Image shows the first GHRSSST-PP level 4 SST Ultra-high Resolution analysis product provided by the Medspiration team. © Medspiration/CLS 2004
Applications

- Alleviation of Poverty
- Safety/security of life and property
- Monitoring of natural hazards/disasters
- Detection and predicting climate variability
- Management of natural resources
- Public health
- Safety of marine operations
- Preserving and restoring the health of ecosystems
- Water quality water quality indicators.
- Tourism and leisure

Neville Smith, Director of the GODAE International Project Office

‘A particular challenge for GODAE is to provide sound guidance on the sampling and accuracy needed for key product streams; the community cannot afford a luxurious suite of remote sensing platforms with large redundancy. The GODAE High-Resolution SST Pilot Project is an example of an integrated approach whereby SST data from different platforms with different characteristics are blended to provide a product that is not available from any one platform and meets the high demand specified by GODAE.’
GODAE: An international cooperation for an international sector

It is only in recent times that nations have begun to recognise the size, diversity and complexity of the ocean industries and their importance. It is estimated that over 90% of world trade is carried over the ocean. Oceanographic research has grown significantly in response to developing concerns over the role of the oceans within the climate system and the growing demand for metocean data as more industries move offshore. Major growth in the marine industry is expected in the sectors of:

- marine transportation;
- the leisure industries;
- marine foods and services;
- mineral exploitation;
- underwater vehicles;
- renewable energy;
- the ports industries
- offshore oil & gas industry;
- submarine cables;
- marine biotechnology;
- marine information technology;
- Research and development.

The Global Ocean Data Assimilation Experiment (GODAE) is an international project to develop operational global ocean analysis and prediction systems to serve these industrial sectors, to save lives and property and to further oceanographic research and development. The vision behind GODAE is that these societal and economic advantages cannot be realized without implementing the concept of:

“A global system of observations, communications, modelling and assimilation, that will deliver regular, comprehensive information on the state of the oceans in a way that will promote and engender wide utility and availability of this resource for maximum benefit to society.”

Through the period 2003-2007, through international co-operation, GODAE products, services and activities will demonstrate the benefits and utility of global ocean data and forecast products.

The importance of SST

Within GODAE, one of the most important dependencies is on sea surface temperature (SST) products that are required to properly constrain the upper ocean circulation and thermal structure. SST data products need to be accurate (better than 0.4K), be available in near real time and have high spatial (<10km) and temporal (6-12 hours) resolution. In 2000, no SST products could satisfy these requirements for the global domain.

As a direct response to this situation, the international GODAE steering team (IGST) initiated in 2000 a GODAE High Resolution SST Pilot Project (GHRSSST-PP) at an international workshop hosted by the European Commission Joint Research Centre, Ispra, Italy.
Sea surface temperature (SST) measured from Earth Observation Satellites in considerable spatial detail and at high frequency, is increasingly required for use in the context of operational monitoring and forecasting of the ocean, for assimilation into coupled ocean-atmosphere model systems and for applications in short-term numerical weather prediction and longer term climate change detection.

The GHRSST-PP is based on a distributed system in which the data processing operations that are necessary to operationally generate and distribute high resolution SST data sets having global coverage are shared by Regional Data Assembly Centres (RDAC). RDAC ingest, quality control and merge existing satellite and in situ SST data sources that are then used together to generate regional coverage quality controlled SST data products to the same specification (called L2P products), in real-time. RDAC data products are then assembled together at Global Data Analysis Centres (GDAC) where they are integrated and analysed to provide L4 global coverage combined analysis products. Data products are served to the user community via dedicated applications and user services tailored to operational and scientific user requirements.

