, the Niels Bohr Institute and GRAS A/S c/o Institute of Geography both at University of Copenhagen, Danish Meteorological Institute, ESA EDUSPACE and DTU Space. In addition a large amount of Envisat satellite scenes were kindly granted from ESA through EDUSPACE. The financial support and satellite scenes are greatly acknowledged.

We wish to thank Grethe Nymark, our project manager at Egmont Fonden, and Margrethe Ahlefeldt, director of Egmont Fonden, for their continued support. This has enabled cooperation with Nature and Science and, furthermore, made the foundation for the follow-up project VirtuelGalathea3 e-learning supported by Undervisningsministeriet UVM Tips and Lotto puljen. This project will keep the results of Satellite Eye alive until June 2011.

We acknowledge the support of Jens Claus Hansen, director of Dansk Ekspeditionsfond and commander senior grade of the Royal Danish Navy, Lisbeth Nannestad Jørgensen, communication officer, and Søren Haslund-Christensen, chair of the board. We also thank Jørgen Balling Rasmussen, assistant secretary in the Ministry of Education, for continued support.

We thank Martin Bech and Michael Viskum at Uni-C and EMU, the portal of the Ministry of Education, for hosting the educational material from Satellite Eye. This enables good contact to the Danish schools.

1 Introduction

1.1 Background

The Danish Expedition Foundation was established to ensure the Galathea 3 expedition. The background for the Galathea 3 expedition was based on the understanding that our society greatly rely on science and education in the future.

There is a declining tendency of young people aiming for professional careers in physical and technological sciences. Thus it is important to stimulate further interest among the young people in these subjects. It is the hope that Galathea 3 and the science onboard will stimulate especially young people. The educational aspect of bringing the science to the classrooms is very important for Galathea 3.

Source: http://www.galathea3.dk/uk/Menu/The+expedition/Background

1.2 Goal

The goal of the 'Satellite Eye for Galathea 3' project was to provide a living atlas based on satellite images along the track of Galathea 3. It was a technological challenge to access, archive and distribute the satellite Earth Observation images in near real time for science and education. Vast amounts of satellite data were handled and state-of-the-art technologies were further developed and used for scientific and educational aspects.

1.3 Objective

The objective of Satellite Eye for Galathea 3 was to enable a systematic pre-ordering, recording, processing, archiving, data handling and distribution of satellite Earth Observation images for science and education along the track of Galathea 3.

The results in year 2006 are described in the Satellite Eye for Galathea 3 Annual Report 2006 (Hasager et al., 2007) available at http://www.risoe.dk/rispubl/reports/ris-r-1594.pdf . The work from year 2006 was continued in year 2007.

Summary of major results in Satellite Eye for Galathea 3 in year 2007

- The web-site www.satelliteeye.dk for the project was active in Danish and English.
- The web-site http://galathea.oersted.dtu.dk using Google Earth for display of the satellite images and ship observations was active in Danish and English.
- The web-site http://galathea3.emu.dk/satelliteeye hosted at Uni-C for EMU was active. Most educational projects are available in both Danish and English whereas the case studies mainly are available in Danish.
- Continued publication of results through media, see the list at http://www.satelliteeye.dk/news.htm
- Continued scientific cooperation with 18 Galathea projects
- Continued educational cooperation with 3 Galathea school classes.
- Satellite images were stored in a database useful for education and research.
- Observations from the ship: from the meteorological station, from the ferry-box and from the navigation instruments were stored a database useful for education.

1.4 Satellite images - are they important?

The importance of satellite images for the Galathea expedition is not easily quantified. Yet an indication of the overall importance is found in the two beautiful Galathea 3 stamps sent out from Post Danmark on the 28th March 2007. The stamps show the Earth observed by satellites - day and night. The stamps can be seen at

http://www.stamps.postdanmark.dk/product_show.asp?dept_id=11&pf_id=1390MA

In the left stamp (4.75 kr.) is shown the satellite during daytime. The satellite maps the reflected sunlight from the ocean and maps algae in the surface water from which a multitude of sea life feeds.

In the right stamp (7.25 kr.) is shown the satellite observing remote and inaccessible areas at night providing detailed maps of the sea ice near the North Pole. The sea ice shrinks during summer and icebergs are drifting. The icebergs were avoided during the expedition partly thanks to the sea ice maps from near-real-time satellites images.

Weather satellites provided valuable information for calculating atmospheric conditions – weather is a very important issue at sea!

Earth observation satellites facilitated GPS navigation for Vædderen along the entire expedition.

Earth-orbiting satellites provided communication and internet connection to Vædderen.

