OurOcean

A web portal to serve near real-time coastal ocean data products

P. Peggy Li (3677)
Joseph Jacob (3677)
Gene Zhijin Li (Raytheon)
Yi Chao (3244)

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Outline

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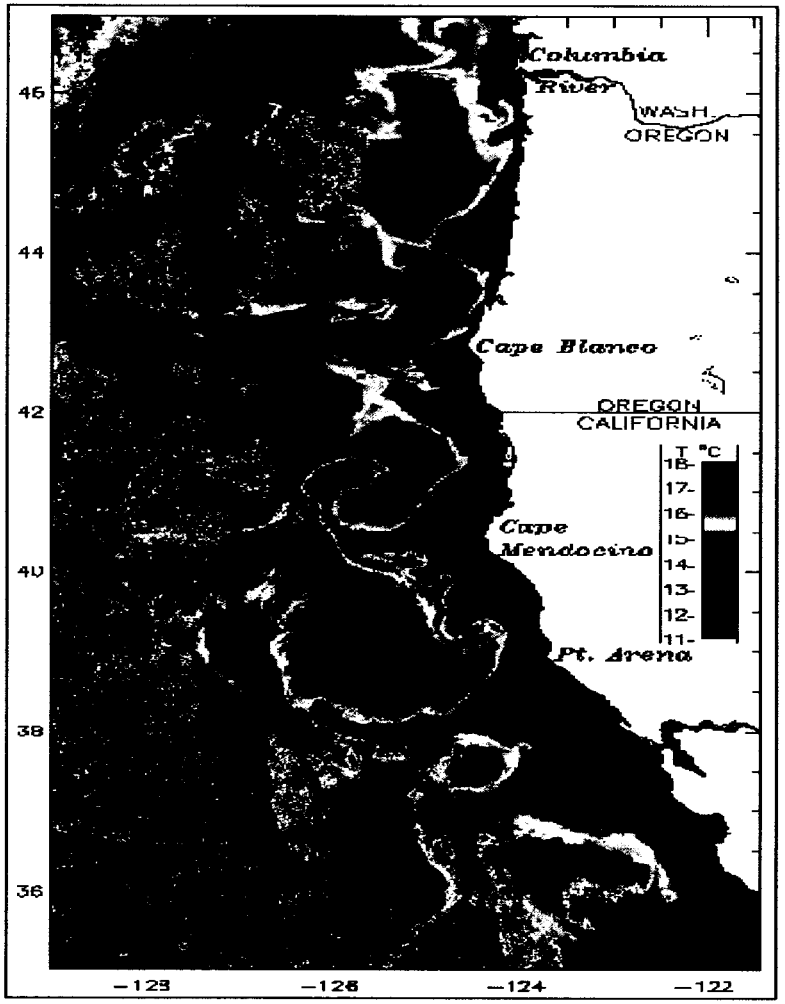
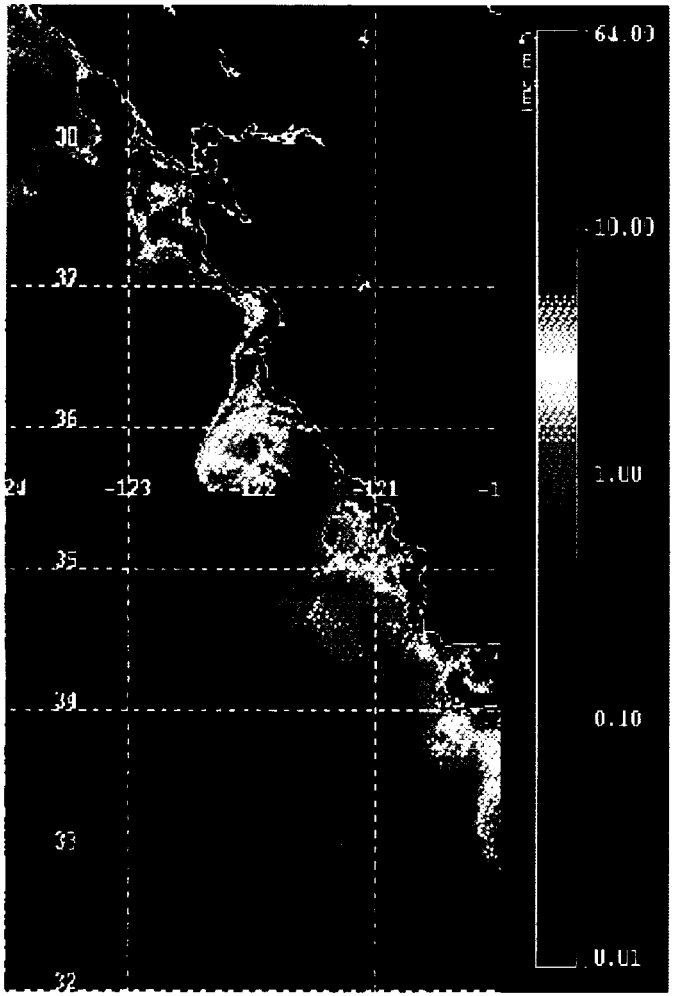
- *OurOcean* Data Server
- *OurOcean* User Interface
- *OurOcean* Visualization Tools
- Current *OurOcean* Data Products
- Status & Future Direction