Oliver Arino, ESA Data User Element

“The European Space Agency (ESA) were encouraged by the initial activities of the GHRSST-PP and in particular, the effectiveness of the GHRSST-PP international federated user community to work together as a coherent and yet energetic and vibrant team.”
The GHRSST-PP

The aim of the GHRSST-PP is to develop and operate an internationally distributed demonstration system that will deliver a new generation of high-resolution (better than 10 km) global coverage SST data products in a real time (~6 hourly) operational context during 2005-2008. Innovative data fusion methods and algorithms will be implemented in an operationally robust manner based on complementary satellite and in situ SST observations that capitalise on synergy benefits. GHRSST-PP data products and services have been designed to serve the diverse needs of GODAE and in addition the wider scientific community taking into consideration solicited user requirements at all levels. A full description of the GHRSST-PP together with a wealth of additional information describing the international partnership and dedicated Science Team can be found on the GHRSST-PP web site at http://www.ghrsst-pp.org.

The GHRSST-PO

At the second GHRSST-PP workshop (Tokyo, Japan, May 2002), the GHRSST-PP Science Team formally endorsed the need for an International GHRSST-PP Project office (GHRSST-PO) to supervise the international coordination and execution of the GHRSST-PP.

The European Space Agency (ESA) and the Hadley Centre for Climate Prediction and Research, Met Office, United Kingdom, responded directly to this international request and agreed to maintain funding for a GHRSST-PP International project Office (GHRSST-PO) for a three year period starting in Autumn 2003. The priority activity of the GHRSST-PO is to obtain, evaluate, disseminate and facilitate the exchange of information within the GHRSST-PP community (including the Space Agencies, funding bodies and sponsors, operational ocean and meteorological agencies, universities and research laboratories, data managers, data analysis and modelling programmes and scientists) and any other entity involved in GHRSST-PP.

The remit of the GHRSST-PO is:

“To manage the international coordination and execution of the GHRSST-PP as described in the GHRSST-PP Development and Implementation Plan (GDIP) including all of its sub-components and deliverables.”
European Space Agency sponsorship

ESA, encouraged by the federated user community embodied by the GHRSSST-PP and in particular, the effectiveness of the international community to work together as a coherent and yet energetic and vibrant team, committed to the GHRSSST-PP by investing €300K over a 3 year period to operate the international GHRSSST-PO. In addition, ESA invested a further €1M to develop a GHRSSST-PP European Regional Data Assembly Centre (EU-RDAC). The Medspiration project, sponsored by the ESA Data User Element (DUE), was founded on a European federated user requirements document taking input from most of the European operational modeling systems. The EU RDAC geographic region encompasses the Atlantic Ocean and all European shelf seas.

In January 2004, following a competitive tender process, the Medspiration consortium began work in earnest to develop an operationally robust system that will deliver GHRSSST-PP SST data products and services as specified in the GHRSSST-PP Data Processing Specification (GDS) developed by the GHRSSST-PP International Science Team.

The Medspiration project will produce Ultra-high resolution (2km) combined analysis data products for the Mediterranean region every 24 hours. This is a particularly challenging area to work in due to the highly variable SST field. Shown right is the first ultra high resolution SST analysis from the Medspiration project for the 2nd October 2004 taking inputs from microwave and infrared satellite sensors.

ESA is the primary data provider delivering climate quality data records (CDR) from the ENVISAT AATSR instrument. For the GHRSSST-PP, ESA has commissioned a special data service to the Medspiration project providing 1km global coverage ENVISAT AATSR data under a category-1 user proposal (headed by the GHRSSST-PO Director) via ftp service. AATSR data provide extremely accurate and stable SST data products (See box below) that will be used as a reference SST data set for the GHRSSST-PP both in real time and as part of the delayed mode reanalysis program. The GHRSSST-PP will ensure that the maximum benefit is obtained from the AATSR mission in the most appropriate manner.

ESA is now considering an operational continuity of the AATSR system within its Sentinel-3 mission.
Met Office sponsorship

The GHRSST-PO is located at the Hadley Centre for Climate Prediction and Research, part of the Met Office, United Kingdom (http://www.metoffice.gov.uk) which is one of the worlds leading providers of environmental information. The Met Office already has considerable experience in the operational processing and application of both in situ and satellite SST data sets in operational ocean modelling, climate applications, and numerical weather prediction (NWP) activities. In addition, it is at the forefront of GODAE activities based on the operational Forecast Ocean Assimilation Model (FOAM) ocean model that runs each day predicting the 3 dimensional ocean state for up to 5 days in advance. FOAM uses the most up-to-date ocean model data assimilation techniques and will be a prime user of GHRSST-PP/Medspiration data products and services. In addition, the Met Office hosts the National Centre for Ocean Forecasting (NCOF) which is dedicated to the development of operational oceanography in the UK. NCOF is a new collaborative partnership including key oceanographic agencies within the UK. The GHRSST-PO will, from early 2005, be a part of the NCOF.