1.5 Plan for year 2008

In year 2008 a DVD will be sent out to the Danish upper secondary schools with the Satellite Living Atlas. This will consist of 40 satellite images with descriptions from each of the 40 weeks of the expedition. Furthermore, the Satellite Living Atlas will include a series of satellite animations.

Finally, an educational film partly based on Satellite Eye for Galathea 3 will be included as well as a series of short videofilms from the Galathea 3 expedition. The films are produced by STV nature & science through funding from Ministry of Education, Tips- og Lottopuljen.

2 Partners

The Satellite Eye for Galathea 3 project has the following partners

- Risø DTU (project management)
- DTU Space
- Danish Meteorological Institute
- Niels Bohr Institute, University of Copenhagen
- ESA EDUSPACE
- GRAS A/S c/o Institute of Geography, University of Copenhagen
- Subcontractor EduGIS Aps

List of people working in Satellite Eye in year 2007:

Risø DTU: Charlotte Bay Hasager (project management), Merete Bruun Christiansen, René Møller

DTU Space: Ole Baltazar Andersen, Leif Toudal Pedersen, Roberto Saldo

DMI: Jacob L. Høyer, Peter Viskum Jørgensen

NBI: Niels Kristian Højerslev, Rune Midjord Nielsen

ESA/EDUSPACE: Peter Brøgger Sørensen, Jürg Lichtenegger

GRAS: Michael Schultz Rasmussen, Lotte Nyborg

EduGIS: Peter Brøgger Sørensen, Karl-Erik Christensen, Torben P. Jensen, Karin Iversen

3 Education

41 educational projects have been developed. The list below indicates their availability in Danish, in English, at EMU http://galathea3.emu.dk/satelliteeye/index.html and those with contribution from the Galathea 3 expedition.

The projects 1-10 are relevant globally whereas the projects 11-41 are site specific, listed along the route in table 3.1.

The educational film ‘Satellite Eye Galathea 3 fra Rummet’ is near completion. It is a film meant to inspire secondary school teachers and students to investigate and learn from the projects. The film has been produced by STV nature & science in cooperation with Satellite Eye. It will all be part of VirtuelGalathea3 in the coming years (www.virtuelgalathea3.dk).

Table 3.1 List of educational projects from Satellite Eye for Galathea 3 for Egmont Fonden in Danish and English (in italic, if not similar).

#	Satellite Eye project title	DK	UK
	SUM	41	21
1	Atmosfærens forurening, *Atmospheric pollution*	1	1
2	Fytoplankton set fra rummet, *Phytoplankton seen from space*	1	1
3	Havets højdeforhold #	1	
4	Havtemperaturen, *Sea temperature* #	1	1
5	Hvordan bliver vejret?, *What is the weather like?*	1	1
6	Jordens tyngde og jordskælv, *The gravity of the Earth and earthquakes* #	1	1
7	Radar over land og by, *Radar on cities and land*	1	1
8	Radar øje på Galathea 3,*Radar eye on Galathea 3*	1	1
9	Radar øje på havet og olieudslip, *Ocean features and oil spill*	1	1
10	Vinden, *Wind*	1	1
11	Galathea 3 i København, *Galathea 3 in Copenhagen*	1	1
12	Thorshavn	1	
13	Golfstrømmen #	*	
14	Havisen omkring Grønland, *Sea ice around Greenland*	1	1
15	Radar opdager havis og isbjerge, *Radar detects sea ice and icebergs*	1	1
16	Narsarsuaq	1	
17	Nuuk	1	
18	Den Kanariske Strøm	1	
19	Azorerne	1	
20	Vindkraft: Kap Verde, *Wind power: Cape Verde*	1	1
21	Senegal	1	1
22	InterTropiske Konvergenszone, ITK	1	
23	Accra, ananas og globalisering, *Ghana/Accra*	+	1
24	Accra	+	1
25	Cape Town	+	1
26	Tranquebar – fiskernes kamp #	*	
27	Bellona - en ø i Stillehavet #	+	
28	Broome	1	
29	Perth og Sydney	1	
30	Great Barrier Reef	1	
31	Hobart	1	
32	Christchurch	+	+
33	Antarktis - navigation og havis #	*	
34	Kap Horn, *Cape Horn* #	1	1
35	Valparaiso	+	+
36	Antofagasta	+	1
37	El Niño	+	
38	Puerto Ayora på Galapagos #	1	
39	Galapagos	1	
40	St. Croix #	+	
41	Midtatlantiske Spredningszone #	1	

Explanation: 1 available at EMU; + completed; * nearly completed; # with contribution from Galathea 3 projects.

