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Technical Note

WAVEWATCH III® Hindcasts with Re-analysis winds[†]. Initial report on model setup

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This report contains the setup that we have developed to undertake a wave hindcast study using the WAVEWATCH III® model. This model will be run with the new NCEP Climate Forecast System Reanalysis Reforecast (CFSRR) 30-year homogeneous data set of hourly $1/2°$ spatial resolution winds, to generate a wave climatology. This report contains detailed information on the grids that have been developed, the products that are going to be generated and some initial validation results.

Acknowledgments. The author thanks Henrique Alves, Roberto Padilla and Andre Van der Westhuysen for comments on early drafts of this manuscript. The present study was made possible by funding from the NOAA High Performance Computing and Communication (HPCC) office.

This report is available as a pdf file from:

http://polar.ncep.noaa.gov/waves

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1 Introduction

A long-term global wave database is very useful to build wave climatologies, do scenario studies as well as undertake model validation analysis across multiple time scales. The wave modeling group at the National Center for Environmental Prediction (NCEP) maintains a wave hindcast database that extends from 1999 to the present. This database uses the archived analysis winds from the GFS atmospheric model to drive the waves. However, this database is inconsistent in the sense that all the numerical and physical upgrades to the models (both wave and atmosphere) are tied in with the variability in the underlying physics. This can be countered by doing a reanalysis so that the same model can be used to build a consistent multi-decadal database.

There is not enough available data to develop a traditional re-analysis of the wave environment. Furthermore, wave dynamics are different from atmospheric dynamics in the sense that they are more of a boundary value problem than an initial value problem, with the wind forcing being the most dominant process driving wave dynamics. It is more useful to do a hindcast re-run using a reanalysis wind field. However, till now the reanalysis winds developed at NCEP were on too coarse a grid to allow for the development of a meaningful wave hindcast database.

A new NCEP Climate Forecast System Reanalysis Reforecast (CFSRR) system has been recently developed and entails a coupled reanalysis of the atmospheric, oceanic, sea-ice and land data from late 1979 through 2010, and a reforecast run with this reanalysis (Saha et al., 2010). This reanalysis has much higher horizontal and vertical resolution of the atmosphere than the Global and the North American Reanalysis, and can thus be used to develop a long-term hindcast wave database.

The wave model used at NCEP is a third generation wind wave model WAVEWATCH III® (Tolman, 2009). In 2007, the model was expanded to run as a mosaic of two–way nested grids (Tolman, 2008). The nested grid driver is described in Tolman (2007a,b), and the grid generation tools used to develop these grids are described in Chawla and Tolman (2007, 2008). To drive the waves the wave model requires two input fields: ice and winds (including the air-sea temperature difference). The high resolution winds used here are 10m above sea level on an hourly temporal and 1/2° spatial resolution which cover the globe from 90°S–90°N. The reanalysis daily ice concentration fields are 1/2° spatial resolution, and are derived from passive microwave from the SMMR and SSMI using the NASA Team algorithm. A companion report (Spindler et al., 2011) takes a closer look at the CFSRR winds that are used in the development of this wave database.

This hindcast database is foreseen to be developed in three stages. In the first stage, the wave model shall be run (for the 30 year hindcast period from

1979 to 2009) using the same physics packages that are currently used in NCEP operations (with minor exceptions these are also the default settings described in Tolman (2009)). This will set the baseline for the wave model. The database will be regenerated in stage 2 and 3 with newer physics packages as they become available, courtesy of a concurrent NOPP initiative to improve physics in operational wind wave models. However, the model setup and products will remain unchanged at the different stages[1]. The mosaic approach to wave modeling in WAVEWATCH III allows us to develop a detailed modeling system with high resolution grids in areas of interest.

The purpose of this report is to outline the model setup and different products that are going to be generated as part of this database and some initial results. In section 2 we outline the grids that have been developed for this database (with further details in appendix B), the physics packages used at this stage are outlined in section 3, the types of output products are listed in section 4, and some initial validation results are shown in section 5.

[1]This may change depending on developments in model capability and/or database generation

2 Grids

The WAVEWATCH III model can be run as a mosaic of grids with two–way interaction between the higher and lower resolution grids. This facilitates increased computational efficiencies by restricting the higher resolution grids only in the necessary areas.

Keeping in mind the requirements of our collaborative partners, a set of nested grids was produced for the Global Ocean. In all the grids, the full resolution ETOPO1 bathymetry was used as the reference grid. Three files were created for each grid: a bathymetry, a mask, and an obstruction grid which accounts for wave attenuation by unresolved islands. See Chawla and Tolman (2007, 2008) for details on the software used for developing these grids.

Grids of three different resolutions were generated: low resolution (1/2 ° or 30 arc-minutes), mid resolution (1/6° or 10 arc-minutes), and high resolution (1/15° or 4 arc-minutes). The grid generation software that has been used to develop these grids provides the flexibility of closing some coastal features that can only be resolved in high resolution grids (e.g. bays, harbors, estuaries etc.). Appendix A provides a list of the water bodies that can be closed. With the exception of the Bay of Fundy and Cook Inlet, only in the high resolution grids were these coastal features kept open. Figures 2.1– 2.3 show the outlines of the intermediate and high resolution grids, along with the masked areas.

The lowest resolution grids are the 30 arc-minute grids and cover the entire globe (in longitude). In this current implementation, we are using regular spherical grids[2] and as a result, model time steps are limited by the CFL limit near the poles. For increased efficiency, the global domain was divided into three "bands" (see Table 2.1). These three grids are primarily used for computation purposes, and the output from these grids is stored in a single global grid (referred to as **glo_30m**).

Table 2.1: 30 arc-minute grids: range and resolution. All output data associated with a particular grid are identified by their grid labels.

Name	Grid label	Latitude	Longitude	Resolution (lat x lon)
Global	glo_30m	$90°S : 90°N$	$180°E : 180°W$	1/2° x 1/2°
Arctic	ao_30m	$55°N : 90°N$	$180°E : 180°W$	1/2° x 1/2°
Mid-Globe	mid_30m	$65°S : 65°N$	$180°E : 180°W$	1/2° x 1/2°
Antarctic	ac_30m	$90°S : 55°S$	$180°E : 180°W$	1/2° x 1/2°

[2] both an unstructured and a curvilinear grid version of the model is currently under development and depending upon progress may be involved in the later stages of the database development

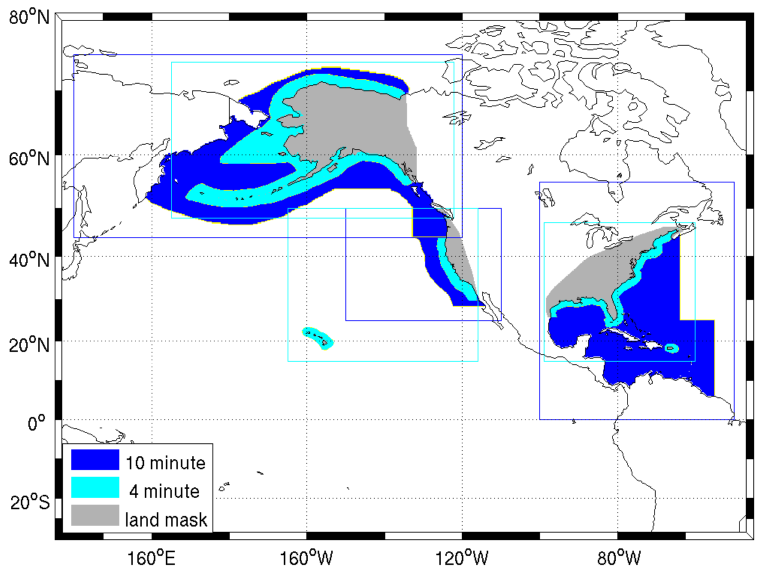

Fig. 2.1 : East and West Coasts of USA, Alaska, and Hawaii Grids

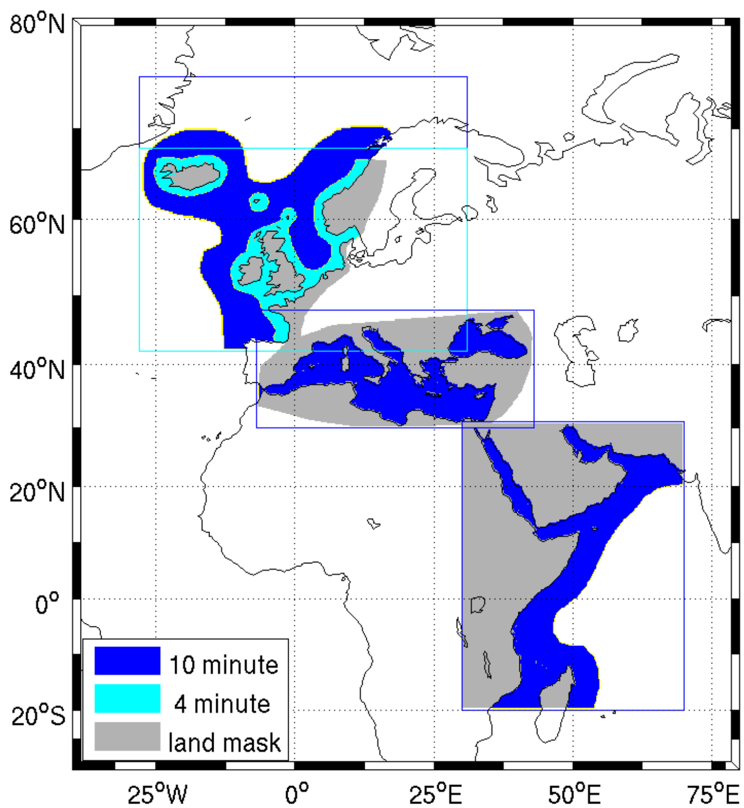

Fig. 2.2 : North Sea / Baltic, Mediterranean, and NW Indian Ocean Grids

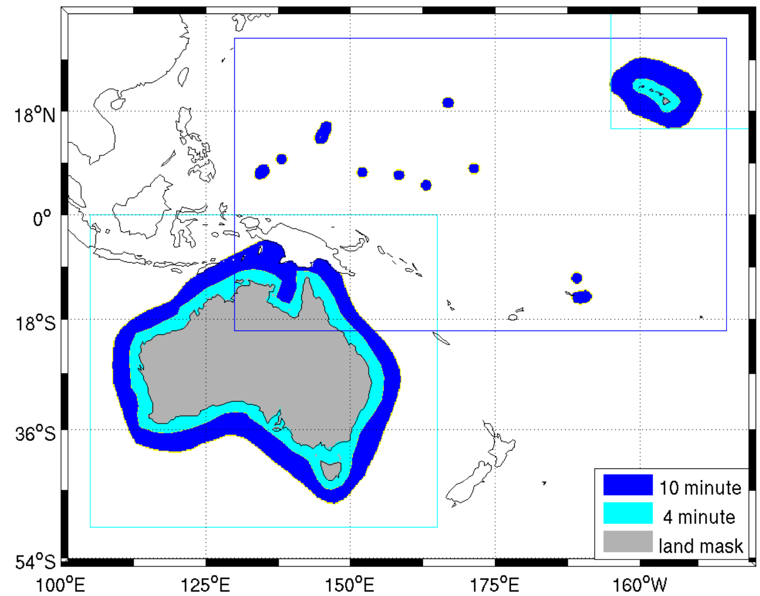

Fig. 2.3 : Australia, Pacific Islands, and West Coast US (Hawaii 4 min) Grids

To avoid the singularity at the poles, all grid points beyond $82°N$ in the Arctic grid are marked as inactive. This is not an issue in the Antarctic grid because of land.

Nested inside the low resolution grids are the intermediate grids, which have been masked so that the only active points are those within approximately 250 nautical miles from shore. See Table 2.2 for details on the individual grids. Note that in the Alaska 10 arc-minute grid, Cook Inlet is open (see Figure B.3 in Appendix B). In this resolution, Hawaii is part of the Pacific Islands grids.

The highest resolution grids are the 4 arc-minute coastal grids, masked so that the only active points are those within approximately 100 km of shore. In this resolution, Hawaii is part of the West Coast US grid. Since these grids can be computationally very expensive, they have been limited to regions of highest priority. See Table 2.3 for the details on the individual grids.

Overall, we have separated the global domain into sixteen computational grids (Fig. 2.4) with the time step particulars given in Table 2.4. Detailed maps of these grids can be seen in appendix B. The wave model uses four different time steps internally for each grid, all of which are pre-defined in the grid setup and have been outlined. Keep in mind that the wave model uses a dynamic time step for source term integration and the time step in Table 2.4 is the minimum time step allowed in the model. A discussion on the meaning of the different time steps is beyond the scope of this report and the readers are referred to the manual (Tolman, 2009) for more details. All the raw output from the wave model is generated at these sixteen different grids. For practical reasons, the gridded

Table 2.2: 10-minute grids: range and resolution.Note that in the higher latitude grids of Alaska and the North Sea, the longitude resolution has been increased to maintain the same resolution in rectilinear coordinates.

Name	Grid label	Latitude	Longitude	Resolution (lat x lon)
East Coast US	ecg_10m	$0°N : 55°N$	$100°W : 50°W$	1/6° x 1/6°
West Coast US	wc_10m	$25°N : 50°N$	$150°W : 110°W$	1/6° x 1/6°
Alaska	ak_10m	$44°N : 75°N$	$140°E : 120°W$	1/6° x 1/4°
Pacific Isl.	pi_10m	$20°S : 30°N$	$130°E : 145°W$	1/6° x 1/6°
Australia	oz_10m	$50°S : 0°N$	$105°E : 165°E$	1/6° x 1/6°
North Sea	nsb_10m	$42°N : 75°N$	$28°W : 31°E$	1/6° x 1/4°
Mediterranean	med_10m	$30°S : 48°N$	$7°W : 43°E$	1/6° x 1/6°
NW Indian O.	nwio_10m	$20°S : 31°N$	$30°E : 70°E$	1/6° x 1/6°

Table 2.3: 4 arc-minute grids: range and resolution.

Name	Grid label	Latitude	Longitude	Resolution (lat x lon)
East Coast US	ecg_4m	$15°N : 47°N$	$101°W : 60°W$	1/15° x 1/15°
West Coast US	wc_4m	$15°N : 50°N$	$165°W : 116°W$	1/15° x 1/15°
Alaska	ak_4m	$48°N : 74°N$	$165°E : 122°W$	1/15° x 2/15°
Australia	oz_4m	$50°S : 0°N$	$105°E : 165°E$	1/15° x 1/15°
North Sea	nsb_4m	$42°N : 68°N$	$28°W : 31°E$	1/15° x 2/15°

output from the three 30 arc-minute computational grids are combined into a single global grid identified in Table 2.1, yielding fourteen output grids.

Table 2.4: Grid Time steps. All the times are in seconds.

Grid label	Global	Spatial	Intra-spectral	Source term
ao_30m	900	300	450	30
mid_30m	1800	900	900	30
ac_30m	900	300	450	30
ak_10m	900	375	450	30
wc_10m	900	450	450	30
pi_10m	900	625	450	30
ecg_10m	900	414	450	30
med_10m	900	485	450	30
nsb_10m	900	400	450	30
nwio_10m	900	615	450	30
oz_10m	900	450	450	30
ecg_4m	450	195	225	15
wc_4m	450	185	225	15
ak_4m	450	160	225	15
oz_4m	450	185	225	15
nsb_4m	450	215	225	15

The spectral domain has been divided into 50 frequency and 36 directional bins (directional resolution of 10°). The minimum frequency has been set at 0.035 Hz and the frequency increment factor has been set at 1.07, providing a frequency range of 0.035–0.963. A parametric tail is fitted beyond the highest computed frequency.

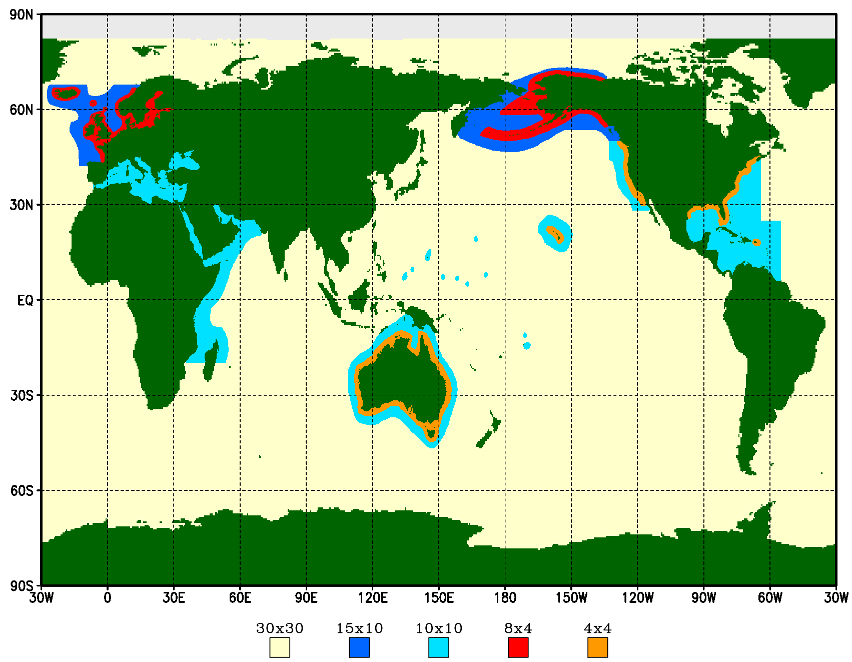

Fig. 2.4 : Global domain. Grid resolution given in arc-minutes.