The Hadley Centre produces a monthly global combined sea surface temperature and sea ice analysis climatology called (HadISST). A new version of the analysis procedure that uses ENVISAT AATSR satellite SST data will be operational in 2005. The AATSR has a significant positive benefit over the AVHRR SST especially in the Atlantic and Indian Oceans due to its ability to compensate for atmospheric aerosols. (Figure from John Kennedy, Met Office)

Within the Met Office Satellites Applications division, the Met Office has an operational validation system dedicated to ENVISAT AATSR SST data products. Each day AATSR data are matched to in situ SST observations in NRT making use of the dedicated METEO data service provided to the Met Office by ESA. Each week, all data are analysed to produce a time series of the bias and standard deviation of all matchups. The figure to the left shows the exceptional accuracy and stability of the ESA METEO SST data product and Met Office SSTdepth retrieval over nearly 2 years! (Figure Jim Watts and Anne O’Carrol, Met Office)

Vision

Through unrivalled now-how, to enable individuals, society and enterprises everywhere to make the most of the weather and the natural environment.
The objectives of the GHRSST-PP Project Office:

1. To staff and operate the GHRSST-PO for a period of three consecutive years stating from September 1st 2003.
2. To manage the international coordination and execution of the GHRSST-PP as described in the GHRSST-PP Development and Implementation Plan (GDIP) including all of its sub-components and deliverables.
3. To support ESA in the coordination of satellite instrument validation activities focussed on the development of a user information service for the reporting and exchange of validation results and information relating to the operational activities of satellite platforms and data delivery in near real time.
4. To provide ESA with appropriate progress and annual reports and attend regular review meetings at ESA ESRIN, Italy.

The GHRSST-PO is managed by a Director (Dr. Craig Donlon) and several support staff. The office was inaugurated at a special ceremony convened by the Met Office in January 2004. The inauguration was attended by delegates from ESA, BNSC, IFREMER, Meteo France, VEGA, CLS, Met Office, AVELMOR, Met.no, EUMETSAT, SOC, and CNR.

“Innovative data fusion methods and algorithms will be implemented by GHRSST-PP in an operationally robust manner that capitalise on synergy benefits to deliver a new generation of SST data products based on complementary satellite and in situ SST observations”
Key results for 2003/4

- GHRSST-PP activities are now established in Australia (BLUElink> RDAC project), Europe (ESA Medspiration project), Japan (University of Tohoku/JMA), and the United States (NASA JPL-GDAC system, MISST SST research project).

- Over €10M (~$10M) has been invested in the GHRSST-PP over the last 4 years by the international partnership with over €6M in 2003/4.

- Over 40 international users in the EU, Australia and USA are now anticipating GHRSST-PP data products in 2005. User requirements have been captured and published for the European area.

- Through the development and publication of the GHRSST-PP Data Processing Specification (GDS), International consensus has been reached for quality control of satellite SST data sets and a baseline GHRSST-PP regional/global task sharing framework shown opposite.

- New systems are being implemented to manage GHRSST-PP data products and services built against international standards and protocols. In particular, an international Metadata repository and data catalogue is being implemented at the NASA Jet Propulsion Laboratory (JPL) providing the basis for a sustainable system. Parallel activities are now in progress within the EU area providing operational redundancy and regional autonomy.

- The Fourth GHRSST-PP Science Team meeting and workshop was organised by the GHRSST-PO in collaboration with NASA JPL. The workshop, held in September 2004 in Pasadena, California, USA, drew over 30 international participants.