Motivation

Coastal Oceans are scientifically interesting and practically important



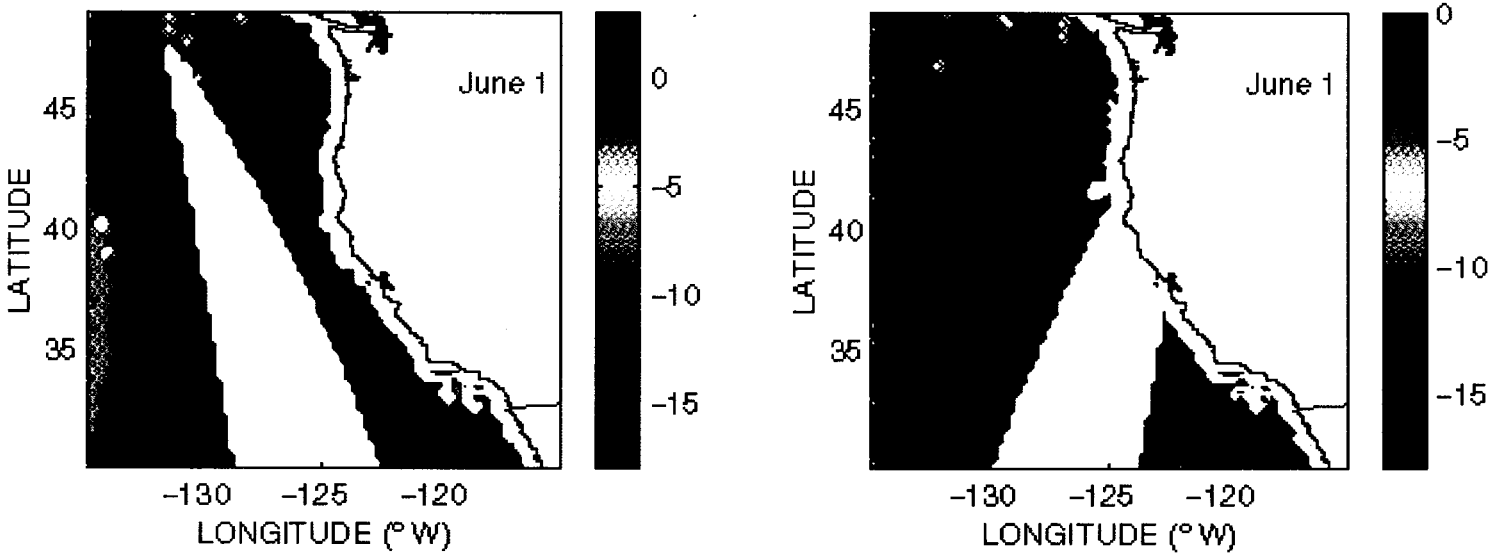
Sea Surface Temperature



Ocean Color

QuikSCAT Coastal Winds

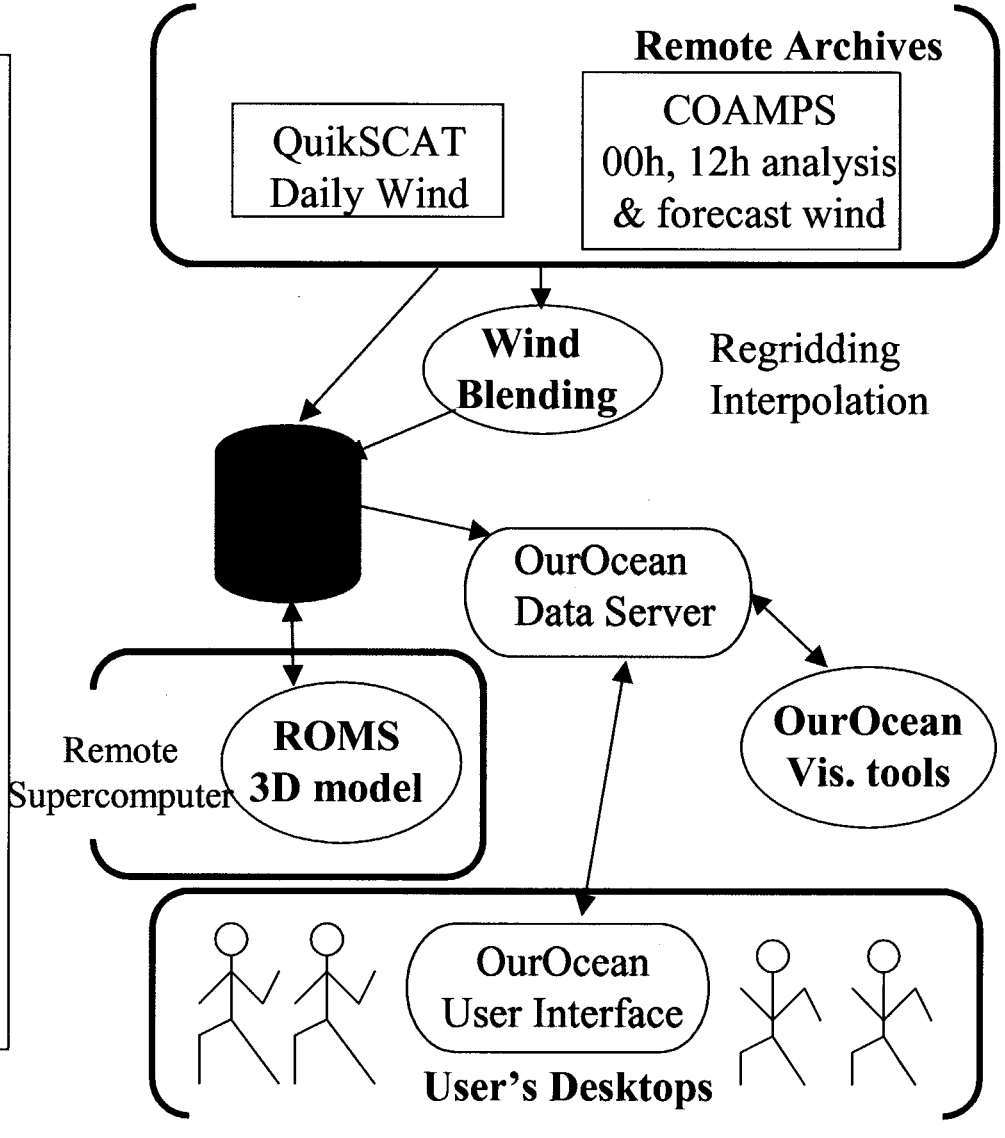
Satellite data alone does not provide enough and accurate information at the coastal regions