4 Publication

4.1 Weekly images

The weekly images are published at http://www.satelliteeye.dk/weeklyimages_uk.htm in Danish and English. In table 4.1 the English titles are listed.

Table 4.1. List of weekly images with the title (in English), type of observation, satellite source and the partner producing the weekly image.

	Title	Type	Source	Partner
33	**Vædderen in Copenhagen**	Aerial photo	COWI	GRAS
34	**Sea surface temperature**	Thermal infrared, passive microwave	NOAA AVHRR, AMSR, Envisat AATSR	DMI
35	**Narsarsuaq, Greenland**	Multispectral	Landsat ETM	ESA Eduspace
36	**Algae around Greenland**	Multispectral	Envisat MERIS	DTU Space
37	**Nuuk, Greenland**	Multispectral, very high resolution	QuickBird	GRAS and Digital Globe
38	**Wind at the Azores**	Synthetic Aperture Radar, wide-swath	Envisat ASAR	Risø DTU
39	**Africa seen from Envisat**	Multispectral mosaic	Envisat MERIS	GRAS
40	**How does the grass grow south of Sahara this year?**	Multispectral NDVI	Envisat MERIS	GRAS
41	**Accra observed from Envisat**	Synthetic Aperture Radar, alternating polarization, high-resolution	Envisat ASAR	ESA Eduspace
42	**Ocean's high and low pressures**	Altimeter	Envisat, Jason, Geosat	DMI
43	**Sea surface temperature**	Thermal infrared, passive microwave	NOAA AVHRR, AMSR, Envisat AATSR	DMI
44	**Australia seen from Envisat**	Multispectral mosaic	Envisat MERIS	DTU Space
45	**Algae near**	Multispectral	Envisat MERIS	DTU Space

	Broome in Australia			
46	**Perth and Freemantle**	Multispectral, multitemporal	SPOT	ESA Eduspace
47	**Australia observed by radar**	Synthetic Aperture Radar, mosaic, global monitoring mode	Envisat ASAR	DTU Space
48	**Tasmania from space**	Synthetic Aperture Radar, multi-temporal, wide swath mode	Envisat ASAR	ESA Eduspace
49	**Tasmania seen from Envisat**	Multispectral, full resolution	Envisat MERIS	ESA Eduspace
50	**Great Barrier Reef from Envisat**	Multispectral	Envisat MERIS	Risø DTU
51	**Bellona and Tikopia, Solomon Islands**	Multispectral, very high resolution	QuickBird	Institute of Geography and Geology
52	**The East-Australian Current**	Thermal infrared, passive microwave	NOAA AVHRR, AMSR, Envisat AATSR	DMI
1	**Ocean depth**	Altimeter og GPS	Topex/Poseidon, GPS	DTU Space
2	**Lyttelton, New Zealand**	Multispectral	PROBA	ESA Eduspace
3	**Antarctica seen from radar images**	Synthetic Aperture Radar, mosaic, and passive microwave	Envisat ASAR, AMSR	DTU Space
4	**Ozone over Antarctica**	Hyperspectral atmospheric	EOS AURA OMI	DMI
5	**Icebergs near Antarctica**	Synthetic Aperture Radar	Envisat ASAR	DTU Space
6	**Storm at Cape Horn**	Scatterometer	QuikSCAT	Risø DTU
7	**Algae along South America**	Multispectral, mosaic	Envisat MERIS	Risø DTU
8	**El Niño**	Thermal infrared, passive microwave, altimeter	NOAA AVHRR, AMSR, Envisat AATSR, Jason, GFO, Topex/Poseidon	DMI
9	**Santa Cruz from**	Multispectral	SPOT	ESA

	space			Eduspace
10	**Galapagos Islands elevations observed from space**	Radar shuttle mission	SRTM	GRAS
11	**Panama**	Synthetic Aperture Radar, alternating polarization, high-resolution	Envisat ASAR	DTU Space and NBI
12	**St. Croix**	Multispectral	Landsat ETM	GRAS
13	**Algae in the Caribbean**	Multispectral	Envisat MERIS	Risø DTU
14	**Boston**	Multispectral	Landsat ETM	GRAS
15	**The height of the Gulf Stream**	Altimeter	Envisat, Jason, Geosat	DTU Space

4.2 Press listing

Press activities continued http://www.satelliteeye.dk/news.htm with the following news in 2007 (until the return of Vædderen 25th April 2007):

30.04.2007, Nordzee-Symposium 2007, Belgien
http://www.vliz.be/docs/Zeelessen/Noordzeesymposium/PP_Galathea3.pdf