3 Physics packages

In WAVEWATCH III the packages used are defined by switches during the compile stage of the wave model(Tolman, 2009). The switches that are being used at this stage of the database development are as follows:

- **NCEP2:** NCEP GRIB2 package for IBM (being used in generating GRIB2 output)
- **LRB4:** 4 Byte words (this is the record length in direct access files)
- **LLG:** Spherical grid
- **PR3:** ULTIMATE QUICKEST propagation scheme with averaging technique for Garden Sprinkler alleviation
- **FLX3:** Friction velocity from Tolman and Chalikov input with a cap (see manual for details)
- **LN1:** Cavaleri and Malanotte-Rizoli linear growth term with a filter
- **ST2:** Tolman and Chalikov source term package (Tolman and Chalikov, 1996)
- **STAB2:** Stability correction for Tolman and Chalikov package (see manual)
- **NL1:** DIA approximation for non-linear interactions
- **BT1:** JONSWAP bottom friction formulation
- **DB1:** Battjes-Janssen shallow water depth breaking
- **MLIM:** Miche-style shallow water limiter for maximum energy (see manual for details)
- **TR0:** No Triad interactions
- **BS0:** No bottom scattering
- **WNT1:** Linear interpolation of wind in time
- **WNX1:** Linear interpolation of wind speed in space

The key points are, that at this first stage of the database, DIA formulation is used to account for non-linear interactions, shallow water wave breaking is simulated using the Battjes-Janssen formulation and the Tolman-Chalikov source term packages are used for wave generation and dissipation. In later stages of the database development one or more of these packages will be changed.

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4 Products

Two types of output products are generated by the wave model—field output that is produced on the model grid layout and point output that is produced at select locations. For the database runs point output locations have been selected that correspond to known buoy locations as well as additional locations that were specifically requested by our collaborators. In all over two thousand output points have been selected (see appendix C for the full list). The output products generated on the grids are:

- Wind speed and direction as well as bulk spectral parameters—Significant wave height (Hs), Peak period (Tp) and Mean Direction at the peak period (Dp). These are stored in GRIB2 format with separate files for each parameter. Temporal resolution for the GRIB2 data is every 3 hours.

- Spectral partition data at all the grid output points. (Exception being the 30 arc-minute global grids where the output is stored at every other point). Temporal resolution for the partition data is every hour.

The temporal resolution of all products generated at the output points is hourly and the list of products are:

- The complete 2D spectra at each output point.

- Bulk spectral parameters using the WMO format at each output point. This includes the wind speed and direction, significant wave height and peak period.

- Partitioned wave data at the output points.

In the event that the output point is located in more than one grid, the energy spectrum is extracted from the finest grid that the point resides in. Linear interpolation is used to generate the spectrum at the output point from the neighboring grid points in the case that the output location does not correspond to a computational point.

Apart from these two types of products wave output is also generated along the altimeter tracks for later validation. This is done by interpolating in time and space wave parameters (significant wave height and wind speed) from the hourly field output files on to the altimeter tracks The altimeter tracks are obtained from the quality controlled global altimeter data set that is maintained at the French Research Institute for the Exploration of the Sea (IFREMER).

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5 Initial validation

As an initial validation, the model was run from June 2005 through December 2005. The model was started from rest condition in June, and run in month long segments with restart files generated at the end of each run used to start the next month's runs. This is the format that shall be used also for the actual runs.

Some initial validation of the model runs has been done with the NDBC buoy data as well as with IFREMER's altimeter database. In this section results from November 2005 (arbitrarily chosen) have been shown. Results from other months show similar trends.

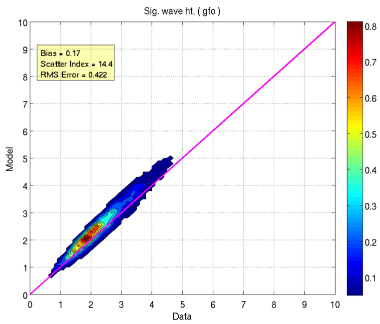
Figure 5.1 shows scatter plots from all the altimeters. Since just a plain scatter plot does not provide enough information on the number of points, a probability density function (PDF) was created by binning model and altimeter data into bins and plotting that distribution (Tolman et al., 2006). The PDF is defined as

$$PDF = \frac{n_{\mathrm{bin}}}{n_{\mathrm{T}} \Delta x \Delta y}$$

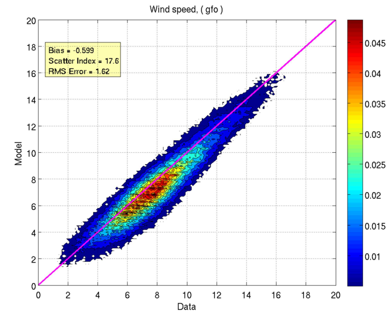
where, n_{bin} are the number of points in the bin, n_{T} are the total number of points, and $\Delta x, \Delta y$ are the bin resolutions for model and altimeter data respectively.

Figure 5.1 shows that in all the altimeters the wave height has a positive bias that increases for higher wave heights and a slightly negative bias for wind speeds. Error maps corresponding to these four different altimeters are shown in Figs. 5.2 to 5.5. Also a map of combined altimeter data was made (Fig 5.6). The maps show that significant part of the biases are along the eastern edges of the ocean basins, corresponding to insufficient dissipation in swell fields in the model. This and the larger biases in the Southern Ocean shall be addressed in the second stage of the wave database.

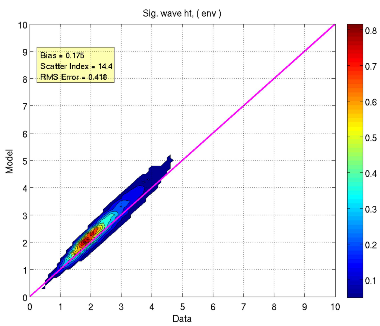
Time series comparisons at some select buoys are also shown in Figs. 5.7–5.13. The presented locations were chosen arbitrarily to correspond to points in the Atlantic Ocean, Pacific Ocean and in the Southern Hemisphere. The biases in the time series reflect what was observed in the error maps in the altimeters.



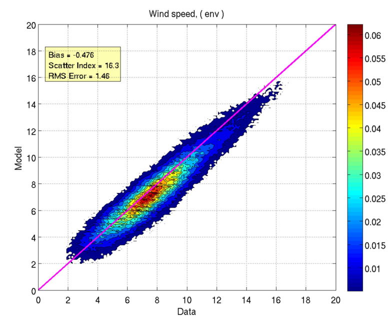
(a) GFO Hs Scatter plot



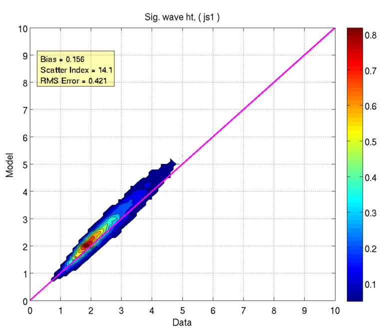
(b) GFO U10 Scatter plot



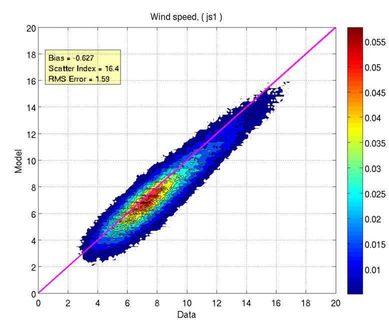
(c) ENVISAT Hs Scatter plot



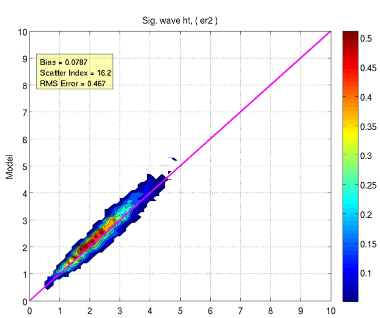
(d) ENVISAT U10 Scatter plot



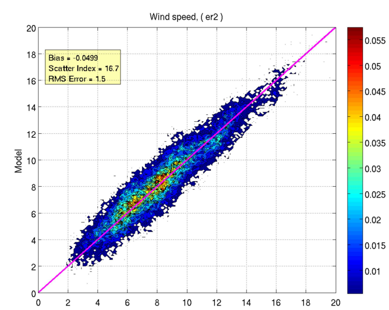
(e) JASON-1 Hs Scatter plot



(f) JASON-1 U10 Scatter plot



(g) ERS2 Hs Scatter plot



(h) ERS2 U10 Scatter plot

Fig. 5.1 : Scatter plot for Significant Wave height and Wind Speed from the several different altimeters for November 2005. Scatter plot was created using PDFs generated by binning the data into 0.1m bins. PDFs less than a cut-off value (0.05 for wave height and 0.005 for wind speed) have not been plotted. Magenta line indicates one to one correspondence between model and data. All values (including the statistics in the yellow boxes) are in m for the wave heights and m/s for wind speeds.

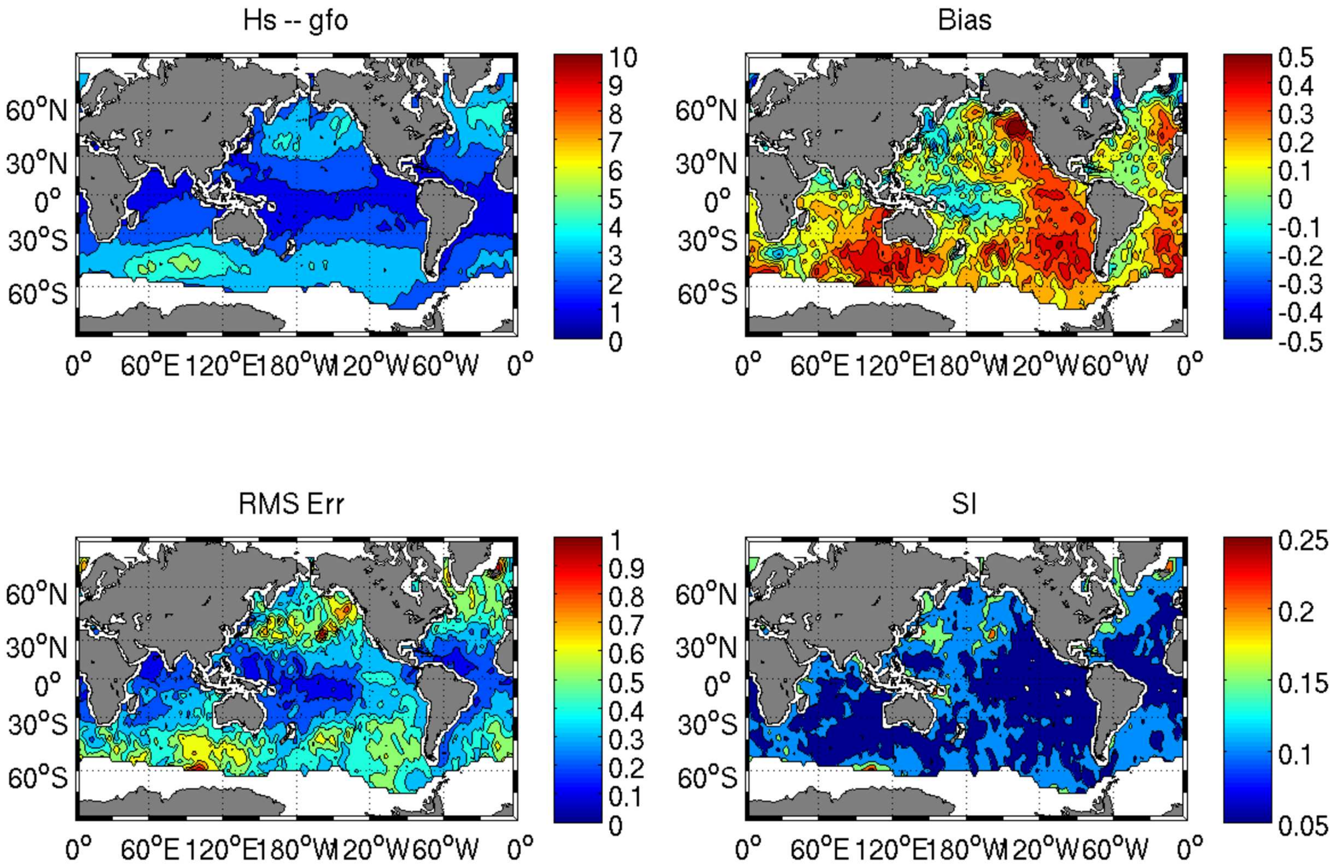


Fig. 5.2 : Error map of Significant wave height from the GFO satellite. To build these maps, model and data wave heights along altimeter tracks are binned into 2° bins. Error statistics have been computed inside each bin and a 3 point running average is done across the longitudes and latitudes to remove track signature. All values are in m (except for SI which is non-dimensional). The H_s map on the top left panel is made with altimeter data.

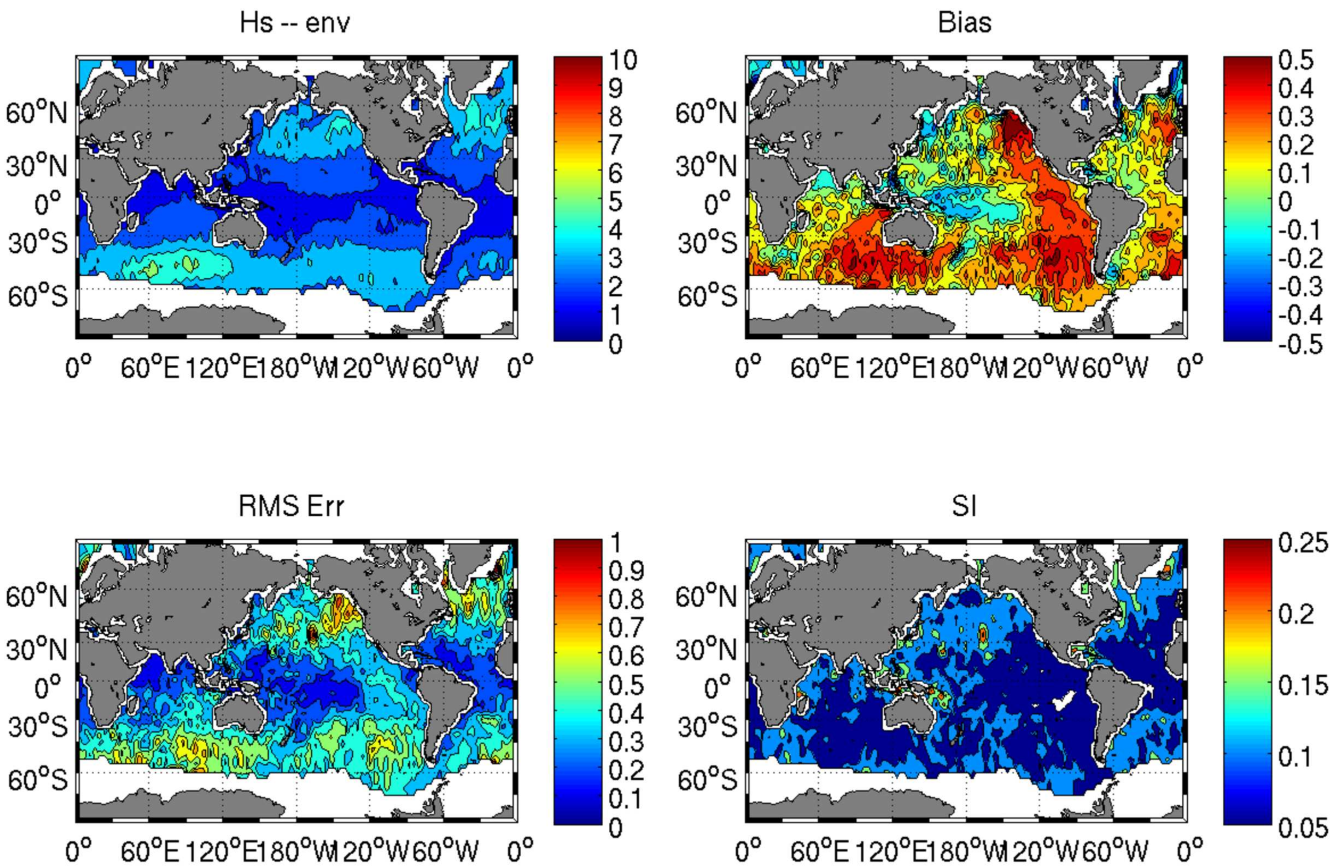


Fig. 5.3 : Idem. Fig 5.2 but from the ENVISAT satellite.

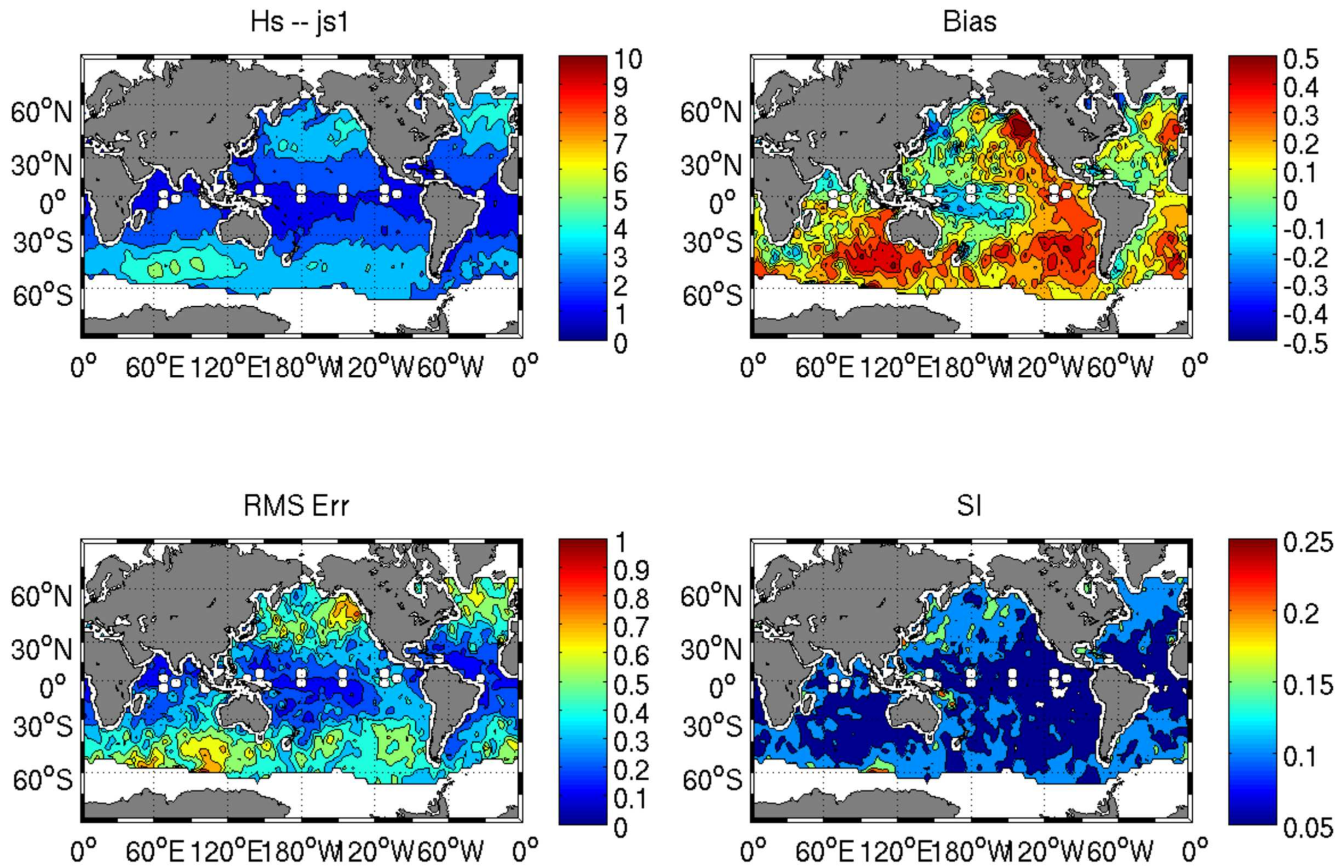


Fig. 5.4 : Idem. Fig 5.2 but from the JASON-1 satellite (white boxes indicate not enough data).