- Ocean data have gaps between satellite tracks
- Satellite data are contaminated near coastlines (by land)
- A high resolution (1-10 km) regional atmosphere model is required to fill the satellite data gaps

OurOcean Architecture

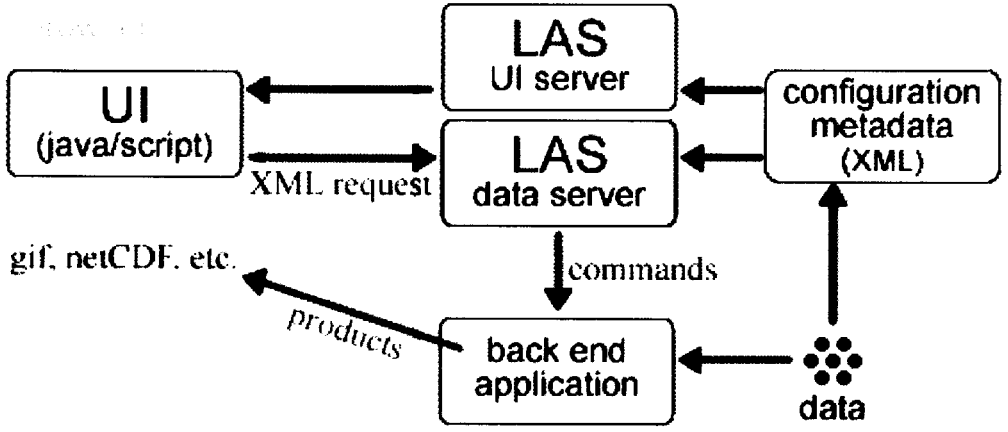
- **An end-to-end web-based system for data retrieval, data archive, data processing and data distribution with a focus on the East Pacific Coastal Ocean wind.**
  - Daily QuikSCAT wind data (PODACC at JPL)
  - Daily COAMPS simulated wind data (FNMOC)
  - Blended wind data (JPL)
  - 3D ocean temperature, salinity and current datasets (ROMS 3D model by JPL)



JPL Data & Algorithms

- Blended Wind Data Product (from QuikSCAT & COAMPS)
  - Two-dimensional variation data assimilation algorithm
  - Fill the missing data in QuikSCAT data set using the simulated wind.
  - Can be used as input to the real-time 3D regional ocean model
- ROMS (Regional Ocean Modeling System)
  - A parallel high-resolution 3D ocean modeling and forecasting system by UCLA/JPL
  - Using terrain-following curvilinear grids and good for modeling coastal oceans.

OurOcean Data Server



- Use LAS (Live Access Server) developed by NOAA Pacific Marine Environmental Laboratory (PMEL) as the web server
- Data are stored in COARDS (Cooperative Ocean/Atmosphere Research Data Service) compliant NetCDF files, one file per year per data source
- Use XML to define the metadata for the datasets, the user interface, and the visualization tool options.
- Use Ferret data visualization and analysis system as the backend visualization tool.

COARDS NetCDF Data Format

NetCDF (Network Common Data Form) -- Unidata

- A machine-independent format for representing scientific data
- An interface for array-oriented data access and a library to implement the interface

COARDS NetCDF (Coorperative Ocean/Atmosphere Research Data Service) -- NOAA

- For sharing and distribution of global atmospheric and oceanographic data sets.
- Support rectilinear coordinate systems
- Support 1D, 2D, 3D, and 4D datasets

```
netcdf QuikSCATL3_2002
  dimensions:
    lat = 126 ;
    lon = 186 ;
    time = UNLIMITED ; // (295 currently)
  variables:
    float lat(lat) ;
          lat:long_name = "Latitude" ;
          lat:units = "degrees_north" ;
    float lon(lon) ;
          lon:long_name = "Longitude" ;
          lon:units = "degrees_east" ;
          lon:modulo = " " ;
    float time(time) ;
          time:long_name = "time" ;
          time:units = "days since 2002-01-
  01" ;
          time:time_origin = "1-JAN-2002" ;
    float u_asc(time, lat, lon) ;
          u_asc:long_name = "u, ASCENDING
  PASS" ;
          u_asc:units = "m/s" ;
          u_asc:scale_factor = 1. ;
          u_asc:add_offset = 0. ;
          u_asc:missing_value = 0. ;
   data:
    lat = 28.875,29.125,29.375,…..
```