- The GHRSST-PO Director obtained external funding from the Office of Naval Research Global (ONR-GLOBAL) to cover travel and subsistence costs for Science Team members attending the 4th GHRSST-PP workshop.

- Scientific challenges associated with diurnal variation have been tackled head on by groups in Europe and the USA. A new GHRSST-PP Diurnal Variation Working Group (DV-WG) has been established, chaired by Dr. Chris Merchant, University of Edinburgh, UK. A new scheme for the estimation of diurnal variation has been developed by the Medspiration team for testing application by the GHRSST-PP. A peer reviewed paper has been published reporting parameterisation schemes for diurnal variation based on satellite data.

- Near Real Time access has been established to all key satellite and in situ data sets required by the GHRSST-PP. In some cases this has resulted in direct data access enhancement to ensure a wide and all encompassing regional/global task sharing framework.

- The fifth GHRSST-PP International Science team meeting and workshop was organised in partnership with CSIRO Marine, Hobart, Australia. The Workshop was attended by over 32 people representing international agencies and institutions participating in the GHRSST-PP. The workshop was held in Townsville, Queensland Australia in July/August 2004.

- Advanced operational data monitoring tools such as the GHRSST-PP High Resolution Diagnostic Data Set (HR-DDS) and matchup database (MDB) have been designed by the GHRSST-PP Science team and are now being implemented by GHRSST-PP RDAC/GDAC teams.

- Efficient operational methodologies have been developed to assign uncertainty estimates to all SST data on a pixel by pixel basis called Single Sensor Error Statistics (SSES). SSES, based on the operational systems used by EUMETSAT and the US-Navy systems, are underpinned by an on-going program of R&D that will improve the methodology based on detailed inter-comparison studies within the HR-DDS and at global level.

- A new generation of Autonomous in situ radiometer systems, called the Infrared Autonomous SST radiometer (ISAR) have been deployed for the validation of ENVISATR AATSR and GHRSST-PP data products. In collaboration with Southampton Oceanography Centre and the University of Miami, the GHRSST-PO Director has supervised the development of these activities including the design and construction of a new Infrared reference radiance calibration black body system. Data from these systems will be used to monitor the performance of the AATSR sensor as a reference SST data provider.

- The GHRSST-PO Director has provided full support to ESA in the review of the Medspiration project and has attended all Medspiration review meetings.

- Full support has been given to NASA in the development and commissioning of the GHRSST-PP data management system at the US-GDAC facility.

- Operational data feeds established for global coverage ENVISAT AATSR 1km SST data within the GHRSST-PP.

- The GHRSST-PO has been actively negotiating the service definition and integration of activities within the EU area that will use GHRSST-PP/Medspiration data.
The GHRSST-PP International partnership

The GHRSST-PP is a large project that includes many user communities, agencies and institutions in many different countries. The core partnership implementing and contributing to the GHRSST-PP is underpinned by the following agencies:

- Hadley Centre for Climate Prediction and Change, UK
- Australian Institute for Marine Science, Australia
- Japan Meteorological Agency (JMA)
- Norwegian Met Office met.no (Norway)
- Naval Research Laboratory, USA
- European Space Agency (ESA)
- University of Tohoku, Japan
- University of Colorado, USA
- University of Edinburgh, UK
- University of Southampton
- University of Miami, USA
- IFREMER, France
- CSIRO, Australia
- Met Office, UK
- NOAA/NESDIS
- NOAA/NODC
- Meteo France
- NASA
- BNSC, UK
- CNR, Italy
- CLS, France
- VEGA, UK
- SeasNET, IRD, France
- Royal Australian Navy
- Avelmor, France
- MEDS data centre, Canada
- University of Leicester, UK
- FerryBox, European Commission
- CORIOLIS data centre, France
- Remote Sensing Systems, USA
- EUMETSAT Ocean and Sea Ice SAF
- National Climate Data Centre, USA
- Naval Oceanographic Office, USA.
- Bureau of Meteorology, Australia.
- Rutherford Appleton Laboratory, UK
- Southampton Oceanography Centre, UK
- National Ocean Partnership Program, USA
- JPL Physical Oceanography Data Active Archive Centre, USA