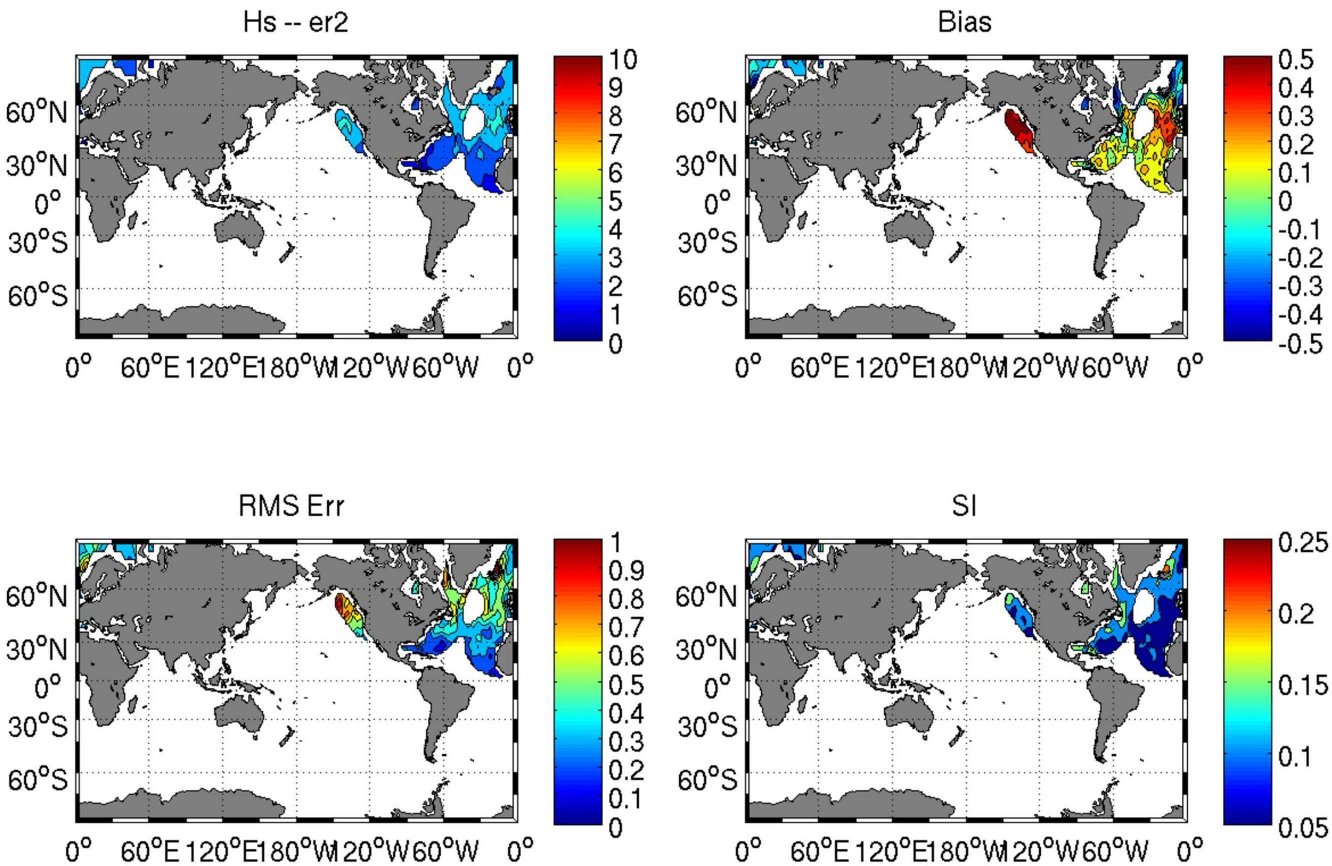


Fig. 5.5 : Idem. Fig 5.2 but from the ERS2 satellite. Note the limited data availability.

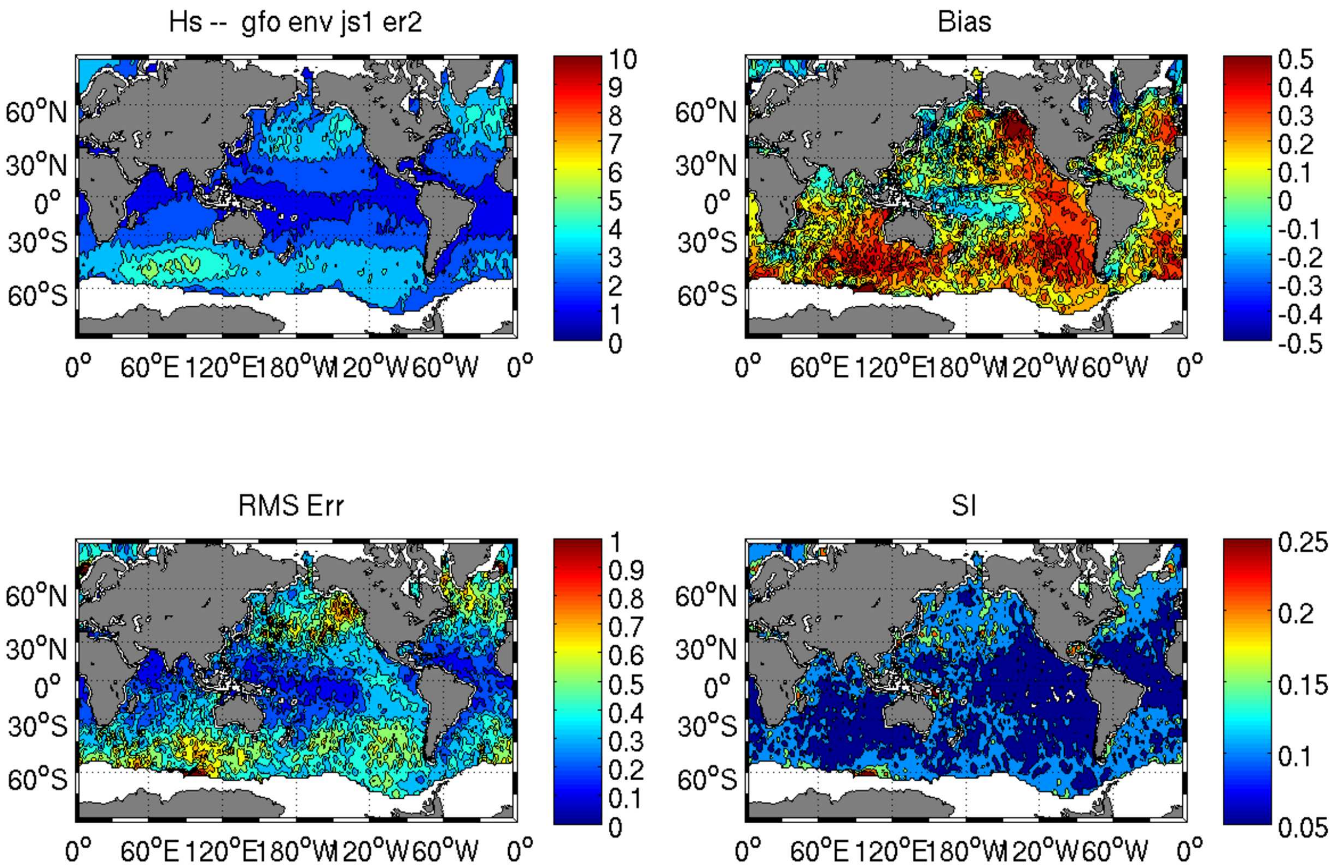
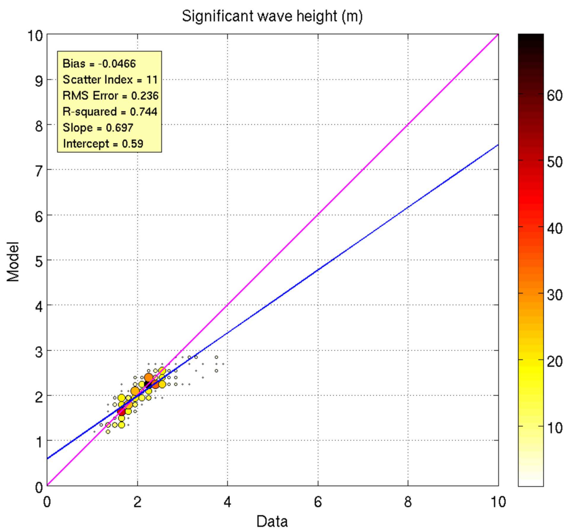
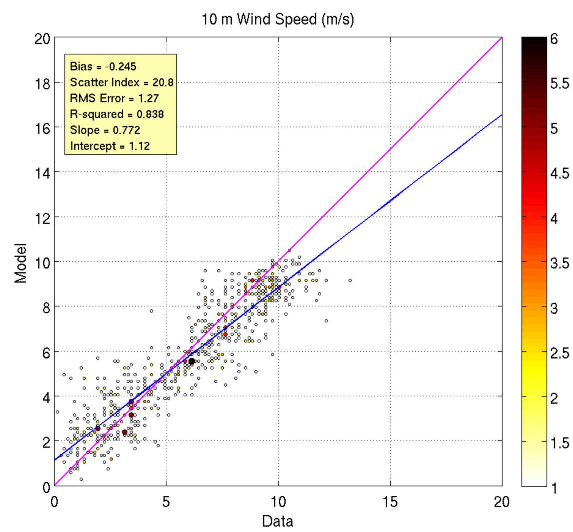


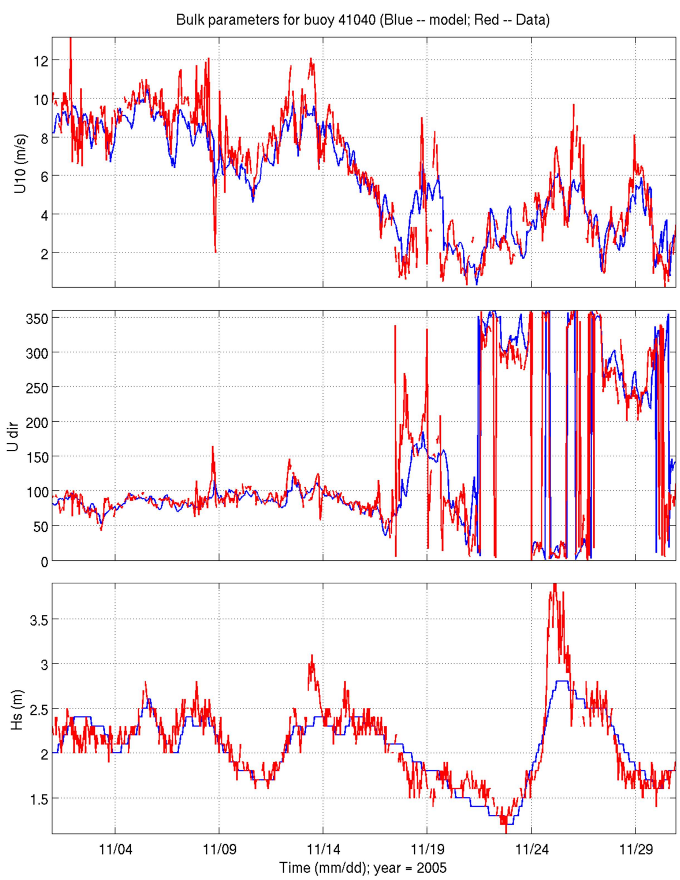
Fig. 5.6 : Idem. Fig 5.2 but for combined altimeter data from all the satellites. Maps for the combined data was made by binning the data in 1° bins (as opposed to 2° bins in the other figures).



(a) Hs Scatter plot

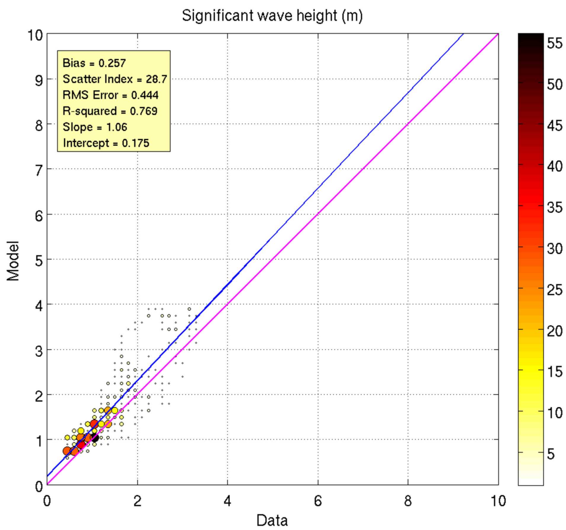


(b) U10 Scatter plot

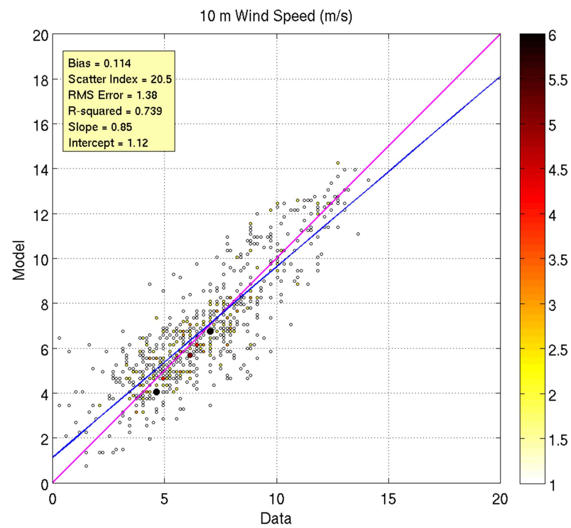


(c) Time Series

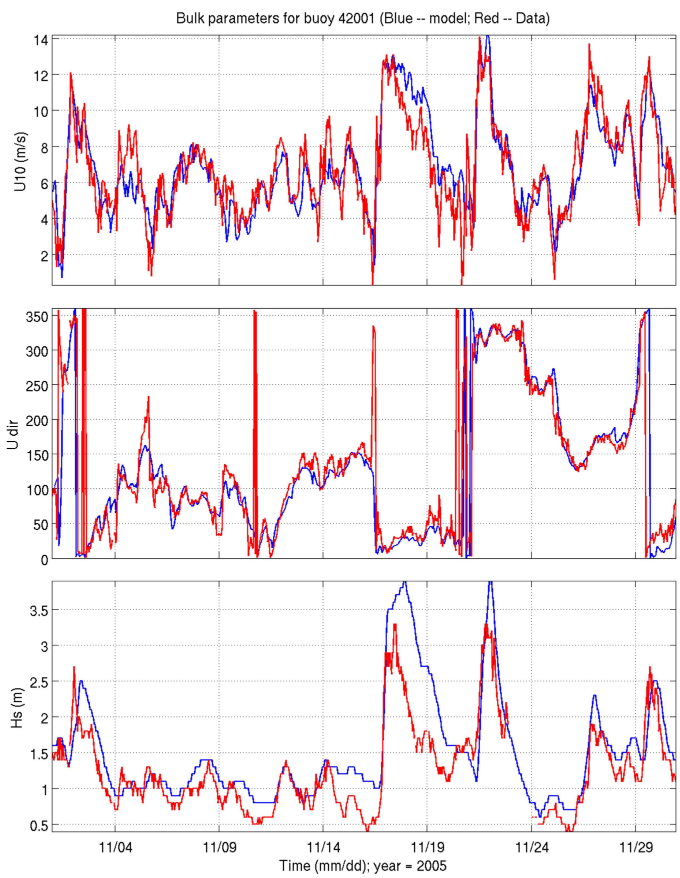
Fig. 5.7 : Model–Data comparison for November 2005 at buoy 41040 located in Western Atlantic Ocean (14.48° N 53° W). In panels (a) and (b) the scatter plots were generated by binning the data in 0.1 m bins. The color bars indicate the number of points that were found in the bins, with the marker size being increased in proportion to the number of points. The magenta line indicates the slope that would be if the model and data were in one to one correspondence and the blue line indicates the actual slope between model and data.