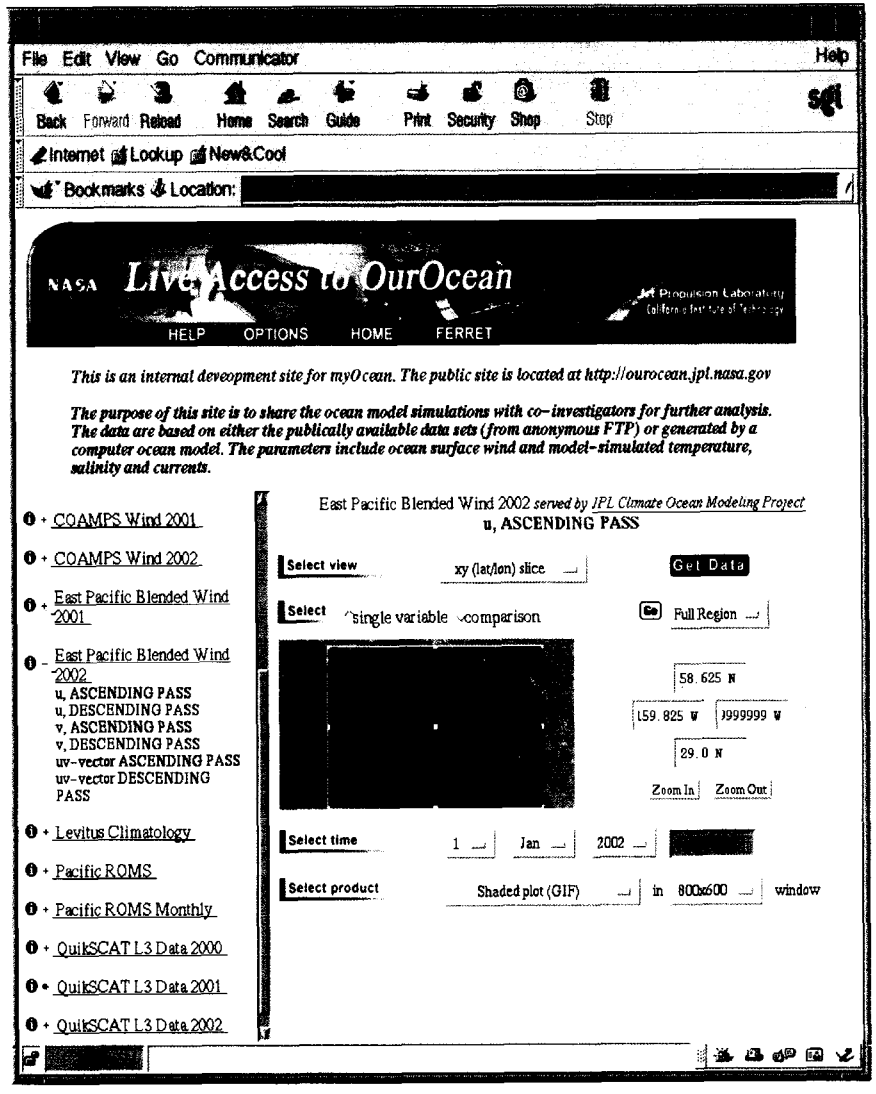
XML Configuration File for Data Sets

```
<lasdata>
  <datasets>
    <QuikSCATL3_2002_nc url="file:/myocean/data/QuikSCAT/QuikSCATL3_2002.nc"
          name = "QuikSCAT L3 Data 2002" namedoc="">

      <variables>
        <u_asc units="m/s" name="u, ASCENDING PASS">
          <link match="/lasdata/grids/QuikSCATL3_2000_nc_lon_lat_time_grid"/>
        </u_asc>
      </variables>
    </QuikSCATL3_2002_nc>
  </dataset>
  <grids>
   <QuikSCATL3_2002_nc_lon_lat_time_grid>
    <link match="/lasdata/axes/QuikSCATL3_2002_nc_lon"/>
    <link match="/lasdata/axes/QuikSCATL3_2002_nc_lat"/>
    <link match="/lasdata/axes/QuikSCATL3_2002_nc_time"/>
   </QuikSCATL3_2002_nc_lon_lat_time_grid>
  </grids>
  <axes>
   <QuikSCATL3_2002_nc_lon units="degrees_east" type="x">
    <arange start="199.875" step="0.25" size="186"/>
   </QuikSCATL3_2002_nc_lon>
   <QuikSCATL3_2002_nc_time units="day" type="t">
    <arange start="2002-01-01 00:00:00" step="1" size="295"/>
   </QuikSCATL3_2002_nc_time>
  </axes>
 </lasdata>
```