The total number of people working within the GHRSST-PP international partnership in 2003/4 is approximately 160 geographically spread between Europe, USA, Japan and Australia. In addition to the GHRSST-PP Science Team which meets at least once per year the following GHRSST-PP groups ensure a good dialog between the GHRSST-PP partnerships:

- The GHRSST-PP Diurnal Variation Working Group (DV-WG)
- The GHRSST-PP Data management technical advisory group (DM-TAG)
- The GHRSST-PP Data Processing Specification Technical Advisory Group (GDS-TAG)
- The GHRSST-PP XML Working Group (XML-WG)
The GHRSST-PP user community

Over 40 user communities are active within the GHRSST-PP ranging from University departments through to National Navies and space agencies. Applications are diverse but are generally based in existing operational ocean modelling and prediction.

Other users are innovating constantly so that user requirements change and evolve. For example, within the UK, the National Ocean Forecasting Centre (NCOF) intends to operate a 10km global coverage daily SST analysis system taking full advantage of the GHRSST-PP in 2005.

Prior to the initiation of the GHRSST-PP, User requirements were solicited in Japan, Australia, Canada, Europe and, in the United States. The overwhelming requirement was for each and every SST measurement to have associated with it uncertainty estimates. In addition, high resolution and accuracy were of paramount importance. In the coastal zone SST data are required to a resolution of at least 1km, every 6 hours and accurate to better than 0.4K. In the open ocean the requirement is for a 10km or better resolution, accurate to at least 0.3K and available with global coverage. In both cases, observational data (swath data) and gridded data (combined analysis) data products were requested. In addition, users request that the GHRSST-PP manages GHRSST-PP data sets in a manner that allows easy data discovery via WWW based tools.

Several operational communities (including National Hurricane Research Centre, Meteorological Offices, Navies, and operational oceanography systems (e.g., MERSEA-IP) will make direct use of GHRSST-PP data products from both RDAC and GDAC centres during 2004-08. The challenge for the GHRSST-PO is to harness the feedback from such a wide base user community and properly support the provision of tailored SST data products and services.
### GHRSST-PO Director co-ordination missions

The GHRSST-PO Director (Dr. Craig Donlon) has completed the following missions in support of GHRSST-PP international project coordination. In most cases, a public presentation describing the activities of the GHRSST-PP has been delivered as part of institutional seminars where feedback on GHRSST-PP methods and techniques can be obtained. Other missions are dedicated to establishing access to particular data streams, coordination of international projects to prevent duplication of effort and for the technical review of the ESA Medspiration project and, AATSR validation activities.

The Table below lists each significant mission completed by the GHRSST-PO Director during 2003/4.