(a) Hs Scatter plot

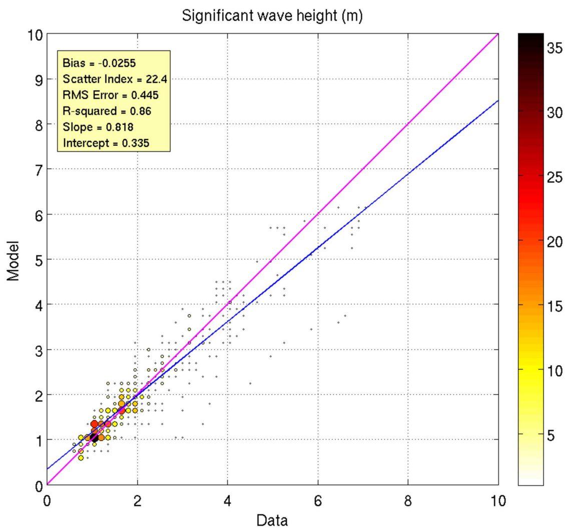


(b) U10 Scatter plot

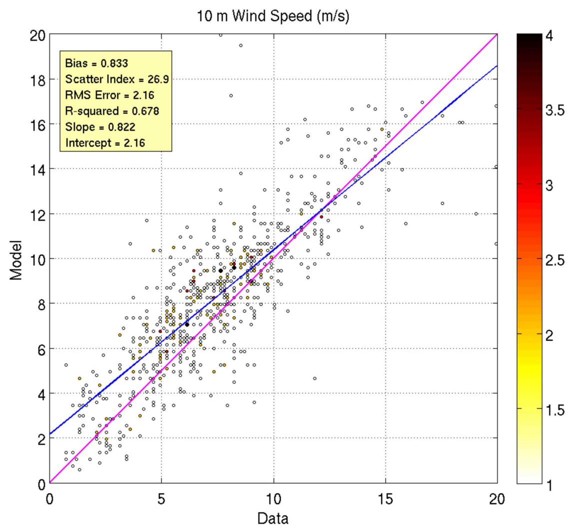


(c) Time Series

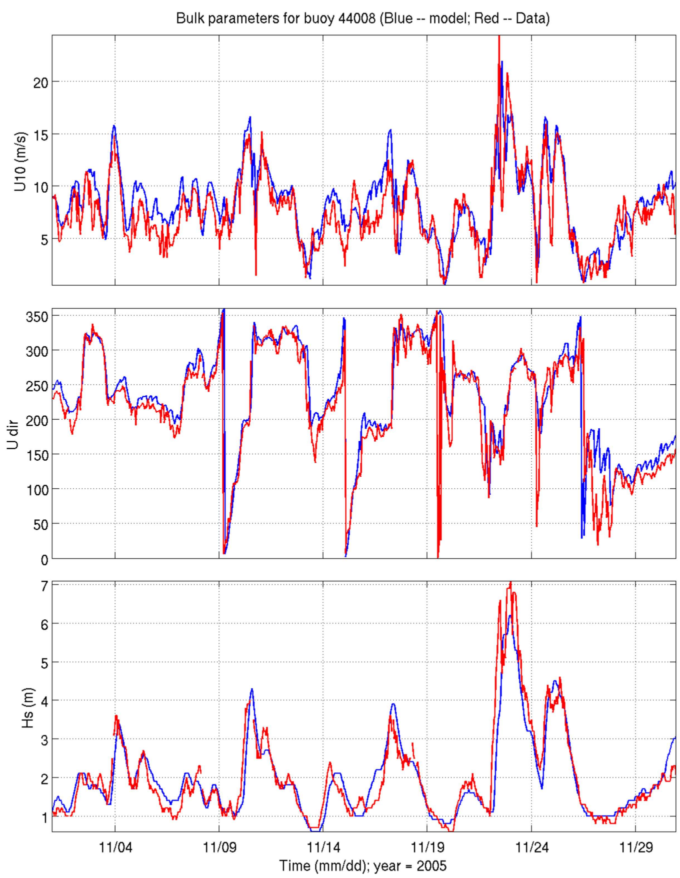
Fig. 5.8 : Idem. Fig 5.7 but at buoy 42001 located in the Gulf of Mexico (25.89° N 89.66° W).



(a) Hs Scatter plot

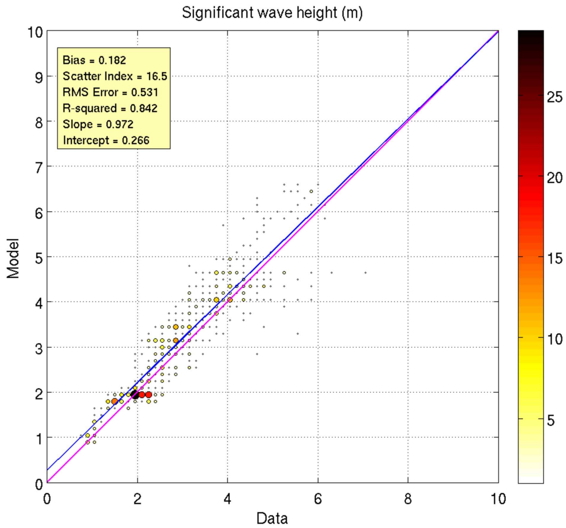


(b) U10 Scatter plot

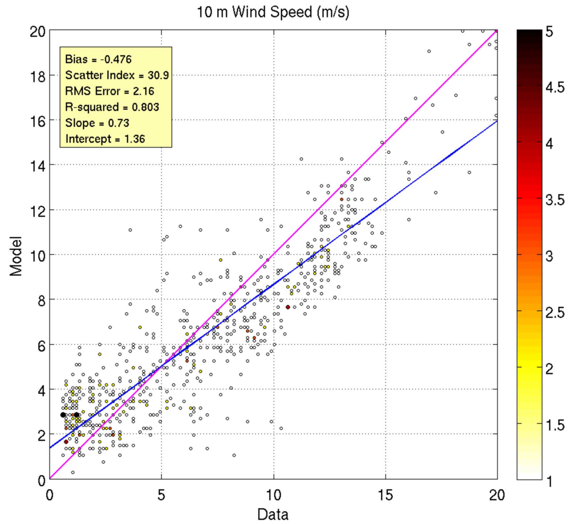


(c) Time Series

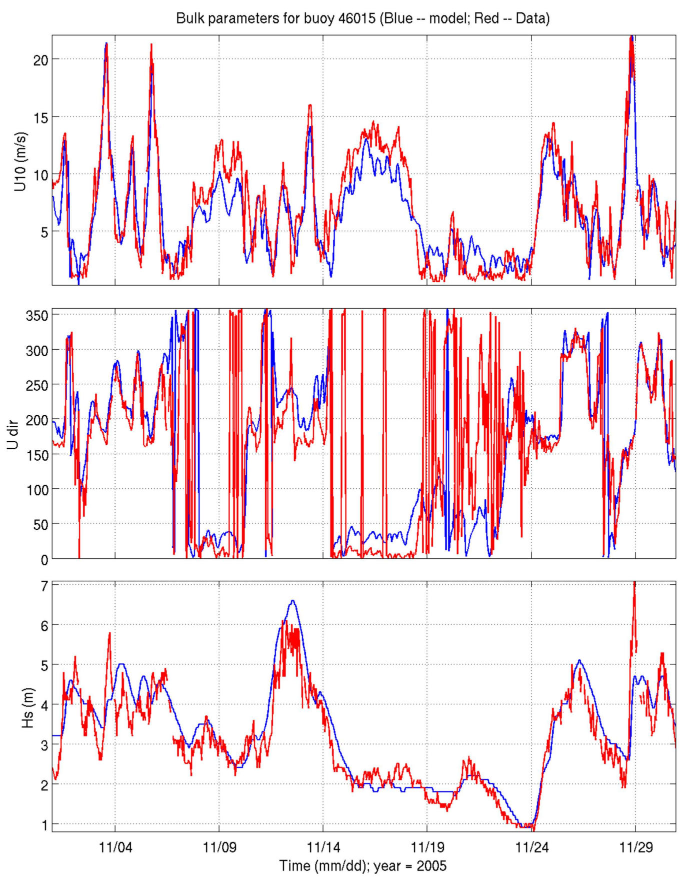
Fig. 5.9 : Idem. Fig 5.7 but at buoy 44008 located South East of Nantucket (40.5° N 69.25° W).



(a) Hs Scatter plot

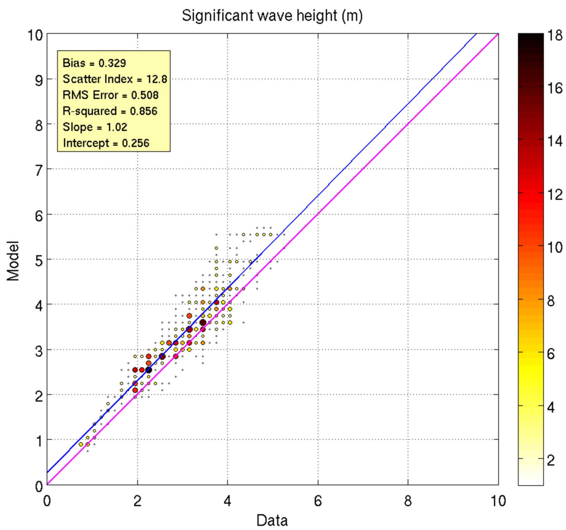


(b) U10 Scatter plot

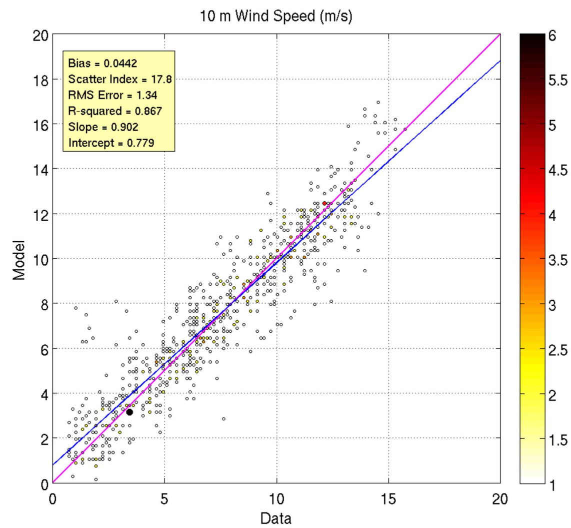


(c) Time Series

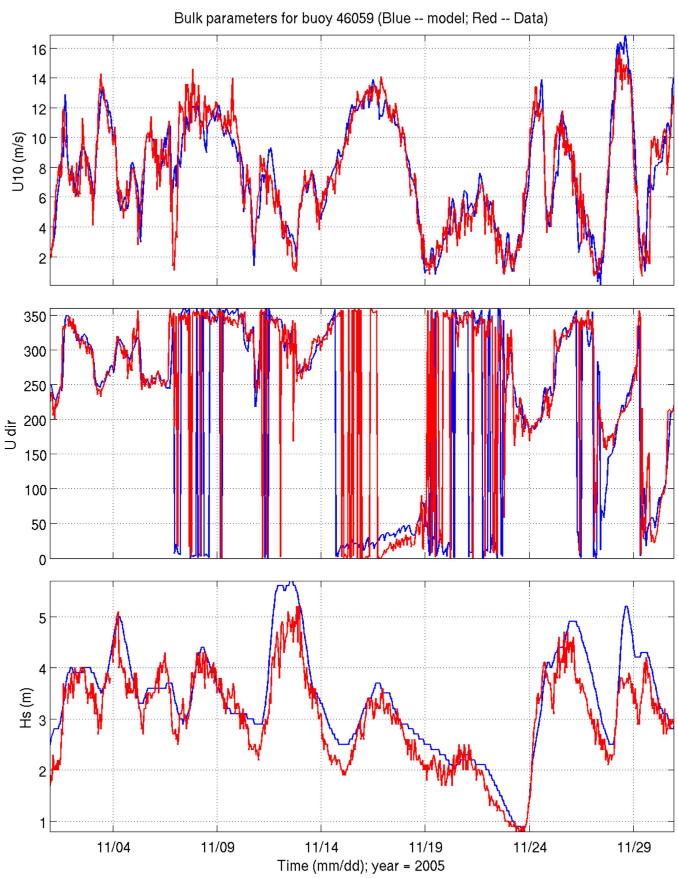
Fig. 5.10 : Idem. Fig 5.7 but at buoy 46015 located West of Port Orford in Oregon in the Pacific Ocean (42.75° N 124.82° W).



(a) Hs Scatter plot

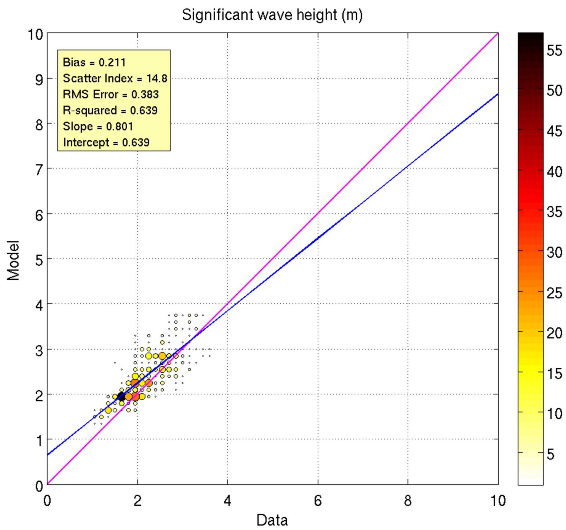


(b) U10 Scatter plot

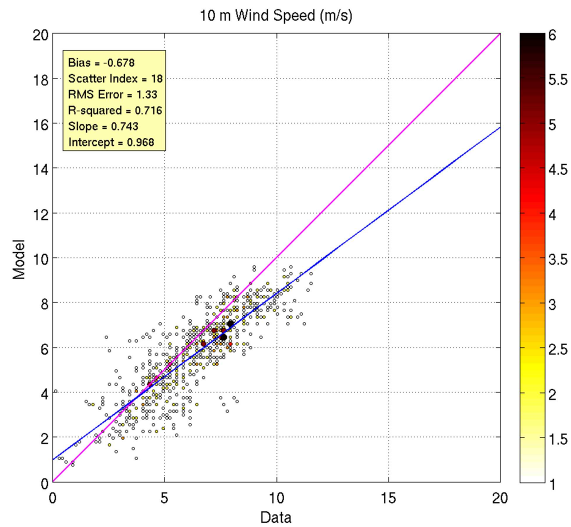


(c) Time Series

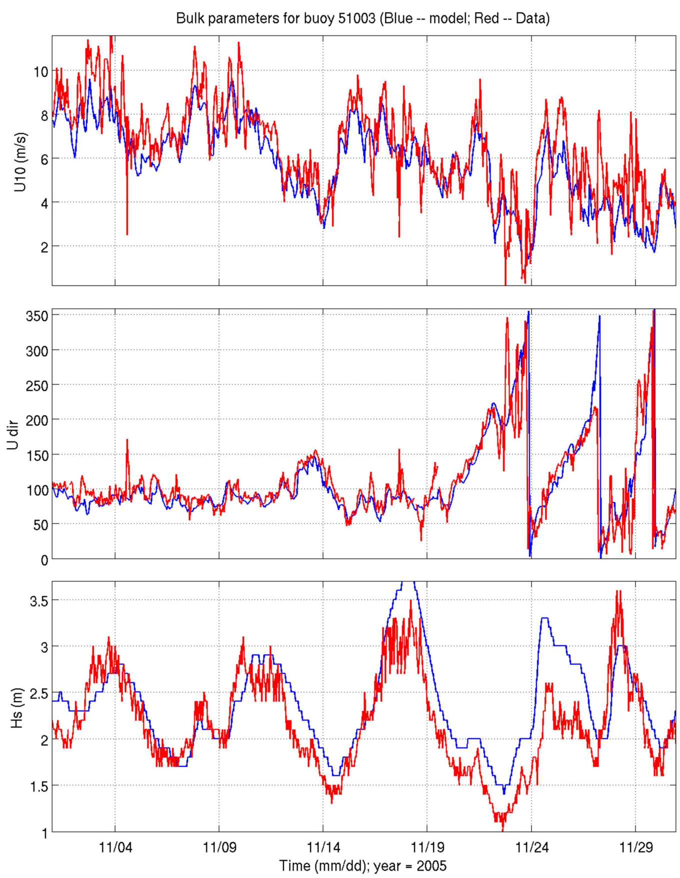
Fig. 5.11 : Idem. Fig 5.7 but at buoy 46059 located West of San Francisco, CA in the Pacific Ocean (38° N 129.97° W).



(a) Hs Scatter plot

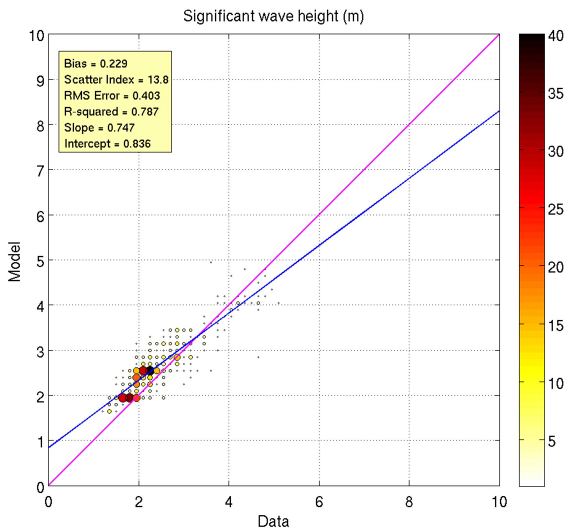


(b) U10 Scatter plot

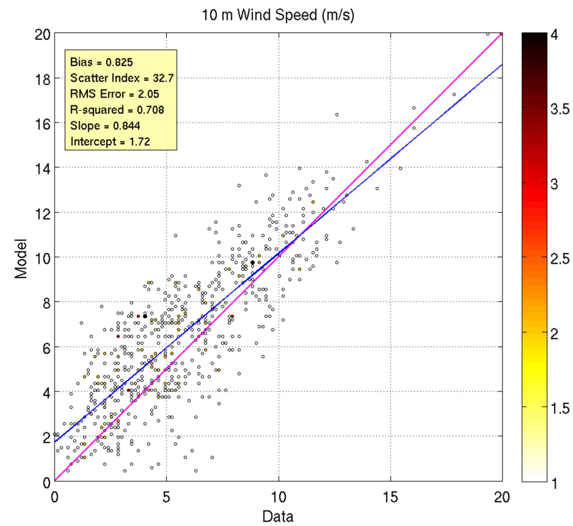


(c) Time Series

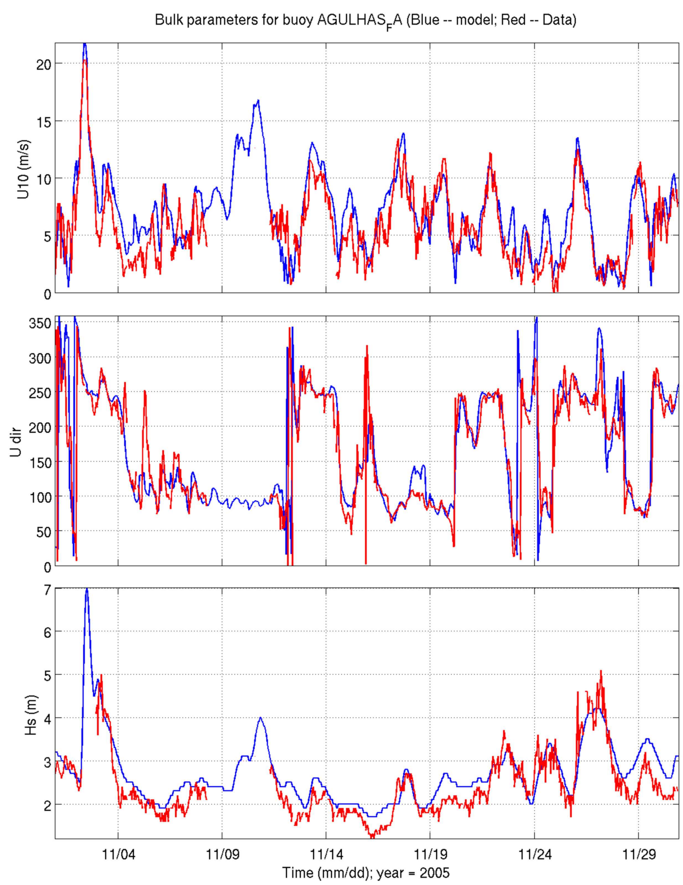
Fig. 5.12 : Idem. Fig 5.7 but at buoy 51003 located South West of Honolulu, HI in the Pacific Ocean (19.35° N 160.62° W).