25.04.2007, Risø Galathea web-log
Se satellitbilleder fra ruten
http://www.risoe.dk/galathea/

03.04.2007, Satellite Eye. Annual report 2007.
http://www.risoe.dk/rispubl/reports/ris-r-1594.pdf

02.04.2007, Risø Galathea web-log.
http://www.risoe.dk/galathea/

31.03.2007, Geografisk Orientering 2007, Nr. 1, side 50-53
http://www.geografforbundet.dk/index.htm

15.03.2007, Risø Galathea web-log
Kraftig vind i Caribien.
http://www.risoe.dk/galathea/index.htm

14.03.2007, Ingeniøren
Moder Jord som patient

12.03.2007, Risø Report
Satellite Eye for Galathea 3, Annual report 2006

11.03.2007, Risø Galathea web-log.
Panama

28.02.2007, Dansk Ekspeditionsfond
Status, formidling

20.02.2007, Risø Galathea web-log
Alger og vind fra Envisat

20.01.2007, Jyllands-Posten
Danske iskort hjælper skibe ved Antarktis

20.01.2007, EMU Galathea 3
I kolde farvande - Antarktis,

15.01.2007, Risø Galathea web-log
Vindkort med Vædderen

10.01.2007, Risø Galathea web-log
Vind omkring New Zealand

10.01.2007, DTU Avisen
Med falkeblik på verdensomsejlingen (Side 8 og 9)

03.01.2007, Risø Galathea web-log
Beskrivelse af vejret over Sydhavet

4.3 Statistics

The statistics of visits on the homepages continued as in year 2006, however decreased in the months after the end of the Galathea 3 expedition.

5 Conclusion and perspective

Satellite Eye for Galathea 3 successfully achieved the goals of the project in year 2007 by establishing a large database of satellite images for education and science during the entire expedition for Galathea 3. The weekly images were published at the project homepage, and the majority of educational projects completed in 2007 were published at EMU.

Satellite images were collected from many sources. In particular, images from ESA and third mission parties were kindly granted through ESA Eduspace. These images include Envisat MERIS and ASAR, SPOT and PROBA, see appendix.

The cooperation between Satellite Eye and many Galathea 3 projects paved the way for the new educational project *VirtuelGalathea3*. This is supported by Tips and Lottopuljen, Ministry of Education.

The perspective is that the technical platform developed in Satellite Eye will be used continuously with daily new satellite images until June 2011 for education in VirtuelGalathea3. The educational projects from Satellite Eye will be used in Danish schools in the coming years through VirtuelGalathea3 (where new technologies are included). A DVD will be sent to the Danish upper secondary schools in 2008 with the Satellite Living Atlas from Satellite Eye, and also include the educational film ‘Satellite Eye – Galathea 3 fra Rummet’. This film will also be dubbed in English. The DVD will also contain short videos from Galathea 3 produced by STV nature and science.

The aim is to inspire and provide teachers and students exciting new educational material from Galathea 3.

Appendix

GALATHEA 3 SPOT IMAGES IN THE ARCHIVE

1. Accra-Tema_910329
2. Accra_Tema_061214
3. Acores_010317
4. Acores_061127
5. Antofagasta_950917
6. Boston_030910
7. Capetown_061018
8. Capetown_860731
9. Christchurch_870208
10. Christchurch_980601
11. Galapagos_Floreana_full_991130
12. Galapagos_Floreana_N_000105
13. Floreana_N_000302
14. Galapagos_Floreana_N_000303
15. Galapagos_Floreana_N_991216
16. Galapagos_Floreana_S_000302
17. Galapagos_Floreana_S_000303
18. Galapagos_Floreana_S_991130
19. Galapagos_Floreana_S_991216
20. Galapagos_Isabel_Sta_Fe
21. Galapagos_Sta-Cruz_000302
22. Galapagos_Sta_Cruz_000105
23. Galapagos_Sta_Cruz_000226
24. Galapagos_Sta_Cruz_000227
25. Kopenhagen_060425
26. Kopenhagen_860803
27. Narssarsuaq_910401
28. Nuuk_060902
29. Nuuk_870814
30. Panamacanal_H_IR_981025
31. Panamacanal_S_IR_980218a
32. Panamacanal_S_IR_990131
33. Panama_971205
34. Panama_Gatun_IR_980915
35. Panama_N_IR_980915
36. Panama_S_IT_980218
37. Perth_041104
38. Perth_860411
39. Sydney_041127
40. Sydney_881030
41. Thorshavn_021009