OurOcean User Interface

- Java applet enabled Web browser
- Multi-level selection of datasets
- Clickable and zoomable map to select a sub-area of the dataset
- Pull-down menu to select a subset in depth or time dimension
- Various output formats– images at different resolutions, raw data, NetCDF file, text data
- 2D plots of cross sections of any two dimensions from a 2D, 3D, or 4D data set.
- Configurable user interface using XML metadata



XML Configuration File for User Interface

```
<menu type="ops" name="Ops_Std2D">
    <item values="shade,shade">Shaded plot (GIF)</item>
    <item values="shade,ps">Shaded plot (PostScript)</item>
    <item values="data,txt">Quick inspection (text)</item>
    <item values="data,cdf">NetCDF</item>
    <item values="data,tsv">Tab separated (text)</item>
    <item values="data,csv">Comma separated (csv)</item>
    <item values="data,asc">FORTRAN formatted (text)</item>
    <item values="data,arc">ArcView gridded</item>
    <item values="ferret_script,jnl">Ferret script</item>
</menu>
```

Customize Operations

```
<menu type="regions" name="Regions_Pacific">
    <item values="190,252,29,60">Full Region</item>
</menu>
```

Customize pre-defined regions

```
<menu type="views" name="Views_StdVec">
    <ifitem view="xy" values="xy">xy (lat/lon) slice</ifitem>
    <ifitem view="xz" values="xz">xz (lon/depth) slice</ifitem>
    <ifitem view="xt" values="xt">xt (Hovmoller) slice</ifitem>
    <ifitem view="yz" values="yz">yz (lat/depth) slice</ifitem>
    <ifitem view="yt" values="yt">yt (lat/time) slice</ifitem>
    <ifitem view="zt" values="zt">zt (depth/time) slice</ifitem>
</menu>
```

Customize views

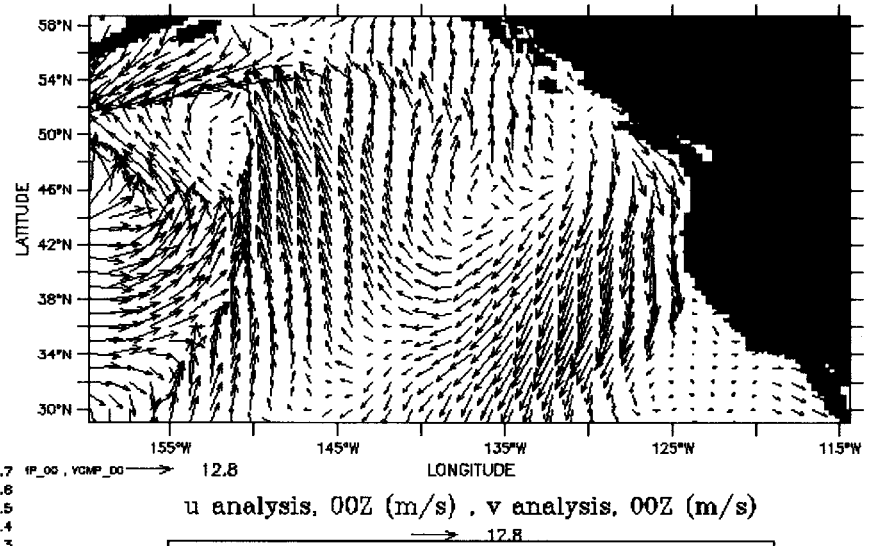
```
<image name="Image_Pacific" url="gifs/region.jpg" bounds="190,252,29,60"/>
<map type="livemap" name="Regions_Pacific">
        <image href="#Image_Pacific"/>
        <menu href="#Regions_Pacific"/>
</map>
```

Customize map image

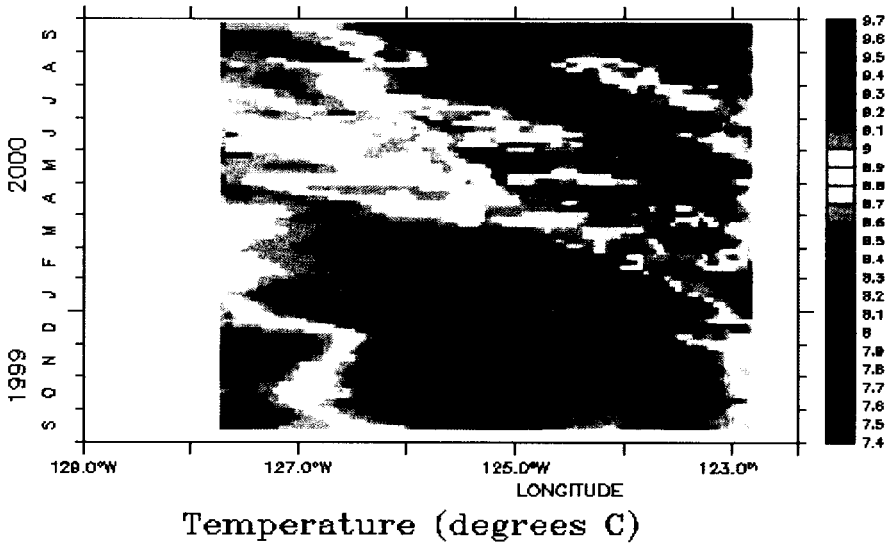
OurOcean Visualization Tools

- Ferret as default visualization tool

  2D plots of large 4D gridded data sets.
  - Shaded plots
  - Contour maps
  - Vector plots
  - Land shade