(a) Hs Scatter plot



(b) U10 Scatter plot



(c) Time Series

Fig. 5.13 : Idem. Fig 5.7 but at station AGULHAS_FA. This station is not a buoy but a downward looking laser sitting on a platform. It is located off of Cape Agulhas in South Africa (34.97° S 22.17° E).

6 Conclusions

This report highlights the setup of the wave model to develop the 30-year hindcast based on the CFSRR reanalysis winds. Grids were designed such that the major water bodies are all well resolved. Higher resolution grids were developed in areas that are of interest to our collaborative partners as well as places where buoy data are available for validation studies. At this stage of the study, we are still limited to using regular spherical grids. This may change for the later stages depending on the progress made in developing alternative numerical algorithms. To make sure that reasonable output is being generated a validation exercise was carried out with output from a short test run. The errors were found to be on the same order as our hindcast validation study based on analysis winds from the GFS model(Chawla et al., 2009). A detailed analysis of the output will be done once the first stage of the database is complete.

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APPENDICES

A Appendix A: Example of user polygons file

```
Hudson Bay
Gulf of St. Lawrence
Mediterranean Sea
Black Sea
Baltic Sea
White Sea
Red Sea
Persian Gulf
Gulf of Aden
Gulf of Oman
Sea of Okhotsk
Sea of Japan
USA East Coast - Long Island Sound
USA East Coast - Delaware Bay
USA East Coast - Atlantic City
USA East Coast - Chesapeake Bay + Ocean City
USA East Coast - Pamlico Sound (Cape Hatteras)
USA East Coast - Cape Canaveral (Florida)
USA Gulf Coast - Charlotte Harbour (Florida)
USA Gulf Coast - Tampa Bay (Florida)
USA Gulf Coast - Panama City (Florida)
USA Gulf Coast - Mobile Bay (Alabama)
USA Gulf Coast - Lake Pontchartrain (New Orleans)
USA Gulf Coast - Grand Isle (New Orleans)
USA Gulf Coast - Sabine Lake (Louisiana)
USA Gulf Coast - Galveston Bay (Texas)
USA Gulf Coast - Padre Island (Texas)
Mexico Gulf Coast - Laguna Madre
Mexico Gulf Coast - Tamiahua
Mexico Gulf Coast - Paso Real (Yukatan)
Mexico Gulf Coast - Belize (Yukatan)
Honduras Gulf Coast - Laguna Caratasca
Nicaragua Gulf Coast
Panama Gulf Coast
Columbia Gulf Coast
Venezuela Gulf Coast - Lago de Maracaibo
Venezuela Gulf Coast - Gulf of Paria
Brazil East Coast - Amazon Delta
Alaska - Cook Inlet
Alaska - Prince William Sound
```

```
Alaska - Yakutat Bay
Alaska - Alexander Archipelago (Chatham Strait, Sitka)
Canada West Coast
US/Canada West Coast - Strait of Juan de Fuca + Puget Sound
US West Coast - Columbia River Estuary
US West Coast - San Francisco Harbor
West Coast - Lake Ojo de Liebre (Baja California)
West Coast - Laguna S. Ignacio (Baja California)
West Coast - Bay of Magdalena (Baja California)
West Coast - Gulf of California (Baja California)
```