<table>
<thead>
<tr>
<th>Date</th>
<th>Country</th>
<th>Mission/destination</th>
<th>Role/purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 2003</td>
<td>USA</td>
<td>Visit to Remote Sensing Systems (RSS), Santa Rosa, Ca. USA.</td>
<td>Establish access to RSS data and assist in the preparation of a NOPP GHRSST-PP proposal.</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>Fourth GHRSST-PP Science Team meeting, Marriot Courtyard Hotel, Pasadena, California, USA</td>
<td>Chair the annual GHRSST-PP Science Team meeting</td>
</tr>
<tr>
<td>October 2003</td>
<td>South Africa</td>
<td>Regional Ocean Observing and Forecasting System for Africa (ROOFS-AFRICA) planning meeting Johannesburg, South Africa.</td>
<td>Presentation and Promotion of the GHRSST-PP. Assistance in the development of the UNESCO/IOC/GOOS ROOFS-AFRICA project.</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>MERIS and AATSR Validation Team meeting, ESA/ESRIN, Frascati, Rome, Italy</td>
<td>Presentation of ISAR/AATSR validation project results.</td>
</tr>
<tr>
<td>November 2003</td>
<td>USA</td>
<td>Rosenstiel School of Marine and Atmospheric Science, University of Miami, USA</td>
<td>Discussions to establish access to MODIS data in NRT for the GHRSST-PP. Discussions on the design of the GHRSST-PP matchup database and metadata repository.</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>International GODAE Steering Team (IGST) meeting, Miami, FL, USA</td>
<td>Report of GHRSST-PP activities to the IGST.</td>
</tr>
<tr>
<td></td>
<td>Belgium</td>
<td>Second JCOMM Workshop on Advances in Marine Climatology (CLIMAR-II), Brussels</td>
<td>Presentation of the GHRSST-PP.</td>
</tr>
<tr>
<td>December 2003</td>
<td>UK</td>
<td>Invited seminar at the Proudman Oceanographic Laboratory (POL), UK</td>
<td>Presentation of the GHRSST-PP and discussion to set up a high resolution diagnostic data set over the POL Coastal Observatory in the Irish Sea.</td>
</tr>
<tr>
<td>February 2004</td>
<td>France</td>
<td>GHRSST-PP/ESA Medspiration collocation meeting, IFREMER, Brest, France.</td>
<td>Discussion of the technical details of the GHRSST-PP data processing specification (GDS) as part of the Medspiration SRR process.</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>Physical Oceanography Data Active Archive Centre (PO.DAAC), Jet Propulsion Laboratory (JPL), Pasadena, USA</td>
<td>Discussion to develop the GHRSST-PP data management working group and GDAC services (MDB, MMR, IDPS). Discussions to access AIRS SST data</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>Southampton Oceanography Centre, Southampton, UK</td>
<td>Technical discussions with Medspiration Project leader and SOC staff on the development of Medspiration/GHRSST-PP interfaces. Development of the GHRSST-PP HR-DDS system</td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>Rosenstiel School of Marine and Atmospheric Science, University of Miami, USA</td>
<td>Attend the NOPP project meeting “Developing autonomous SSTskin measurements for validation of satellite SST”</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>GHRSST-PP International Project Office Inauguration, Hadley Centre for Climate Prediction and Research, Met Office, Exeter, UK</td>
<td>Host to the GHRSST-PO Inauguration.</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>Southampton Oceanography Centre, Southampton, UK</td>
<td>Joint EU-FerryBox-ISAR/AATSR validation team workshop.</td>
</tr>
<tr>
<td>Date</td>
<td>Country</td>
<td>Mission/destination</td>
<td>Role/purpose</td>
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</tr>
<tr>
<td>April 2004</td>
<td>France</td>
<td>MERSEA-IP kick off meeting, IFREMER, Brest, France.</td>
<td>Presentation of the GHRSST-PP. Integration of GHRSST-PP activities within the MERSEA-IP program.</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>Invited Seminar, University of Portsmouth, Department of Earth Science, Portsmouth, UK</td>
<td>Presentation of the GHRSST-PP.</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>Medspiration Technical meeting, CNR, Rome, Italy</td>
<td>Discussion of SST optimal interpolation schemes developed by CNR for application in the Mediterranean Sea.</td>
</tr>
<tr>
<td>May 2004</td>
<td>France</td>
<td>Joint Commission for Oceanography and Marine Meteorology (JCOMM) Ocean Ops 2004 meeting, Toulouse, France.</td>
<td>Present the GHRSST-PP and discuss the role of operational SST data provision within JCOMM.</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>Medspiration Preliminary Design review (PDR), ESA/ESRIN, Frascati, Rome, Italy.</td>
<td>Project support to ESA throughout the PDR process.</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>GHRSST-PP Project Office review, ESA/ESRIN, Frascati, Rome, Italy.</td>
<td>Review of GHRSST-PP project Office activities with the ESA technical officer.</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>Interim North Sea Observing System (NOOS) steering group meeting, Met Office, UK.</td>
<td>Integration of GHRSST-PP activities within NOOS.</td>
</tr>
<tr>
<td>June 2004</td>
<td>UK</td>
<td>Invited seminar at Space and Atmospheric group, Imperial College London, UK.</td>
<td>Presented the GHRSST-PP.</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>Meeting on board the P&amp;O vessel Pride of Bilbao, Portsmouth, UK.</td>
<td>Met Office, GHRSST-PP and Southampton Oceanography Staff met with the ships Captain to discuss the validation of ENVISAT AATSR aboard the ship.</td>
</tr>
<tr>
<td>October 2004</td>
<td>Italy</td>
<td>Medspiration Critical Design review (CDR), ESA/ESRIN, Frascati, Rome, Italy.</td>
<td>Assist ESA throughout the CDR process.</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>UK Ocean Data assimilation meeting, Met Office, UK.</td>
<td>Discussions with ECMWF on the provision and use of Medspiration data products.</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>National Environmental Research Council (NERC) technology forum held at the SOC, UK.</td>
<td>Presented ISAR/AATSR validation program.</td>
</tr>
<tr>
<td>August 2004</td>
<td>UK</td>
<td>Southampton Oceanography Centre, Southampton, UK.</td>
<td>ISAR/AATSR validation design team meeting.</td>
</tr>
</tbody>
</table>