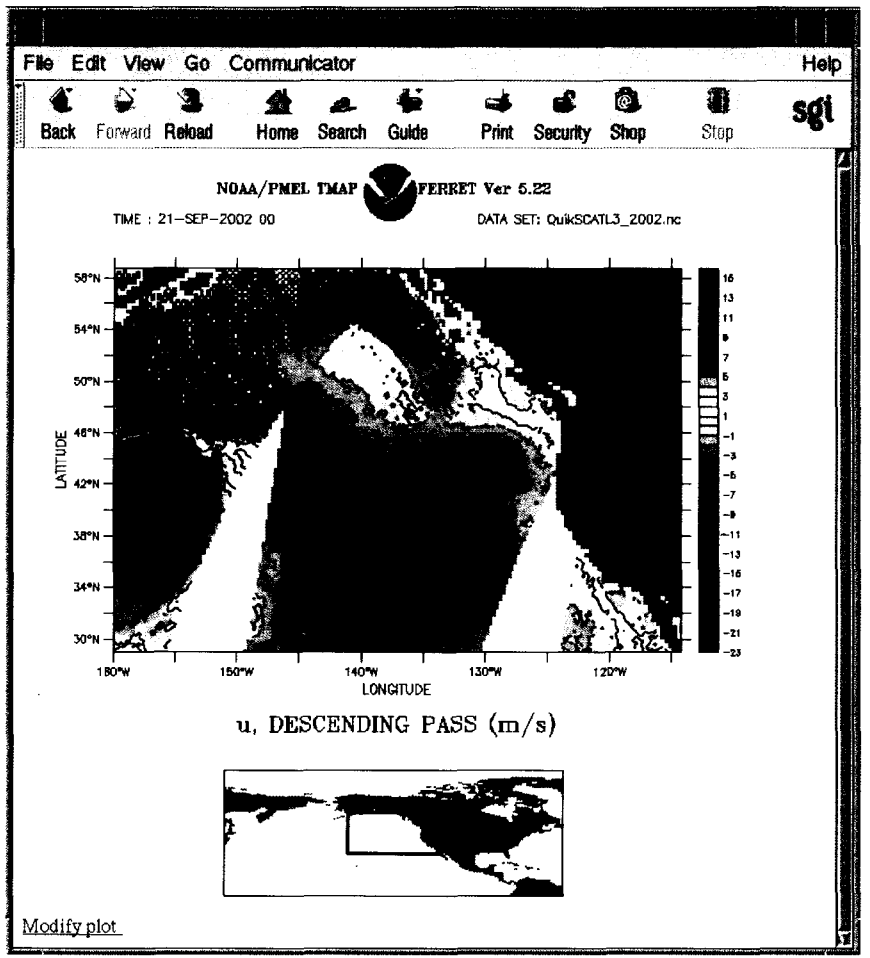
Wind vector plot from COAMPS



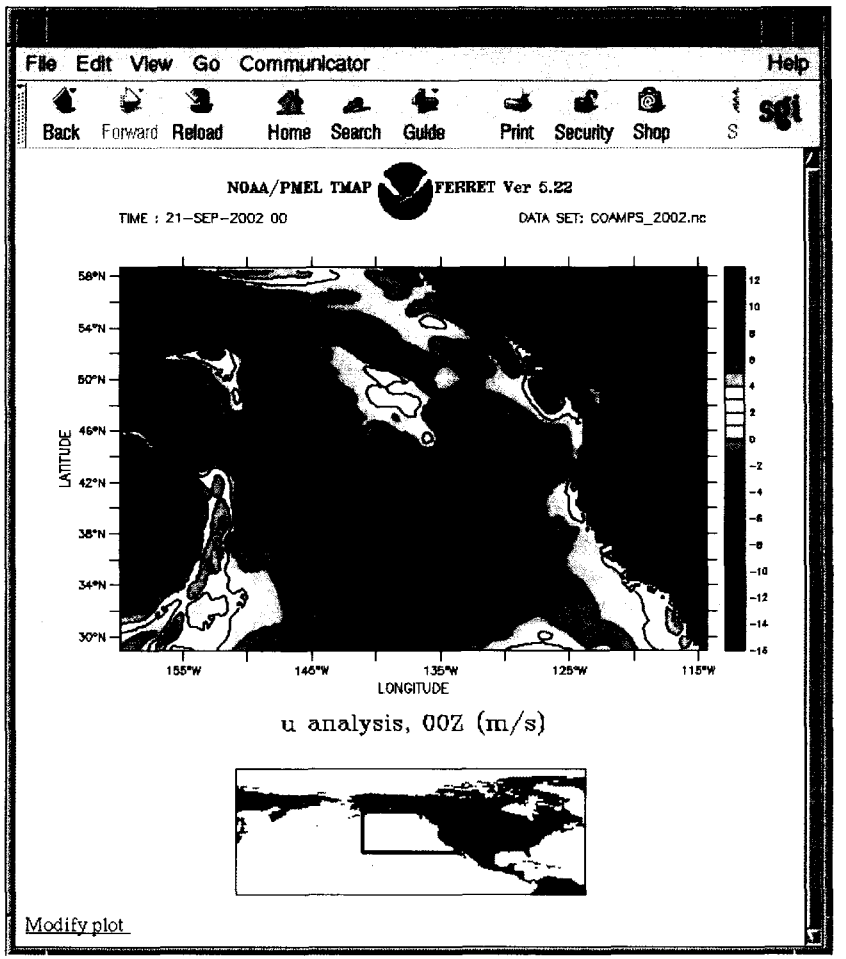
The temperature profile from 9/99 –9/00 at 37.5° latitude, Data generated from a ROMS 3D model