B Appendix B: Grids

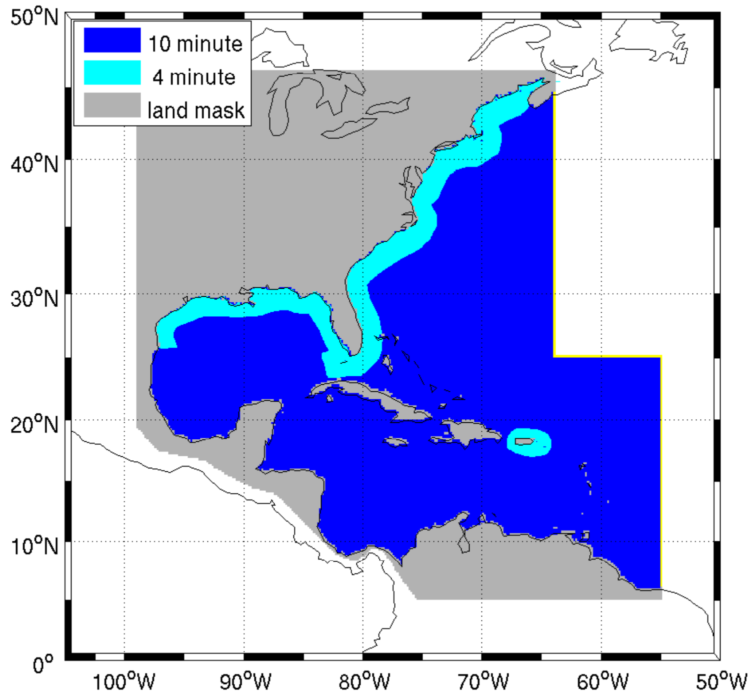

Fig. B.1 : East Coast of USA

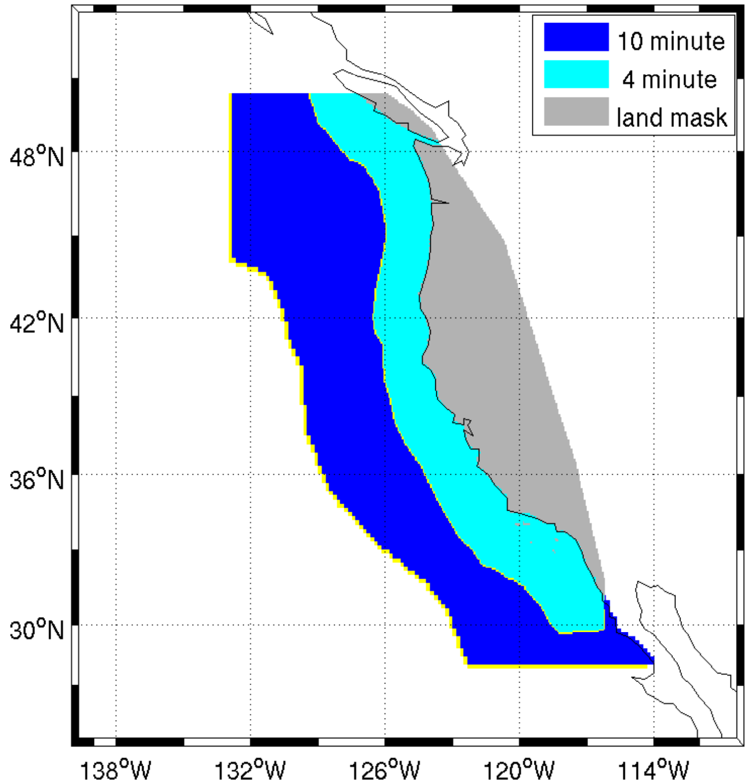

Fig. B.2 : West Coast of USA

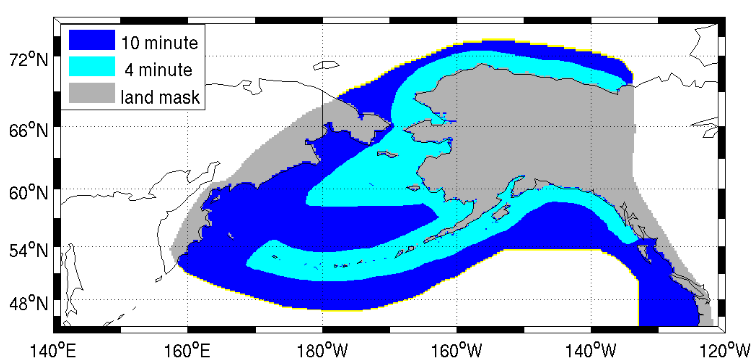

Fig. B.3 : Alaska

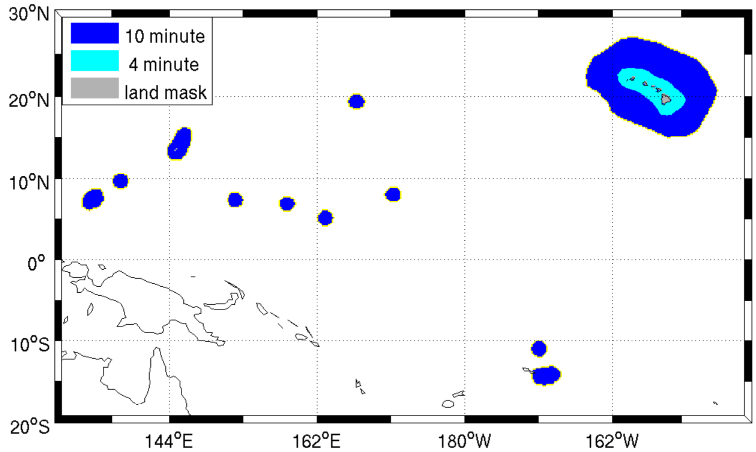

Fig. B.4 : Pacific Islands and Hawaii

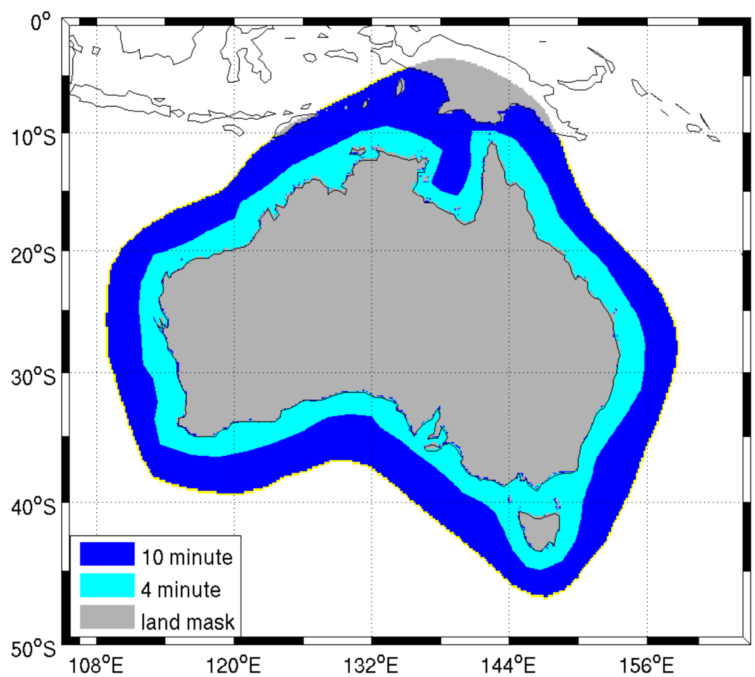

Fig. B.5 : Australia

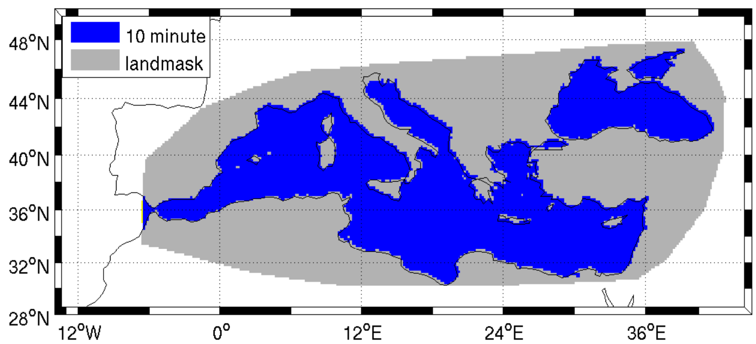

Fig. B.6 : Mediterranean

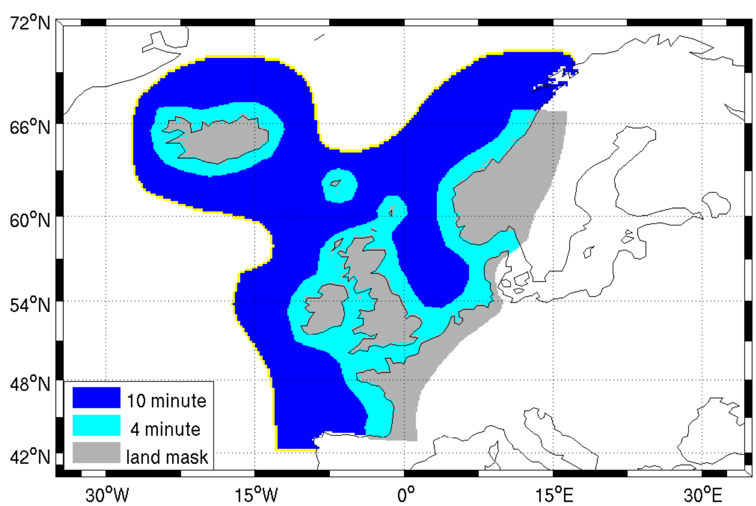

Fig. B.7 : North Sea and Baltic

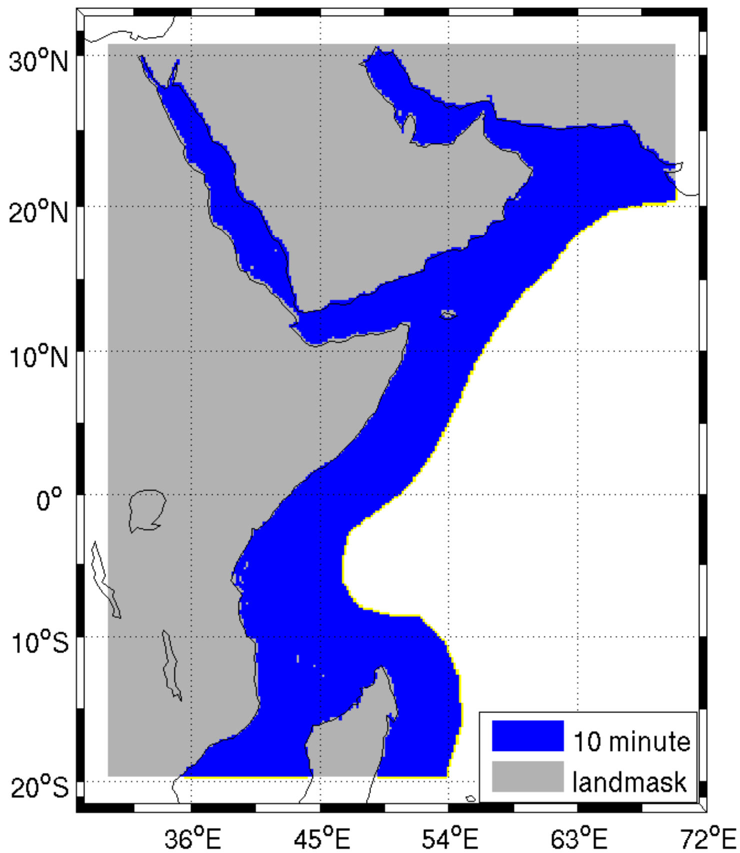

Fig. B.8 : North West Indian Ocean

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C Appendix C: Output Points

```
$
$ Global output point data file for multi-grid wave model
$
$ Key to data in file:
$
$   LON      Longitude, east positive
$   LAT      Latitude
$   NAME     Output point name C*10, no blanks in name allowed
$   AH       Anemometer height, dummy value for none-data points
$   TYPE     Buoy type indicator, used for plotting and postprocessing
$             DAT      Data point
$             XDT      Former data point
$             BPT      Boundary data for external models.
$             VBY      'Virtual buoy'
$   SOURCE   Source of data point
$             ENCAN    Environment Canada
$             GOMOOS   Gulf of Maine OOS
$             IDT      Irish Department of Transportation
$             METFR    Meteo France
$             NCEP     Boundary and other data points
$             NDBC     National Data Buoy Center
$             PRIV     Private and incidental data sources
$             SCRIPPS  Scripps
$             UKMO     UK Met Office
$             PDES     Puertos del Estados
$             SHOM     Service Hydrographique et Oceanographique de la Marine
$             OCNOR    Fugro Oceanor
$             WHOI     Woods Hole Oceanographic Institute
$       SKOREA   South Korea
$             MVEW     Ministerie van Verkeer en Waterstaat
$             CORMP    Coastal Ocean Research and Monitoring Program
$             DIMAR    Direccion General Maritima (Columbia)
$             BP       British Petroleum
$   SCALE    Scale indicator for plotting of locations on map
$            Point will only be plotted if SCALE =< DX in our
$            GrADS scripts, DX is width of plot in logitude
$
$ Notes:
$
$  - The '$' at the first position identifies comments for WAVEWATCH III
```

```
$    input.
$  - The first three data columns are used by the forecats code, the other
$    are used by postprocessing scripts.
$
$ NE Pacific deep ocean
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
  -148.02   56.31  '46001      '   5.0   DAT  NDBC     360
  -130.27   42.60  '46002      '   5.0   DAT  NDBC     360
  -136.10   50.93  '46004      '   5.0   DAT  ENCAN    360
  -131.02   46.05  '46005      '   5.0   DAT  NDBC     360
  -137.48   40.80  '46006      '   5.0   DAT  NDBC     360
  -177.58   57.05  '46035      '  10.0   DAT  NDBC     360
  -133.94   48.35  '46036      '   5.0   DAT  ENCAN    360
  -130.00   37.98  '46059      '   5.0   DAT  NDBC     360
  -154.98   52.70  '46066      '   5.0   DAT  NDBC     360
   175.28   55.00  '46070      '   5.0   DAT  NDBC     360
  -172.03   54.94  '46073      '  10.0   DAT  NDBC     360
  -138.85   53.91  '46184      '   5.0   DAT  ENCAN    360
$
$ NE Pacific coastal
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
$ Alaska
$
  -146.83   60.22  '46061      '   5.0   DAT  NDBC      90
   179.05   51.16  '46071      '   5.0   DAT  NDBC     360
  -171.73   52.25  '46072      '   5.0   DAT  NDBC     360
  -160.81   53.93  '46075      '   5.0   DAT  NDBC     360
  -148.00   59.50  '46076      '   5.0   DAT  NDBC     360
  -152.45   56.05  '46078      '   5.0   DAT  NDBC     360
  -152.09   59.76  '46106      '   999   DAT  NDBC     75
  -150.00   58.00  '46080      '   5.0   DAT  NDBC     360
  -143.42   59.69  '46082      '   5.0   DAT  NDBC     360
  -138.00   58.25  '46083      '   5.0   DAT  NDBC     360
  -136.16   56.59  '46084      '   5.0   DAT  NDBC     360
  -142.56   56.85  '46085      '   5.0   DAT  NDBC     360
$
$ Canada
$
```

```
  -127.93   49.74  '46132      '   5.0   DAT  ENCAN     90
  -132.45   54.38  '46145      '   5.0   DAT  ENCAN     45
  -131.22   51.83  '46147      '   5.0   DAT  ENCAN     90
  -131.10   53.62  '46183      '   5.0   DAT  ENCAN     45
  -129.81   52.42  '46185      '   5.0   DAT  ENCAN     45
  -128.75   51.37  '46204      '   5.0   DAT  ENCAN     45
  -134.28   54.16  '46205      '   5.0   DAT  ENCAN     45
  -126.00   48.84  '46206      '   5.0   DAT  ENCAN     45
  -129.92   50.87  '46207      '   5.0   DAT  ENCAN     45
  -132.68   52.52  '46208      '   5.0   DAT  ENCAN     45
$
$ USA
$
  -120.87   34.88  '46011      '   5.0   DAT  NDBC      15
  -122.88   37.36  '46012      '   5.0   DAT  NDBC      45
  -123.32   38.23  '46013      '   5.0   DAT  NDBC      25
  -123.97   39.22  '46014      '   5.0   DAT  NDBC      45
  -124.85   42.75  '46015      '   5.0   DAT  NDBC      45
  -124.54   40.78  '46022      '   5.0   DAT  NDBC      25
  -120.97   34.71  '46023      '  10.0   DAT  NDBC      45
  -119.08   33.75  '46025      '   5.0   DAT  NDBC      45
  -122.82   37.75  '46026      '   5.0   DAT  NDBC      25
  -124.38   41.85  '46027      '   5.0   DAT  NDBC      45
  -121.89   35.74  '46028      '   5.0   DAT  NDBC      45
  -124.51   46.12  '46029      '   5.0   DAT  NDBC      45
  -124.53   40.42  '46030      '   5.0   DAT  NDBC      15
  -124.75   47.34  '46041      '   5.0   DAT  NDBC      45
  -122.42   36.75  '46042      '   5.0   DAT  NDBC      45
  -119.53   32.43  '46047      '   5.0   DAT  NDBC      45
  -124.53   44.62  '46050      '   5.0   DAT  NDBC      45
  -119.85   34.24  '46053      '   5.0   DAT  NDBC      45
  -120.45   34.27  '46054      '  10.0   DAT  NDBC      25
  -121.01   35.10  '46062      '   5.0   DAT  NDBC      45
  -120.70   34.27  '46063      '   5.0   DAT  NDBC      45
  -120.20   33.65  '46069      '   5.0   DAT  NDBC      45
  -118.00   32.50  '46086      '   5.0   DAT  NDBC      45
  -124.73   48.49  '46087      '   5.0   DAT  NDBC      45
-125.77   45.88  '46089      '   5.0   DAT  NDBC      45
  -124.24   46.86  '46211      '  999.   DAT  SCRIPPS   25
$  -124.31   40.75  '46212      '  999.   DAT  SCRIPPS   25
  -124.74   40.29  '46213      '  999.   DAT  SCRIPPS   25
  -123.47   37.95  '46214      '  999.   DAT  SCRIPPS   45
```

```
  -119.80   34.33  '46216     '  999.   DAT  SCRIPPS   15
  -119.43   34.17  '46217     '  999.   DAT  SCRIPPS   15
  -120.78   34.45  '46218     '  999.   DAT  SCRIPPS   25
  -119.88   33.22  '46219     '  999.   DAT  SCRIPPS   45
  -118.63   33.85  '46221     '  999.   DAT  SCRIPPS   15
  -118.32   33.62  '46222     '  999.   DAT  SCRIPPS   15
  -117.77   33.46  '46223     '  999.   DAT  SCRIPPS   15
  -117.47   33.18  '46224     '  999.   DAT  SCRIPPS   15
  -117.39   32.93  '46225     '  999.   DAT  SCRIPPS   15
  -117.44   32.63  '46227     '  999.   DAT  SCRIPPS   15
  -124.55   43.77  '46229     '  999.   DAT  SCRIPPS   25
  -117.37   32.75  '46231     '  999.   DAT  SCRIPPS   15
  -117.33   32.43  '46232     '  999.   DAT  SCRIPPS   15
  -119.47   33.40  '46238     '  999.   DAT  SCRIPPS   15
$
  -117.75   32.64  'SGX01     '  999.   VBY  NCEP      25
$
$ South America
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   -77.50    6.26  '32488     '  999.   DAT  DIMAR     45
   -77.74    3.52  '32487     '  999.   DAT  DIMAR     45
   -72.22   12.35  '41193     '  999.   DAT  DIMAR    120
$
$ Japanese buoys
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   134.90   28.90  '21004     '   999.  XDT  JAPAN    360
   126.30   28.10  '22001     '   999.  XDT  JAPAN    360
$
$ South Korean buoys
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   126.02   37.23  '22101     '   999.  DAT  SKOREA    100
   125.77   34.80  '22102     '   999.  DAT  SKOREA    100
   127.50   34.00  '22103     '   999.  DAT  SKOREA    100
   128.90   34.77  '22104     '   999.  DAT  SKOREA    100
   130.00   37.53  '22105     '   999.  DAT  SKOREA    100
   129.78   36.35  '22106     '   999.  DAT  SKOREA    100
```

```
   126.33   33.00  '22107     '   999.  DAT  SKOREA    100
$
$ Hawaii
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
  -162.21   23.43  '51001     '   5.0   DAT  NDBC     360
  -157.78   17.19  '51002     '   5.0   DAT  NDBC     360
  -160.82   19.22  '51003     '   5.0   DAT  NDBC     360
  -152.48   17.52  '51004     '   5.0   DAT  NDBC     360
  -154.06   23.55  '51000     '   5.0   DAT  NDBC      11
  -153.90   23.56  '51100     '   5.0   DAT  NDBC      11
  -162.06   24.32  '51101     '   5.0   DAT  NDBC      11
  -158.12   21.67  '51201     '  999.   DAT  SCRIPPS   11
  -157.68   21.42  '51202     '  999.   DAT  SCRIPPS   11
$
  -158.00   24.00  'HNL01     '  999.   VBY  NCEP     360
  -153.00   22.50  'HNL02     '  999.   VBY  NCEP     360
  -157.75   22.00  'HNL10     '  999.   VBY  NCEP      45
  -158.25   21.00  'HNL11     '  999.   VBY  NCEP      45
  -156.50   19.75  'HNL12     '  999.   VBY  NCEP      45
$
$ Other deep Pacific
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
  -153.87    0.02  '51028     '   5.0   DAT  NDBC     360
   144.79   13.54  '52200     '  999.   DAT  SCRIPPS  360
$
$ NWS forecast points
$
   143.75   12.00  'GUAM      '  999.   VBY  NCEP     360
   147.50   16.00  'SAIPAN    '  999.   VBY  NCEP     360
   166.50   19.50  'WAKE      '  999.   VBY  NCEP     360
   136.25    9.00  'PALAU     '  999.   VBY  NCEP     360
   138.00    9.60  'YAP       '  999.   VBY  NCEP     360
   152.50    8.00  'CHUUK     '  999.   VBY  NCEP     360
   157.50    7.00  'POHNPEI   '  999.   VBY  NCEP     360
   163.00    5.10  'KOSRAE    '  999.   VBY  NCEP     360
   167.80    9.50  'KWAJALEIN '  999.   VBY  NCEP     360
   167.50    8.67  'KWAJ_W1   '  999.   VBY  NCEP     360
   167.00    8.67  'KWAJ_W2   '  999.   VBY  NCEP     360
```

```
   168.17    8.67  'KWAJ_E    '  999.   VBY  NCEP     360
   166.33    9.17  'WOTHO     '  999.   VBY  NCEP     360
   168.00    9.17  'ROI_NAMUR '  999.   VBY  NCEP     360
   171.50    9.17  'WOTJE_E   '  999.   VBY  NCEP     360
   146.25  -12.00  'NEWGUINE_S'  999.   VBY  NCEP     360
   171.25    8.00  'MAJURO    '  999.   VBY  NCEP     360
   163.75   13.00  'ENEWETAK  '  999.   VBY  NCEP     360
  -168.75  -15.00  'PAGO_PAGO '  999.   VBY  NCEP     360
$
$ Pacific training points
$
  -177.40   28.20  'MIDWAY    '  999.   VBY  NCEP     360
  -169.50   16.70  'JOHNSTON  '  999.   VBY  NCEP     360
   176.25  -18.00  'NADI      '  999.   VBY  NCEP     360
   179.20   -8.50  'FUNAFUTI  '  999.   VBY  NCEP     360
  -175.00  -22.00  'TONGATAPU '  999.   VBY  NCEP     360
  -159.80  -21.20  'RAROTONGA '  999.   VBY  NCEP     360
   167.50  -24.00  'NOUMEA    '  999.   VBY  NCEP     360
   167.50  -18.00  'PORT_VILA '  999.   VBY  NCEP     360
  -149.60  -19.00  'PAPEETE   '  999.   VBY  NCEP     360
   174.00    1.00  'TARAWA    '  999.   VBY  NCEP     360
  -169.90  -19.10  'NIUE      '  999.   VBY  NCEP     360
  -166.30   23.90  'FF_SHOALS '  999.   VBY  NCEP     360
   167.00   -0.50  'NAURU     '  999.   VBY  NCEP     360
  -171.90   -9.20  'NUKUNONO  '  999.   VBY  NCEP     360
   160.00  -12.00  'SOLOMON_SW'  999.   VBY  NCEP     360
   165.00  -12.00  'SOLOMON_SE'  999.   VBY  NCEP     360
   160.00   -5.00  'SOLOMON_N '  999.   VBY  NCEP     360
$
$ Virtual points for Indonesia
$
   102.00   -5.00  'P_ENGGANO '  999.   VBY  NCEP     360
   107.00    0.00  'P_PENJAN  '  999.   VBY  NCEP     360
   110.00   -5.00  'SEMARANG  '  999.   VBY  NCEP     360
   122.00  -11.00  'P_SAWA    '  999.   VBY  NCEP     360
   132.00    1.00  'P_IGI     '  999.   VBY  NCEP     360
   133.00   -8.00  'P_JAMDENA '  999.   VBY  NCEP     360
    93.00    6.00  'G_NICOBAR '  999.   VBY  NCEP     360
   100.00    4.00  'P_PANGKOR '  999.   VBY  NCEP     100
   118.00   -1.00  'SULAWESI  '  999.   VBY  NCEP     360
   120.00   -7.50  'P_BONARAT '  999.   VBY  NCEP     100
   125.00   -5.00  'P_RUNDUMA '  999.   VBY  NCEP     100
```

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   123.00    3.00  'BORNEO      '  999.   VBY  NCEP     360
   126.00    1.00  'P_GUREDA    '  999.   VBY  NCEP     100
$
$ Virtual points for Malaysia
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
$
   104.00    6.00  'MALAY01     '  999.   VBY  NCEP     100
   105.00    3.00  'MALAY02     '  999.   VBY  NCEP     100
   110.00    3.00  'MALAY03     '  999.   VBY  NCEP     100
   113.00    5.00  'MALAY04     '  999.   VBY  NCEP     100
   116.00    7.50  'MALAY05     '  999.   VBY  NCEP     100
   117.00    7.50  'MALAY06     '  999.   VBY  NCEP     100
$
$ Gulf of Mexico and Carabean
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   -89.67   25.90  '42001       '  10.0   DAT  NDBC     360
   -94.42   25.17  '42002       '  10.0   DAT  NDBC     360
   -85.94   26.07  '42003       '  10.0   DAT  NDBC     360
   -88.77   30.09  '42007       '   5.0   DAT  NDBC      90
   -95.36   27.91  '42019       '   5.0   DAT  NDBC      90
   -96.70   26.94  '42020       '   5.0   DAT  NDBC      90
   -94.40   29.22  '42035       '   5.0   DAT  NDBC      90
   -84.52   28.50  '42036       '   5.0   DAT  NDBC      90
   -92.55   27.42  '42038       '   5.0   DAT  NDBC      90
   -86.02   28.79  '42039       '   5.0   DAT  NDBC      90
   -87.55   30.06  '42012       '   5.0   DAT  NDBC      90
   -88.21   29.18  '42040       '   5.0   DAT  NDBC      90
   -90.46   27.50  '42041       '   5.0   DAT  NDBC      90
   -88.49   28.19  '42887       '  48.2   DAT  BP        90
$
   -87.73   26.00  '42054       '  10.0   XDT  NDBC     360
   -94.05   22.01  '42055       '  10.0   DAT  NDBC     360
   -85.06   19.87  '42056       '  10.0   DAT  NDBC     360
   -81.50   16.83  '42057       '  10.0   DAT  NDBC     360
   -75.06   15.09  '42058       '  10.0   DAT  NDBC     360
   -81.95   24.39  '42080       ' 999.    DAT  NDBC      45
   -84.24   27.34  '42099       ' 999.    DAT  SCRIPPS  100
$
```

```
   -67.50   15.01  '42059      '   5.0   DAT  NDBC     360
   -63.50   16.50  '42060      '   5.0   DAT  NDBC     360
$
   -53.08   14.55  '41040      '   5.0   DAT  NDBC     360
   -46.00   14.53  '41041      '   5.0   DAT  NDBC     360
   -57.90   15.90  '41100      '   5.0   DAT  METFR    360
   -56.20   14.60  '41101      '   5.0   DAT  METFR    360
$
   -81.75   24.00  'EYW01      '  999.   VBY  NCEP      90
   -82.25   25.00  'EYW02      '  999.   VBY  NCEP      90
$
   -66.50   19.00  'PUERTO_R_N'  999.   VBY  NCEP      90
   -66.50   17.50  'PUERTO_R_S'  999.   VBY  NCEP      90
   -67.50   19.00  'CARCOOS01 '  999.   VBY  NCEP      90
   -65.50   19.00  'CARCOOS02 '  999.   VBY  NCEP      90
   -64.00   19.00  'CARCOOS03 '  999.   VBY  NCEP      90
   -64.40   17.30  'CARCOOS04 '  999.   VBY  NCEP      90
   -67.50   17.50  'CARCOOS05 '  999.   VBY  NCEP      90
$
$ NW Atlantic deep ocean
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ----------------------------------------------------------
   -72.66   34.68  '41001      '   5.0   DAT  NDBC     360
   -75.36   32.32  '41002      '   5.0   DAT  NDBC     360
   -79.09   32.50  '41004      '   5.0   DAT  NDBC     360
   -80.87   31.40  '41008      '   5.0   DAT  NDBC     360
   -66.58   41.11  '44011      '   5.0   DAT  NDBC     360
   -62.00   42.26  '44137      '   5.0   DAT  ENCAN    360
   -53.62   44.26  '44138      '   5.0   DAT  ENCAN    360
   -57.08   44.26  '44139      '   5.0   DAT  ENCAN    360
   -51.74   43.75  '44140      '   5.0   DAT  ENCAN    360
   -58.00   43.00  '44141      '   5.0   DAT  ENCAN    360
   -64.02   42.50  '44142      '   5.0   DAT  ENCAN    360
   -64.01   42.50  '44150      '   5.0   DAT  ENCAN    360
   -48.01   46.77  'WRB07      '  10.0   DAT  PRIV     360
$
$ NW Atlantic coastal
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ----------------------------------------------------------
   -80.17   28.50  '41009      '   5.0   DAT  NDBC      80
```