GALATHEA 3 PROBA IMAGES IN THE ARCHIVE

1. 20060727_153159_HRC_21197_Nuuk_GL.bmp
2. 20060727_153159_HRC_21198_Nuuk_GL.bmp
3. 20060727_153159_HRC_21199_Nuuk_GL.bmp
4. 20060729_001352_HRC_21216_Sydney_AU.bmp
5. 20060729_001352_HRC_21217_Sydney_AU.bmp
6. 20060729_001352_HRC_21218_Sydney_AU.bmp
7. 20060729_001352_HRC_21219_Sydney_AU.bmp
8. 20060729_001352_HRC_21220_Sydney_AU.bmp
9. 20060731_150418_HRC_21258_Antofagasta_CL.bmp
10. 20060731_150418_HRC_21259_Antofagasta_CL.bmp

11. 20060731_150418_HRC_21260_Antofagasta_CL.bmp
12. 20060801_164554_HRC_21261_Galapagos_EC.bmp
13. 20060802_023453_HRC_21266_Perth_AU.bmp
14. 20060802_023453_HRC_21267_Perth_AU.bmp
15. 20060802_023453_HRC_21268_Perth_AU.bmp
16. 20060802_023453_HRC_21269_Perth_AU.bmp
17. 20060802_023453_HRC_21270_Perth_AU.bmp
18. 20060810_114301_HRC_21366_Torshavn_FO.bmp
19. 20060810_114301_HRC_21367_Torshavn_FO.bmp
20. 20060810_150814_HRC_21369_St-Thomas_VI.bmp
21. 20060818_150106_HRC_21456_St-Thomas_VI.bmp
22. 20060818_150106_HRC_21457_St-Thomas_VI.bmp
23. 20060818_150106_HRC_21458_St-Thomas_VI.bmp
24. 20060818_150106_HRC_21459_St-Thomas_VI.bmp
25. 20060818_150106_HRC_21460_St-Thomas_VI.bmp
26. 20060903_150016_HRC_21645_Valparaiso_CL.bmp
27. 20060903_150016_HRC_21646_Valparaiso_CL.bmp
28. 20060903_150016_HRC_21647_Valparaiso_CL.bmp
29. 20060903_150016_HRC_21648_Valparaiso_CL.bmp
30. 20060903_150016_HRC_21649_Valparaiso_CL.bmp
31. 20060904_021327_HRC_21650_Broom_AU.bmp
32. 20060904_021327_HRC_21651_Broom_AU.bmp
33. 20060904_021327_HRC_21652_Broom_AU.bmp
34. 20060904_021327_HRC_21653_Broom_AU.bmp
35. 20060904_021327_HRC_21654_Broom_AU.bmp
36. 20060904_145747_HRC_21655_St-Thomas_VI.bmp
37. 20060904_145747_HRC_21656_St-Thomas_VI.bmp
38. 20060904_145747_HRC_21657_St-Thomas_VI.bmp
39. 20060904_145747_HRC_21658_St-Thomas_VI.bmp
40. 20060904_145747_HRC_21659_St-Thomas_VI.bmp
41. 20060908_152949_HRC_21711_Nuuk_GL.bmp
42. 20060908_152949_HRC_21712_Nuuk_GL.bmp
43. 20060910_155845_HRC_21730_New-York_US.bmp
44. 20060910_155845_HRC_21731_New-York_US.bmp
45. 20060910_155845_HRC_21732_New-York_US.bmp
46. 20060910_155845_HRC_21733_New-York_US.bmp
47. 20060910_224817_HRC_21734_Christchurch-Lyttelton_NZ.bmp
48. 20060910_224817_HRC_21735_Christchurch-Lyttelton_NZ.bmp
49. 20060910_224817_HRC_21736_Christchurch-Lyttelton_NZ.bmp
50. 20060910_224817_HRC_21737_Christchurch-Lyttelton_NZ.bmp
51. 20060910_224817_HRC_21737_Christchurch-Lyttelton_NZ.jpg
52. 20060910_224817_HRC_21738_Christchurch-Lyttelton_NZ.bmp
53. 20060913_150133_HRC_21763_St-Thomas_VI.bmp
54. 20060913_150133_HRC_21764_St-Thomas_VI.bmp
55. 20060913_150133_HRC_21765_St-Thomas_VI.bmp
56. 20060913_150133_HRC_21766_St-Thomas_VI.bmp
57. 20060903_150016_HRC_21647_Valparaiso_CL.tif

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Risø’s research is aimed at solving concrete problems in the society.

Research targets are set through continuous dialogue with business, the political system and researchers.

The effects of our research are sustainable energy supply and new technology for the health sector.