Ian Poiner, Director of the Australian Institute of Marine Science

“GHRSST-PP is essential; sea surface temperature is foundation data set for all of our work from monitoring and prediction to policy and management”. 5th GHRSST-PP Science Team meeting, Townsville Australia, 2004
**Publications in 2003/4**

The GHRSST-PO is responsible for the publication and supply of GHRSST-PP documentation. Conference proceedings, test data sets, and web based material have all been edited and published as part of the GHRSST-PO activities. Bound full colour hard copy versions of Conference proceedings and DVD-ROM data sets are always available from the GHRSST-PO and have been mailed to the GHRSST-PP scientific and application community.

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**Promotion and Outreach in 2003/4**

Branding and promotion are key elements of all successful projects as bringing instant user association with products and services. The GHRSST-PP logo has been used to promote all aspects of the project in documentation and as part of the project web portal (http://www.ghrsst-pp.org). In 2003/4, the project web site has developed to generally serve the scientific community actively involved in the development and implementation of the GHRSST-PP itself. It provides access to all project documentation, links to RDAC and GDAC team pages and to information developed by the GHRSST-PP scientific and technical working groups.

[Image of GHRSST-PP logo and web page]

As part of the GHRSST-PP Outreach effort, stylish GHRSST-PP pens and tie pins have been produced for dissemination at GHRSST-PP meetings and conferences.
Financial summary for 2003/4

All invoices to ESA have been issued and paid for the period 2003/04 as per ESA ESRIN Contract: 17420/03/I-LG. The ESA Technical Officer is Olivier Arino.

### Incoming

<table>
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<th>Description</th>
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<td>ESA sponsorship</td>
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<tr>
<td>Met Office sponsorship</td>
<td>72.95</td>
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<tr>
<td>ONR-Global (travel grant for 4th workshop)</td>
<td>10</td>
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<tr>
<td>DEFRA/SOC (AATSR validation)</td>
<td>10</td>
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<tr>
<td>MERSEA-IP (GHRSST-PP integration)</td>
<td>3</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>195.95</strong></td>
</tr>
</tbody>
</table>

### Outgoing

<table>
<thead>
<tr>
<th>Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Salaries (including all overhead)</strong></td>
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</tr>
<tr>
<td>GHRSS-PO Director</td>
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<tr>
<td>Secretarial support</td>
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<td><strong>Capital equipment</strong></td>
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<td>Computer laptop</td>
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<tr>
<td>Software costs</td>
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</tr>
<tr>
<td><strong>Travel and subsistence</strong></td>
<td></td>
</tr>
<tr>
<td>GHRSS-PO Director</td>
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<tr>
<td>Science Team support (ONR grant)</td>
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<tr>
<td><strong>Consumables</strong></td>
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<tr>
<td>Publication and printing costs</td>
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<tr>
<td><strong>Outreach</strong></td>
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<tr>
<td>Promotional pens and tie-pins</td>
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</tr>
<tr>
<td><strong>Support to ESA (AATSR validation)</strong></td>
<td></td>
</tr>
<tr>
<td>Validation contract</td>
<td>10</td>
</tr>
<tr>
<td><strong>MERSEA-IP</strong></td>
<td></td>
</tr>
<tr>
<td>Travel and subsistence</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>195.95</strong></td>
</tr>
</tbody>
</table>
In the coming 12 month period, the GHRSST-PO will nurture and consolidate the GHRSST-PP regional/global task sharing framework. During this time, the first GHRSST-PP data products and services will be provided by the European Medspiration project, serving key users in the European area including MERSEA-IP, MERCATOR, the UK National Centre for Ocean Forecasting, ECMWF, TOPAZ and partners in the Mediterranean Sea area. These data products will exercise all components of the international GHRSST-PP framework acting together in concert, to deliver a new generation of sea surface temperature data products.