```
   -78.47   28.95  '41010      '   5.0   DAT  NDBC       80
   -80.60   30.00  '41012      '   5.0   DAT  NDBC       80
   -77.74   33.44  '41013      '   5.0   DAT  NDBC       80
   -75.40   35.01  '41025      '   5.0   DAT  NDBC       80
   -77.28   34.48  '41035      '   5.0   DAT  NDBC       80
   -76.95   34.21  '41036      '   5.0   DAT  NDBC       80
   -77.36   33.99  '41037      '   3.0   DAT  CORMP      80
   -77.72   34.14  '41038      '   3.0   DAT  CORMP      80
   -65.01   20.99  '41043      '   5.0   DAT  NDBC       90
   -70.99   24.00  '41046      '   5.0   DAT  NDBC       90
   -71.49   27.47  '41047      '  10.0   DAT  NDBC       90
   -69.65   31.98  '41048      '  10.0   DAT  NDBC       90
   -63.00   27.50  '41049      '   5.0   DAT  NDBC       90
   -58.69   21.65  '41044      '   5.0   DAT  NDBC       90
   -77.71   34.14  '41110      '   3.0   DAT  CORMP      80
   -81.29   30.72  '41112      '  999.   DAT  SCRIPPS    30
   -80.53   28.40  '41113      '  999.   DAT  SCRIPPS    30
   -80.22   27.55  '41114      '  999.   DAT  SCRIPPS    30
$
$   -75.72   36.20  '44056      '  999.   DAT  USACE      90
   -75.78   36.91  '44099      '  999.   DAT  SCRIPPS    90
   -75.59   36.26  '44100      '  999.   DAT  SCRIPPS    90
   -70.43   38.48  '44004      '   5.0   DAT  NDBC       90
   -69.16   43.19  '44005      '   5.0   DAT  NDBC       90
   -69.43   40.50  '44008      '   5.0   DAT  NDBC       90
   -74.70   38.46  '44009      '   5.0   DAT  NDBC       90
   -74.84   36.61  '44014      '   5.0   DAT  NDBC       90
   -72.10   40.70  '44017      '   5.0   DAT  NDBC       80
   -71.01   41.38  '44070      '  999.   DAT  NDBC       60
   -69.29   41.26  '44018      '   5.0   DAT  NDBC       80
   -72.60   39.58  '44066      '   5.0   DAT  NDBC       80
   -65.93   42.31  '44024      '   4.0   DAT  GOMOOS     80
   -73.17   40.25  '44025      '   5.0   DAT  NDBC       80
   -70.17   42.80  '44098      '  999.   DAT  SCRIPPS    80
   -67.31   44.27  '44027      '   5.0   DAT  NDBC       80
   -67.88   43.49  '44037      '   4.0   DAT  GOMOOS     80
   -66.55   43.62  '44038      '   4.0   DAT  GOMOOS     80
$
   -53.39   46.44  '44251      '   5.0   DAT  ENCAN      80
   -57.35   47.28  '44255      '   5.0   DAT  ENCAN      80
$
   -70.25   42.50  'BOX01      '  999.   VBY  NCEP       45
```

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   -67.50   44.00  'CAR01      '  999.   VBY  NCEP      45
   -77.00   30.75  'CHS01      '  999.   VBY  NCEP      80
   -69.75   43.25  'GYX01      '  999.   VBY  NCEP      45
   -77.00   34.00  'ILM01      '  999.   VBY  NCEP      45
   -78.50   33.25  'ILM02      '  999.   VBY  NCEP      45
   -80.25   29.50  'JAX02      '  999.   VBY  NCEP      90
   -79.50   27.25  'MLB01      '  999.   VBY  NCEP      90
   -79.50   26.25  'MIA01      '  999.   VBY  NCEP      80
   -79.75   25.00  'MIA02      '  999.   VBY  NCEP      90
$
$ NE Atlantic
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
$
    -5.00   45.20  '62001      '   3.0   DAT  UKMO     360
   -20.00   41.60  '62002      '  999.   DAT  UNKNOWN  360
   -12.40   48.70  '62029      '   3.0   DAT  UKMO     360
    -7.90   51.40  '62023      '  999.   DAT  UNKNOWN  360
    -5.60   48.50  '62052      '  999.   DAT  METFR    100
$    -1.45   44.65  '62064      '  999.   DAT  SHOM     100
   -13.30   51.00  '62081      '   3.0   DAT  UKMO     360
   -11.20   53.13  '62090      '   4.5   DAT  IDT      100
    -5.42   53.47  '62091      '   4.5   DAT  IDT       60
   -10.55   51.22  '62092      '   4.5   DAT  IDT      100
    -9.07   54.67  '62093      '   4.5   DAT  IDT       60
    -6.70   51.69  '62094      '   4.5   DAT  IDT       60
   -15.92   53.06  '62095      '   4.5   DAT  IDT      100
    -2.90   49.90  '62103      '  14.0   DAT  UKMO     360
   -12.36   54.54  '62105      '   3.0   DAT  UKMO     360
    -9.90   57.00  '62106      '   4.5   DAT  UKMO     360
    -6.10   50.10  '62107      '  14.0   DAT  UKMO     360
   -19.50   53.50  '62108      '   3.0   DAT  UKMO     360
    -8.50   47.50  '62163      '   3.0   DAT  UKMO     360
    -4.70   52.30  '62301      '   3.0   DAT  UKMO      25
    -5.10   51.60  '62303      '   3.0   DAT  UKMO      25
     0.00   50.40  '62305      '  14.0   DAT  UKMO      25
     2.00   51.40  '62170      ' 999.0   DAT  UKMO      25
   -11.40   59.10  '64045      '   3.0   DAT  UKMO     360
    -4.50   60.70  '64046      '   3.0   DAT  UKMO     360
$
$ Iceland
```