- Customized visualization tools such as MatLab, IDL or other 3D vis. tools can be added.
- Capable of plotting compound variables (vectors) or difference of any two variables
- XML definition for plotting options

OurOcean Data Products

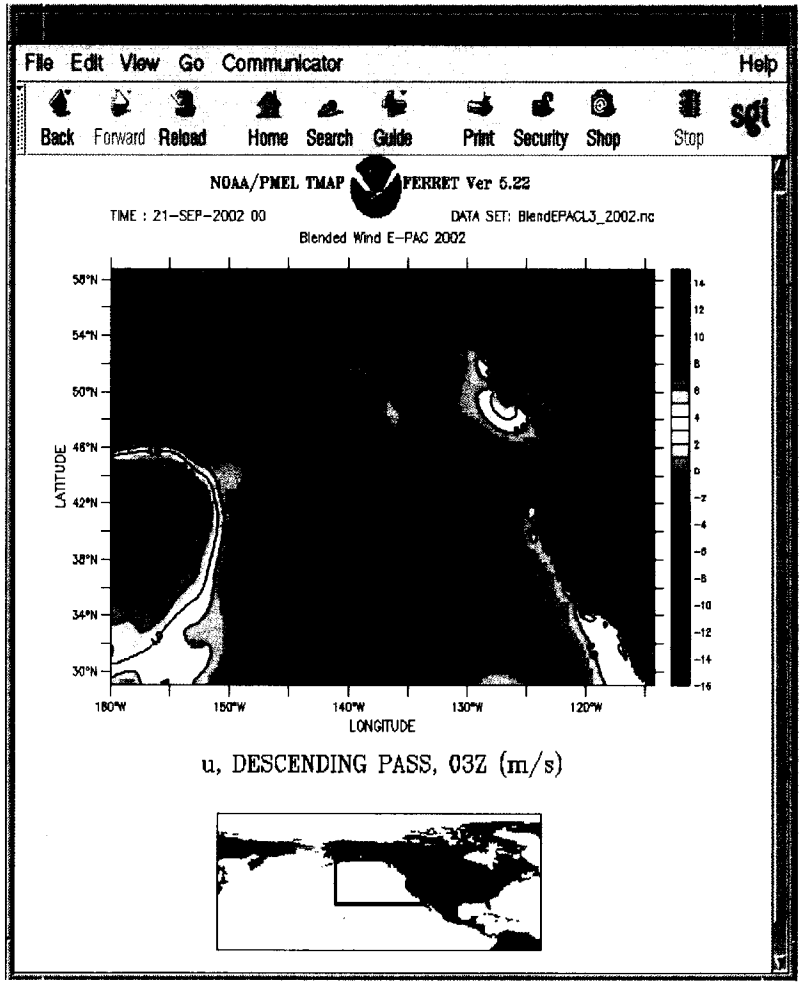


The QuikSCAT wind, u component, descending pass, 9/21/2002

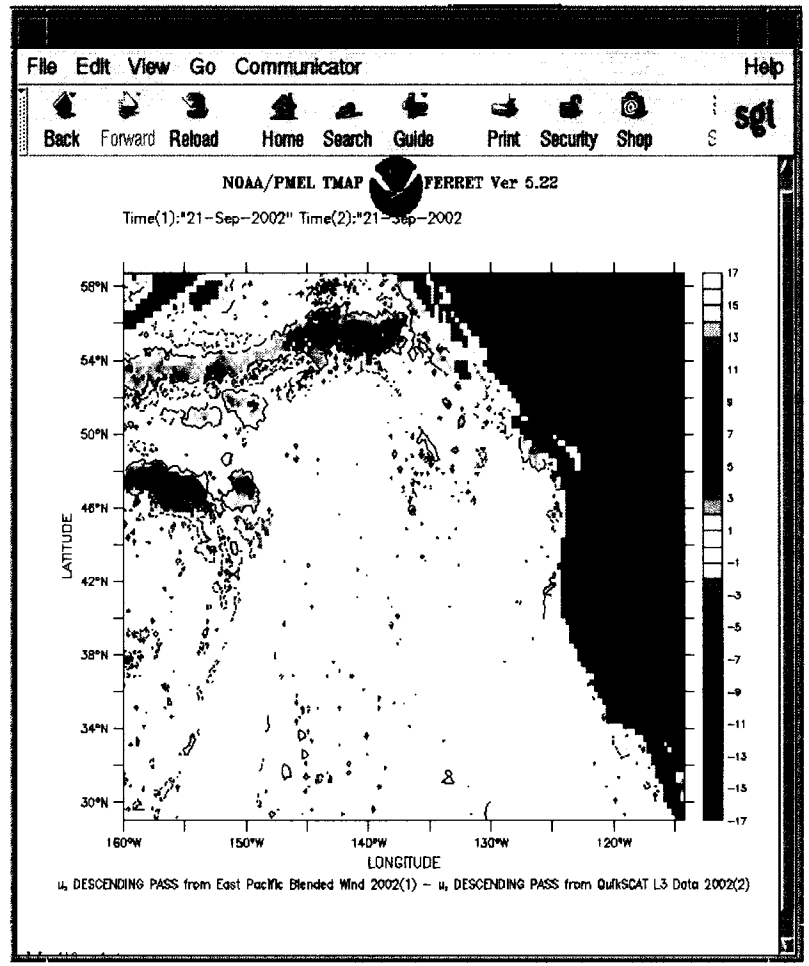


The COAMPS wind, u analysis data at 00h, 9/21/2002

OurOcean Data Products (cont.)