In May 2005, the 6th GHRSST-PP Science Team meeting will be held at the Met Office, Exeter, UK. The timing of this workshop is such that users of the first GHRSST-PP data products and services will be in a position to pass comment and feedback to the GHRSST-PP based on their initial experiences with the Medspiration project. These will be used to innovate the GDS specification so that data products are tuned to user requirements. By the middle of 2005, a revised version 2.0 of the GHRSST-PP GDS will have been generated by the GDS Technical Advisory Group based on experience within the project. This will then be available for a full Critical Design Review before acceptance and integration within the GHRSST-PP.

In addition, it is anticipated that significant development will take place within the GHRSST-PP reanalysis project including the implementation of a long term data stewardship archive and data reprocessing/reanalysis facility. This system will enable the best quality satellite SST data set to be generated working with additional data streams not available to the GHRSST-PP in NRT. Through the GHRSST-PP re-analysis project, the GHRSST-PP intends to generate the best possible legacy SST data set for use in climate studies.

Finally, as more experience is gained within the GHRSST-PP, it is expected that a new generation of user requirements will be raised by the international user community based on the additional experience and collaboration gained within the GHRSST-PP. New global coverage SST analyses will be available for inter-comparison and validation by the GHRSST-PP community - all in real time and at high resolution. In 2004/5, the GHRSST-PP will come of age.
**Satellite image data within the GHRSSST-PP**

ENVISAT AATSR 12μm, 10.5μm and 3.7μm brightness temperature images of the Mediterranean Sea showing the Balearic Islands on 27th June 2002 at 21:02. The images are 512km wide and reveal exquisite thermal patterns associated with diurnal stratification and different water masses.

GHRSSST-PP format L2P format AVHRR data files for the Mediterranean Sea together with a map of L2P Infrared Proximity Confidence Values (IPCV). Data produced by the ESA Medspiration project.
GHRSS-PP format L2P format MSG SEVIRI data files for the Atlantic Ocean and European Shelf Seas together with a map of L2P Infrared Proximity Confidence Values (IPCV). Data produced by the ESA Medspiration project.

Contemporaneous Microwave SST and infrared SST retrievals from the TRMM microwave imager and VIRS infrared imager respectively. Note the significant increase in coverage of the microwave system. Images courtesy of the Japan Meteorological Agency (T. Kuragano)
How to find out more about GODAE and the GHRSSST-PP:

A complete description of the GODAE project together with all project documentation can be found at the following web spaces:

- Medspiration: http://www.medspiration.org
- BLUElink>: http://www.bluelink.au
- NGSST: http://www.ocean.caos.tohoku.jp
- GODAE: http://www.godae.au
- ESA: http://www.esa.int
- Met Office: http://www.metoffice.gov.uk

Published by the International GHRSSST-PP Project Office
Hadley Centre for Climate Prediction and Change
Met Office,
Fitzroy Road
Exeter, EX3 1PB
United Kingdom

Tel: +44 (0)1392 886622
Fax: +44 (0)1393 885681
E-mail: craig.donlon@metoffice.gov.uk
http://www.ghrsst-pp.org

Layout and design by C Donlon, GHRSSST-PO, October, 2004

The GHRSSST-PP International Project Office is sponsored by the European Space Agency and the Met Office, United Kingdom.