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$
    -9.26   68.48  '64071      '  999.   DAT  UNKNOWN   60
   -23.10   64.05  'TFGSK      '  999.   DAT  UNKNOWN   60
   -25.00   65.69  'TFBLK      '  999.   DAT  UNKNOWN   60
$  -23.36   66.44  'TFSTD      '  999.   DAT  UNKNOWN   60
$  -21.12   65.76  'TFDRN      '  999.   DAT  UNKNOWN   60
   -18.20   66.50  'TFGRS      '  999.   DAT  UNKNOWN   60
   -13.50   65.65  'TFKGR      '  999.   DAT  UNKNOWN   60
   -15.20   64.00  'TFHFN      '  999.   DAT  UNKNOWN   60
   -20.35   63.00  'TFSRT      '  999.   DAT  UNKNOWN   60
$  -22.46   63.82  'TFGRV      '  999.   DAT  UNKNOWN   60
$
$ Norwegian Sea
$
     7.80   64.30  'LF3F       '  999.   DAT  UNKNOWN  360
     7.30   65.30  'LF3N       '  999.   DAT  UNKNOWN   60
     8.10   66.00  'LF5T       '  999.   DAT  UNKNOWN  360
     2.00   66.00  'LDWR       '  999.   DAT  UNKNOWN  360
$
$ North Sea
$
     1.10   55.30  '62026      '  999.   DAT  UNKNOWN  360
     0.00   57.00  '62109      '  999.   DAT  UNKNOWN   25
     0.40   58.10  '62111      '  999.   DAT  UNKNOWN   25
     1.30   58.70  '62112      '  999.   DAT  UNKNOWN   25
     1.40   57.70  '62116      '  999.   DAT  UNKNOWN  360
     0.00   57.90  '62117      '  999.   DAT  UNKNOWN   15
     0.90   57.70  '62118      '  999.   DAT  UNKNOWN   15
     2.00   57.00  '62119      '  999.   DAT  UNKNOWN   25
$    -3.50   53.80  '62125      '  999.   DAT  PRIV       25
$    -3.60   53.90  '62126      '  999.   DAT  UNKNOWN    25
$    -3.80   54.00  '62135      '  999.   DAT  UNKNOWN    25
     1.40   58.70  '62128      '  999.   DAT  UNKNOWN   25
     2.00   56.40  '62132      '  999.   DAT  UNKNOWN   25
     1.00   57.10  '62133      '  999.   DAT  UNKNOWN   15
     2.10   53.00  '62142      '  999.   DAT  PRIV      30
     1.80   57.70  '62143      '  999.   DAT  UNKNOWN   25
     1.70   53.40  '62144      '  999.   DAT  PRIV      45
     2.80   53.10  '62145      '  999.   DAT  PRIV     360
     2.10   57.10  '62146      '  999.   DAT  UNKNOWN   25
     1.80   57.00  '62152      '  999.   DAT  UNKNOWN   25
     0.50   57.40  '62162      '  999.   DAT  UNKNOWN   25
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    0.50   57.20  '62164      '  999.   DAT  PRIV       15
    1.90   51.10  '62304      '  14.0   DAT  UKMO       25
    1.70   60.60  '63055      '  999.   DAT  UNKNOWN    25
    1.60   59.50  '63056      '  999.   DAT  UNKNOWN    25
    1.50   59.20  '63057      '  999.   DAT  UNKNOWN   360
    1.10   61.20  '63103      '  999.   DAT  UNKNOWN    15
    1.70   60.80  '63108      '  999.   DAT  UNKNOWN    15
    1.50   59.50  '63110      '  999.   DAT  PRIV       15
    1.50   59.50  '63111      '  10.0   XDT  PRIV        0
    1.00   61.10  '63112      '  999.   DAT  PRIV      360
    1.70   61.00  '63113      '  999.   DAT  PRIV      100
    1.30   61.60  '63115      '  999.   DAT  PRIV       25
$
    2.30   61.20  'LF3J       '  999.   DAT  UNKNOWN    25
    3.70   60.60  'LF4B       '  999.   DAT  UNKNOWN   360
    2.20   59.60  'LF4H       '  999.   DAT  UNKNOWN    25
    1.90   58.40  'LF4C       '  999.   DAT  UNKNOWN    25
    3.20   56.50  'LF5U       '  999.   DAT  UNKNOWN    60
$
    6.33   55.00  'BSH01      '  999.   DAT  UNKNOWN    60
    7.89   54.16  'BSH02      '  999.   DAT  UNKNOWN    60
    8.12   54.00  'BSH03      '  999.   DAT  UNKNOWN    60
    6.58   54.00  'BSH04      '  999.   DAT  UNKNOWN    60
    8.22   54.92  'BSH05      '  999.   DAT  UNKNOWN    60
$    13.87   54.88  'BSH54      '  999.   DAT  UNKNOWN    60
$    12.70   54.70  'BSH71      '  999.   DAT  UNKNOWN    60
$
$ Dutch Stations
$
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
    3.28   51.99  'EURO       '  999.   DAT  MVEW       60
    3.22   53.22  'K13        '  999.   DAT  MVEW       25
$
$ Barents Sea
$
   21.10   71.60  '3FYT       '  999.   DAT  UNKNOWN   360
   15.50   73.50  'LFB1       '  999.   DAT  OCNOR     360
   30.00   74.00  'LFB2       '  999.   DAT  OCNOR     360
$
$ Brazil
```

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$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   -48.13  -27.70  '31201     '  999.   DAT  SCRIPPS  180
   -48.75  -32.00  'RIO_GRANDE'  999.   VBY  NCEP     360
   -46.25  -28.00  'FLORIPA   '  999.   VBY  NCEP     360
   -43.75  -25.00  'SANTOS    '  999.   VBY  NCEP     360
   -38.75  -21.00  'CAMPOS    '  999.   VBY  NCEP     360
   -36.25  -13.00  'SALVADOR  '  999.   VBY  NCEP     360
   -32.50   -8.00  'RECIFE    '  999.   VBY  NCEP     360
   -36.25   -3.00  'FORTALEZA '  999.   VBY  NCEP     360
   -47.50    3.00  'AMAZON    '  999.   VBY  NCEP     360
   -30.00    1.00  'PETER_PAUL'  999.   VBY  NCEP     360
$
$ Peru/Chile Basin
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   -85.38  -19.62  '32012'       999.   DAT  WHOI     360
$
$ South Africa
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
    22.17  -34.97  'AGULHAS_FA'  10.0   DAT  PRIV     360
$
$ Australia
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   141.75  -12.68  '52121     '  999.   DAT  UNKNOWN   50
   150.34  -35.71  '55014     '  999.   DAT  UNKNOWN   50
   153.73  -28.69  '55017     '  999.   DAT  UNKNOWN   10
   153.27  -30.35  '55018     '  999.   DAT  UNKNOWN   10
   152.86  -31.83  '55019     '  999.   DAT  UNKNOWN   50
   150.18  -37.29  '55020     '  999.   DAT  UNKNOWN   50
   151.03  -34.48  '55022     '  999.   DAT  UNKNOWN   50
   151.42  -33.77  '55024     '  999.   DAT  UNKNOWN   50
   151.32  -33.90  '55025     '  999.   DAT  UNKNOWN   10
   145.01  -42.08  '55026     '  999.   DAT  UNKNOWN   50
   145.71  -16.73  '55028     '  999.   DAT  UNKNOWN   50
   147.06  -19.16  '55029     '  999.   DAT  UNKNOWN   50
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   149.55  -21.04  '55031      '  999.   DAT  UNKNOWN   50
   149.31  -21.27  '55032      '  999.   DAT  UNKNOWN   15
   151.07  -23.31  '55033      '  999.   DAT  UNKNOWN   50
   153.20  -27.25  '55034      '  999.   DAT  UNKNOWN   10
   153.63  -27.49  '55035      '  999.   DAT  UNKNOWN   50
   153.44  -27.96  '55036      '  999.   DAT  UNKNOWN   10
   153.58  -28.18  '55037      '  999.   DAT  UNKNOWN   10
   148.19  -38.60  '55039      '  999.   DAT  UNKNOWN   50
   136.62  -36.07  '55040      '  999.   DAT  UNKNOWN   50
   116.14  -19.59  '56002      '  999.   DAT  UNKNOWN  120
   114.91  -30.29  '56004      '  999.   DAT  UNKNOWN   50
   115.40  -32.11  '56005      '  999.   DAT  UNKNOWN   50
   114.78  -33.36  '56006      '  999.   DAT  UNKNOWN  120
   114.94  -21.41  '56007      '  999.   DAT  UNKNOWN   50
   121.90  -34.00  '56010      '  999.   DAT  UNKNOWN   50
   117.72  -35.20  '56011      '  999.   DAT  UNKNOWN   50
   114.10  -21.70  '56012      '  999.   DAT  UNKNOWN   50
   115.69  -31.98  '56008      '  999.   DAT  UNKNOWN   25
   136.20  -36.10  'CADUCOU    '  999.   VBY  UNKNOWN  120
   139.00  -38.00  'SWROBE     '  999.   VBY  UNKNOWN  120
   142.45  -39.20  'WBAST1     '  999.   VBY  UNKNOWN  120
   141.50  -40.00  'WBAST2     '  999.   VBY  UNKNOWN  120
   151.00  -40.00  'EBAST      '  999.   VBY  UNKNOWN  120
   146.50  -40.50  'CBAST      '  999.   VBY  UNKNOWN  120
   144.60  -42.30  'CSORRELL   '  999.   VBY  UNKNOWN  120
   144.50  -40.10  'SEKING     '  999.   VBY  UNKNOWN  120
   143.80  -39.20  'NKING      '  999.   VBY  UNKNOWN  120
   144.85  -38.60  'PNEPEAN    '  999.   VBY  UNKNOWN  120
   147.40  -39.20  'EHOGAN     '  999.   VBY  UNKNOWN  120
   147.00  -44.00  'STHSEC     '  999.   VBY  UNKNOWN  120
   149.50  -41.50  'EBICHENO   '  999.   VBY  UNKNOWN  120
   133.50  -33.50  'WCAPYORK   '  999.   VBY  UNKNOWN  120
$
$ India
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
    72.49   17.02  '23092      '  999.   DAT  UNKNOWN   20
    73.75   15.40  '23093      '  999.   DAT  UNKNOWN  120
    74.50   12.94  '23094      '  999.   DAT  UNKNOWN  120
    80.39   13.19  '23096      '  999.   DAT  UNKNOWN  120
    69.24   15.47  '23097      '  999.   DAT  UNKNOWN  360
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    72.51   10.65  '23098      '  999.   DAT  UNKNOWN  360
    90.74   12.14  '23099      '  999.   DAT  UNKNOWN  360
    87.56   18.35  '23100      '  999.   DAT  UNKNOWN  120
    83.27   13.97  '23101      '  999.   DAT  UNKNOWN  360
    85.00   12.60  '23167      '  999.   DAT  UNKNOWN  360
    87.50   15.00  '23168      '  999.   DAT  UNKNOWN  360
    90.14   18.13  '23169      '  999.   DAT  UNKNOWN  360
    72.66    8.33  '23170      '  999.   DAT  UNKNOWN  360
    70.00   11.02  '23171      '  999.   DAT  UNKNOWN  360
    72.00   12.50  '23172      '  999.   DAT  UNKNOWN  360
    78.57    8.21  '23173      '  999.   DAT  UNKNOWN  120
    81.53   11.57  '23174      '  999.   DAT  UNKNOWN  360
    91.66   10.52  '23451      '  999.   DAT  UNKNOWN  120
    89.04   10.97  '23455      '  999.   DAT  UNKNOWN  120
    86.98    9.99  '23456      '  999.   DAT  UNKNOWN  120
    70.10    5.16  '23491      '  999.   DAT  UNKNOWN  120
    68.08   13.89  '23492      '  999.   DAT  UNKNOWN  120
    66.98   11.12  '23493      '  999.   DAT  UNKNOWN  120
    75.00    6.46  '23494      '  999.   DAT  UNKNOWN  120
    68.97    7.13  '23495      '  999.   DAT  UNKNOWN  120
$
$ Red Sea
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
$    38.50   23.16  '23020      '  999.   DAT  UNKNOWN  120
$
$ Spain
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
    -3.03   43.63  '62024      '  999.   DAT  PDES      25
    -6.17   43.73  '62025      '  999.   DAT  PDES      25
    -7.62   44.07  '62082      '  999.   DAT  PDES      25
    -9.22   43.48  '62083      '  999.   DAT  PDES      25
    -9.40   42.12  '62084      '  999.   DAT  PDES      25
    -6.97   36.48  '62085      '  999.   DAT  PDES      25
$
$ Mediteranean Sea
$
     3.65   41.92  '61196      '  999.   DAT  PDES      25
     4.42   39.72  '61197      '  999.   DAT  PDES      25
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    -2.33   36.57  '61198      '  999.   DAT  PDES      25
    -5.03   36.23  '61199      '  999.   DAT  PDES      25
     1.47   40.77  '61280      '  999.   DAT  PDES      25
     0.21   39.52  '61281      '  999.   DAT  PDES      25
    -0.32   37.65  '61417      '  999.   DAT  PDES      25
     2.10   39.55  '61430      '  999.   DAT  PDES      25
     7.80   43.40  '61001      '  999.   DAT  METFR     25
     4.70   42.10  '61002      '  999.   DAT  METFR     25
$
$ Canary Islands
$
   -15.82   28.18  '13130      '  999.   DAT  PDES      25
   -16.58   28.00  '13131      '  999.   DAT  PDES      25
$
$ TPC and OPC
$
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
   -85.00  -15.00  'TPC01      '  999.   VBY  NCEP     360
  -110.00  -15.00  'TPC02      '  999.   VBY  NCEP     360
  -135.00  -15.00  'TPC03      '  999.   VBY  NCEP     360
   -93.75    0.00  'TPC04      '  999.   VBY  NCEP     360
$
   -55.00   15.00  'TPC20      '  999.   VBY  NCEP     360
   -63.00   15.00  'TPC21      '  999.   VBY  NCEP     360
   -77.00   12.00  'TPC22      '  999.   VBY  NCEP     360
   -80.00   15.00  'TPC23      '  999.   VBY  NCEP     360
   -76.00   22.00  'TPC24      '  999.   VBY  NCEP     360
   -80.00   24.00  'TPC25      '  999.   VBY  NCEP     360
   -86.00   23.00  'TPC26      '  999.   VBY  NCEP     360
$
  -118.00   30.00  'TPC50      '  999.   VBY  NCEP     360
  -135.00   20.00  'TPC51      '  999.   VBY  NCEP     360
  -117.00   20.00  'TPC52      '  999.   VBY  NCEP     360
  -120.00    6.00  'TPC53      '  999.   VBY  NCEP     360
   -95.00   15.00  'TPC54      '  999.   VBY  NCEP     360
   -88.00    9.00  'TPC55      '  999.   VBY  NCEP     360
   -80.00    6.00  'TPC56      '  999.   VBY  NCEP     360
$
  -130.50   48.10  'OPCP01     '  999.   VBY  NCEP      45
  -126.60   48.10  'OPCP02     '  999.   VBY  NCEP      45
  -129.70   45.30  'OPCP03     '  999.   VBY  NCEP      45
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  -125.60   45.30  'OPCP04     '  999.   VBY  NCEP      45
  -129.90   41.75  'OPCP05     '  999.   VBY  NCEP      45
  -125.80   41.90  'OPCP06     '  999.   VBY  NCEP      45
  -129.00   38.50  'OPCP07     '  999.   VBY  NCEP      45
  -125.50   39.20  'OPCP08     '  999.   VBY  NCEP      45
  -125.40   36.40  'OPCP09     '  999.   VBY  NCEP      45
  -125.00   33.30  'OPCP10     '  999.   VBY  NCEP      45
  -122.30   34.60  'OPCP11     '  999.   VBY  NCEP      45
  -121.50   30.90  'OPCP12     '  999.   VBY  NCEP      45
  -117.00   29.60  'OPCP13     '  999.   VBY  NCEP      45
$
   -67.70   42.35  'OPCA01     '  999.   VBY  NCEP      45
   -72.00   39.30  'OPCA02     '  999.   VBY  NCEP      45
   -65.70   39.30  'OPCA03     '  999.   VBY  NCEP      45
   -70.10   37.30  'OPCA04     '  999.   VBY  NCEP      45
   -74.60   36.30  'OPCA05     '  999.   VBY  NCEP      45
   -73.80   35.60  'OPCA06     '  999.   VBY  NCEP      45
   -70.80   34.90  'OPCA07     '  999.   VBY  NCEP      45
   -76.00   33.80  'OPCA08     '  999.   VBY  NCEP      45
   -72.30   32.80  'OPCA09     '  999.   VBY  NCEP      45
$
$ WIS OUTPUT POINTS
$
$ Alaska WIS points
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
  -156.75   71.75  'WIS_82001 '    999.   VBY  USACE     45
  -156.50   71.75  'WIS_82002 '    999.   VBY  USACE     45
  -156.25   71.75  'WIS_82003 '    999.   VBY  USACE     45
  -157.00   71.50  'WIS_82004 '    999.   VBY  USACE     45
  -156.00   71.50  'WIS_82005 '    999.   VBY  USACE     45
  -155.75   71.50  'WIS_82006 '    999.   VBY  USACE     45
  -155.50   71.50  'WIS_82007 '    999.   VBY  USACE     45
  -155.25   71.50  'WIS_82008 '    999.   VBY  USACE     45
  -155.00   71.50  'WIS_82009 '    999.   VBY  USACE     45
  -159.75   71.25  'WIS_82010 '    999.   VBY  USACE     45
  -159.50   71.25  'WIS_82011 '    999.   VBY  USACE     45
  -159.25   71.25  'WIS_82012 '    999.   VBY  USACE     45
  -159.00   71.25  'WIS_82013 '    999.   VBY  USACE     45
  -158.75   71.25  'WIS_82014 '    999.   VBY  USACE     45
  -158.50   71.25  'WIS_82015 '    999.   VBY  USACE     45
  -158.25   71.25  'WIS_82016 '    999.   VBY  USACE     45
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-158.00	71.25	'WIS_82017 '	999.	VBY	USACE	45
-157.75	71.25	'WIS_82018 '	999.	VBY	USACE	45
-157.50	71.25	'WIS_82019 '	999.	VBY	USACE	45
-157.25	71.25	'WIS_82020 '	999.	VBY	USACE	45
-160.75	71.00	'WIS_82021 '	999.	VBY	USACE	45
-160.50	71.00	'WIS_82022 '	999.	VBY	USACE	45
-160.25	71.00	'WIS_82023 '	999.	VBY	USACE	45
-160.00	71.00	'WIS_82024 '	999.	VBY	USACE	45
-162.00	70.75	'WIS_82025 '	999.	VBY	USACE	45
-161.75	70.75	'WIS_82026 '	999.	VBY	USACE	45
-161.50	70.75	'WIS_82027 '	999.	VBY	USACE	45
-161.25	70.75	'WIS_82028 '	999.	VBY	USACE	45
-161.00	70.75	'WIS_82029 '	999.	VBY	USACE	45
-162.75	70.50	'WIS_82030 '	999.	VBY	USACE	45
-162.50	70.50	'WIS_82031 '	999.	VBY	USACE	45
-162.25	70.50	'WIS_82032 '	999.	VBY	USACE	45
-163.00	70.25	'WIS_82033 '	999.	VBY	USACE	45
-163.50	70.00	'WIS_82034 '	999.	VBY	USACE	45
-163.25	70.00	'WIS_82035 '	999.	VBY	USACE	45
-163.50	69.75	'WIS_82036 '	999.	VBY	USACE	45
-164.25	69.50	'WIS_82037 '	999.	VBY	USACE	45
-164.00	69.50	'WIS_82038 '	999.	VBY	USACE	45
-163.75	69.50	'WIS_82039 '	999.	VBY	USACE	45
-166.00	69.25	'WIS_82040 '	999.	VBY	USACE	45
-165.75	69.25	'WIS_82041 '	999.	VBY	USACE	45
-165.50	69.25	'WIS_82042 '	999.	VBY	USACE	45
-165.25	69.25	'WIS_82043 '	999.	VBY	USACE	45
-165.00	69.25	'WIS_82044 '	999.	VBY	USACE	45
-164.75	69.25	'WIS_82045 '	999.	VBY	USACE	45
-164.50	69.25	'WIS_82046 '	999.	VBY	USACE	45
-166.50	69.00	'WIS_82047 '	999.	VBY	USACE	45
-166.25	69.00	'WIS_82048 '	999.	VBY	USACE	45
-166.75	68.75	'WIS_82049 '	999.	VBY	USACE	45
-166.75	68.50	'WIS_82050 '	999.	VBY	USACE	45
-166.75	68.25	'WIS_82051 '	999.	VBY	USACE	45
-166.50	68.00	'WIS_82052 '	999.	VBY	USACE	45
-166.25	67.75	'WIS_82053 '	999.	VBY	USACE	45
-166.00	67.75	'WIS_82054 '	999.	VBY	USACE	45
-165.75	67.75	'WIS_82055 '	999.	VBY	USACE	45
-165.50	67.75	'WIS_82056 '	999.	VBY	USACE	45
-165.25	67.50	'WIS_82057 '	999.	VBY	USACE	45
-165.00	67.50	'WIS_82058 '	999.	VBY	USACE	45

-164.75	67.50	'WIS_82059 '	999.	VBY	USACE	45
-164.50	67.25	'WIS_82060 '	999.	VBY	USACE	45
-164.75	67.00	'WIS_82061 '	999.	VBY	USACE	45
-164.50	67.00	'WIS_82062 '	999.	VBY	USACE	45
-164.25	67.00	'WIS_82063 '	999.	VBY	USACE	45
-164.00	67.00	'WIS_82064 '	999.	VBY	USACE	45
-166.00	66.75	'WIS_82065 '	999.	VBY	USACE	45
-165.75	66.75	'WIS_82066 '	999.	VBY	USACE	45
-165.50	66.75	'WIS_82067 '	999.	VBY	USACE	45
-165.25	66.75	'WIS_82068 '	999.	VBY	USACE	45
-165.00	66.75	'WIS_82069 '	999.	VBY	USACE	45
-163.50	66.75	'WIS_82070 '	999.	VBY	USACE	45
-163.25	66.75	'WIS_82071 '	999.	VBY	USACE	45
-163.00	66.75	'WIS_82072 '	999.	VBY	USACE	45
-167.00	66.50	'WIS_82073 '	999.	VBY	USACE	45
-166.75	66.50	'WIS_82074 '	999.	VBY	USACE	45
-166.50	66.50	'WIS_82075 '	999.	VBY	USACE	45
-166.25	66.50	'WIS_82076 '	999.	VBY	USACE	45
-167.75	66.25	'WIS_82077 '	999.	VBY	USACE	45
-167.50	66.25	'WIS_82078 '	999.	VBY	USACE	45
-169.00	66.00	'WIS_82079 '	999.	VBY	USACE	45
-168.75	66.00	'WIS_82080 '	999.	VBY	USACE	45
-168.25	66.00	'WIS_82081 '	999.	VBY	USACE	45
-169.25	65.75	'WIS_82082 '	999.	VBY	USACE	45
-168.75	65.75	'WIS_82083 '	999.	VBY	USACE	45
-168.25	65.75	'WIS_82084 '	999.	VBY	USACE	45
-169.25	65.50	'WIS_82085 '	999.	VBY	USACE	45
-169.00	65.50	'WIS_82086 '	999.	VBY	USACE	45
-168.75	65.50	'WIS_82087 '	999.	VBY	USACE	45
-168.25	65.50	'WIS_82088 '	999.	VBY	USACE	45
-168.25	65.25	'WIS_82089 '	999.	VBY	USACE	45
-168.00	65.00	'WIS_82090 '	999.	VBY	USACE	45
-167.75	65.00	'WIS_82091 '	999.	VBY	USACE	45
-167.50	65.00	'WIS_82092 '	999.	VBY	USACE	45
-167.25	65.00	'WIS_82093 '	999.	VBY	USACE	45
-167.25	64.75	'WIS_82094 '	999.	VBY	USACE	45
-167.00	64.75	'WIS_82095 '	999.	VBY	USACE	45
-166.75	64.50	'WIS_82096 '	999.	VBY	USACE	45
-166.50	64.50	'WIS_82097 '	999.	VBY	USACE	45
-166.25	64.25	'WIS_82098 '	999.	VBY	USACE	45
-166.00	64.25	'WIS_82099 '	999.	VBY	USACE	45
-165.75	64.25	'WIS_82100 '	999.	VBY	USACE	45

-165.50	64.25	'WIS_82101 '	999.	VBY	USACE	45
-164.25	64.25	'WIS_82102 '	999.	VBY	USACE	45
-164.00	64.25	'WIS_82103 '	999.	VBY	USACE	45
-163.75	64.25	'WIS_82104 '	999.	VBY	USACE	45
-163.50	64.25	'WIS_82105 '	999.	VBY	USACE	45
-162.50	64.25	'WIS_82106 '	999.	VBY	USACE	45
-162.25	64.25	'WIS_82107 '	999.	VBY	USACE	45
-162.00	64.25	'WIS_82108 '	999.	VBY	USACE	45
-161.75	64.25	'WIS_82109 '	999.	VBY	USACE	45
-172.25	64.00	'WIS_82110 '	999.	VBY	USACE	45
-172.00	64.00	'WIS_82111 '	999.	VBY	USACE	45
-171.75	64.00	'WIS_82112 '	999.	VBY	USACE	45
-171.50	64.00	'WIS_82113 '	999.	VBY	USACE	45
-171.25	64.00	'WIS_82114 '	999.	VBY	USACE	45
-171.00	64.00	'WIS_82115 '	999.	VBY	USACE	45
-170.75	64.00	'WIS_82116 '	999.	VBY	USACE	45
-170.50	64.00	'WIS_82117 '	999.	VBY	USACE	45
-170.25	64.00	'WIS_82118 '	999.	VBY	USACE	45
-165.25	64.00	'WIS_82119 '	999.	VBY	USACE	45
-165.00	64.00	'WIS_82120 '	999.	VBY	USACE	45
-164.75	64.00	'WIS_82121 '	999.	VBY	USACE	45
-164.50	64.00	'WIS_82122 '	999.	VBY	USACE	45
-163.25	64.00	'WIS_82123 '	999.	VBY	USACE	45
-163.00	64.00	'WIS_82124 '	999.	VBY	USACE	45
-162.75	64.00	'WIS_82125 '	999.	VBY	USACE	45
-161.75	64.00	'WIS_82126 '	999.	VBY	USACE	45
-172.25	63.75	'WIS_82127 '	999.	VBY	USACE	45
-170.00	63.75	'WIS_82128 '	999.	VBY	USACE	45
-169.75	63.75	'WIS_82129 '	999.	VBY	USACE	45
-169.50	63.75	'WIS_82130 '	999.	VBY	USACE	45
-169.25	63.75	'WIS_82131 '	999.	VBY	USACE	45
-169.00	63.75	'WIS_82132 '	999.	VBY	USACE	45
-168.75	63.75	'WIS_82133 '	999.	VBY	USACE	45
-168.50	63.75	'WIS_82134 '	999.	VBY	USACE	45
-168.25	63.75	'WIS_82135 '	999.	VBY	USACE	45
-164.25	63.75	'WIS_82136 '	999.	VBY	USACE	45
-164.00	63.75	'WIS_82137 '	999.	VBY	USACE	45
-163.75	63.75	'WIS_82138 '	999.	VBY	USACE	45
-163.50	63.75	'WIS_82139 '	999.	VBY	USACE	45
-163.25	63.75	'WIS_82140 '	999.	VBY	USACE	45
-163.00	63.75	'WIS_82141 '	999.	VBY	USACE	45
-162.75	63.75	'WIS_82142 '	999.	VBY	USACE	45

-162.50	63.75	'WIS_82143 '	999.	VBY	USACE	45
-162.25	63.75	'WIS_82144 '	999.	VBY	USACE	45
-162.00	63.75	'WIS_82145 '	999.	VBY	USACE	45
-161.75	63.75	'WIS_82146 '	999.	VBY	USACE	45
-172.25	63.50	'WIS_82147 '	999.	VBY	USACE	45
-168.25	63.50	'WIS_82148 '	999.	VBY	USACE	45
-165.00	63.50	'WIS_82149 '	999.	VBY	USACE	45
-164.75	63.50	'WIS_82150 '	999.	VBY	USACE	45
-164.50	63.50	'WIS_82151 '	999.	VBY	USACE	45
-172.25	63.25	'WIS_82152 '	999.	VBY	USACE	45
-168.25	63.25	'WIS_82153 '	999.	VBY	USACE	45
-165.50	63.25	'WIS_82154 '	999.	VBY	USACE	45
-165.25	63.25	'WIS_82155 '	999.	VBY	USACE	45
-172.25	63.00	'WIS_82156 '	999.	VBY	USACE	45
-172.00	63.00	'WIS_82157 '	999.	VBY	USACE	45
-171.75	63.00	'WIS_82158 '	999.	VBY	USACE	45
-171.50	63.00	'WIS_82159 '	999.	VBY	USACE	45
-171.25	63.00	'WIS_82160 '	999.	VBY	USACE	45
-171.00	63.00	'WIS_82161 '	999.	VBY	USACE	45
-170.75	63.00	'WIS_82162 '	999.	VBY	USACE	45
-168.25	63.00	'WIS_82163 '	999.	VBY	USACE	45
-165.50	63.00	'WIS_82164 '	999.	VBY	USACE	45
-170.50	62.75	'WIS_82165 '	999.	VBY	USACE	45
-170.25	62.75	'WIS_82166 '	999.	VBY	USACE	45
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   -175.50   51.75  'WIS_82446 '    999.   VBY  USACE     45
   -175.25   51.75  'WIS_82447 '    999.   VBY  USACE     45
   -175.00   51.75  'WIS_82448 '    999.   VBY  USACE     45
   -174.75   51.75  'WIS_82449 '    999.   VBY  USACE     45
   -174.50   51.75  'WIS_82450 '    999.   VBY  USACE     45
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    178.25   51.50  'WIS_82452 '    999.   VBY  USACE     45
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   -176.25   51.25  'WIS_82468 '    999.   VBY  USACE     45
   -176.00   51.25  'WIS_82469 '    999.   VBY  USACE     45
$
$ Pacific WIS points
$   LON      LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
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-144.00	59.00	'WIS_81046 '	999.	VBY	USACE	45
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-170.50	-15.00	'WIS_81159 '	999.	VBY	USACE	45
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-169.00	-13.50	'WIS_81169 '	999.	VBY	USACE	45
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-162.00	22.00	'WIS_81171 '	999.	VBY	USACE	45
-166.00	23.00	'WIS_81172 '	999.	VBY	USACE	45
-174.00	25.00	'WIS_81173 '	999.	VBY	USACE	45
-178.00	26.00	'WIS_81174 '	999.	VBY	USACE	45

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$
$ Gulf of Mexico WIS points
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
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   -97.25   25.08  'WIS_73008 '    999.   VBY  USACE     45
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$
$ Atlantic WIS points
$   LON     LAT     NAME          AH   TYPE  SOURCE  SCALE
$ ---------------------------------------------------------
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$  -70.0    37.5   'ZNT42     '  999.   VBY  NCEP       0
$  -67.5    40.0   'ZNT43     '  999.   VBY  NCEP       0
$  -85.0    25.0   'ZNT45     '  999.   VBY  NCEP       0
$ -125.0    47.5   'ZPZ41     '  999.   VBY  NCEP       0
$ -125.0    45.0   'ZPZ42     '  999.   VBY  NCEP       0
$ -130.0    42.5   'ZPZ43     '  999.   VBY  NCEP       0
$ -122.5    35.0   'ZPZ44     '  999.   VBY  NCEP       0
$ -120.0    32.5   'ZPZ45     '  999.   VBY  NCEP       0
$ -122.5    27.5   'ZPZ46     '  999.   VBY  NCEP       0
$
```

```
$ End of list
$
     0.00    0.00  'STOPSTRING'  999.   XXX  NCEP       0
```