The blended wind data, u component, descending pass, 9/21/2002

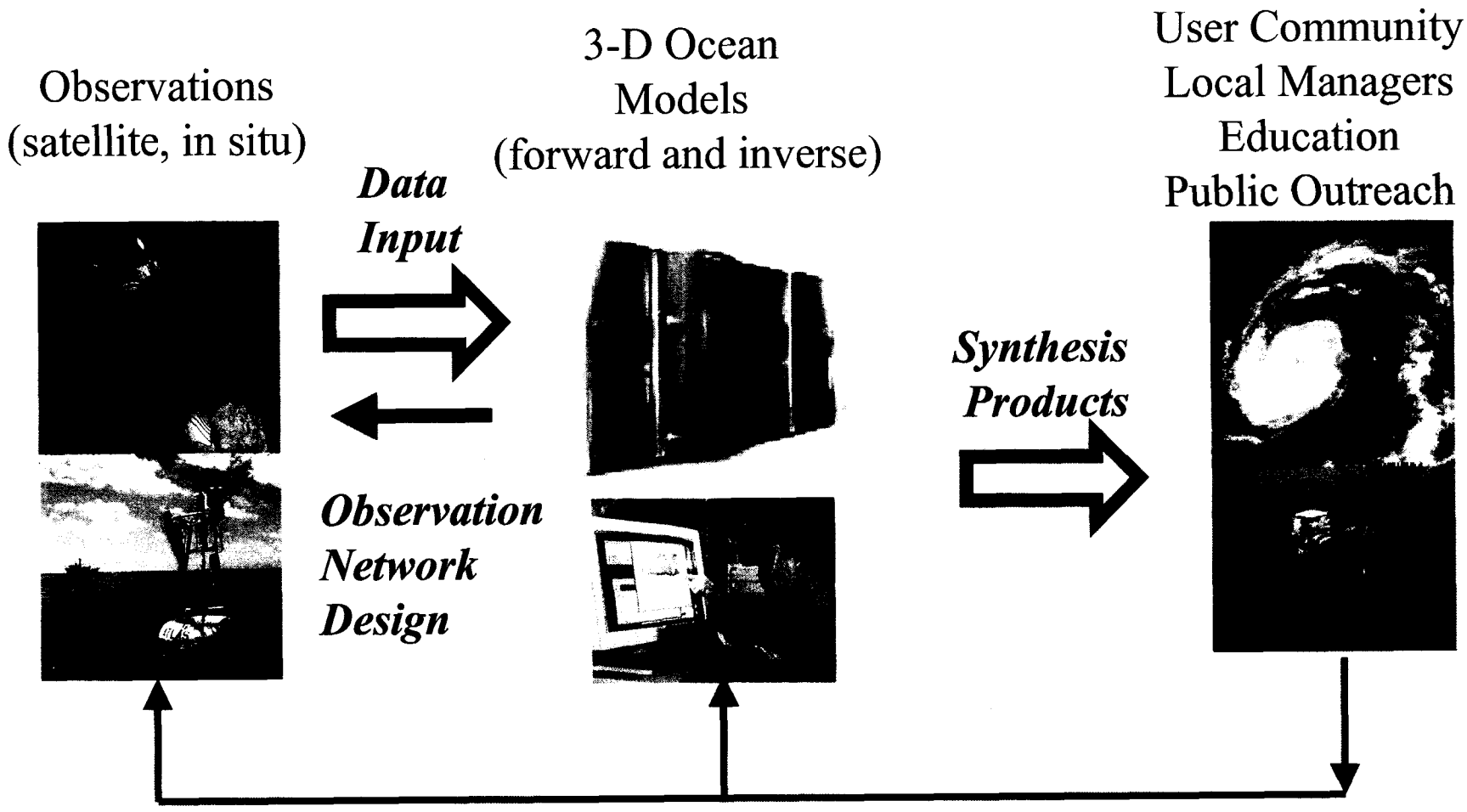


The comparison of the blended wind and the QuikSCAT data, u component, 9/21/2002

Status & Future Direction

- *OurOcean* is serving 3 real time datasets (QuikSCAT, COAMPS, Blended Wind) and 3 ROMS datasets covering different regions (Atlantic, Central California Coastal and Pacific)
- *OurOcean* is currently open to selected collaborators outside JPL, will go public in December.
- Future plans:
  - Run East Pacific Coastal ROMS model on SGI Origin 2000 daily with the blended wind data as input, serve real time ROMS data on *OurOcean*
  - Add customized 3D visualization tool to *OurOcean*

An End-to-End Ocean Forecasting System Integrating Observations, Model and Users



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