



# Informatics, Inclusion, and Integration: Linking Adaptive Management to Adaptive Science

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with contributions from  
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**Scott Wooldridge, Stephen Hall, Terry Done et al. (AIMS)**  
and the entire Hexacoral project team

Basic definition -- **INFORMATICS**: application of computer and internet technology to data and metadata to enable their

- Identification, acquisition and conversion;
- Analysis and synthesis; and
- Dissemination and application.



## Objectives, extended definition, and rationale

### **User-friendly access to information, data and tools broadens participation, understanding and ownership:**

- **Transparent access and easily visualized information and procedures ‘level the playing field’ for participants from diverse backgrounds;**
- **Consistent, accessible output in the form of interactive images serves to inform, educate, and enlist policy makers and the general public.**
- **Field scientist and managers can work directly with data and models to define problems and test solutions;**

Development and implementation of multi-stakeholder solutions to temporally urgent, large-scale problems is a natural arena for high-leverage application of informatics.



## State of the science, status, needs and opportunities

Many datasets and much information is on-line (e.g., NVOODS, OBIS, CORIS, ReefBase, AIMS, WRI -- but:

- **search and visualization tools are limited,**
- **data integration and application still requires high-end, off-line computer skills and facilities,**
- **interoperability among (and even within) providers is extremely limited, and**
- **the potential for dynamic sharing of the full cycle from problem identification to implemented solution is not yet realized.**

Examples from the domain of SST time series analysis:

- Map products of temperature stress history (NODC/WWF)
- Multi-variable model outputs (AIMS)
- SST history data access and comparison (Hexacoral)



## Searching for areas resistant to bleaching

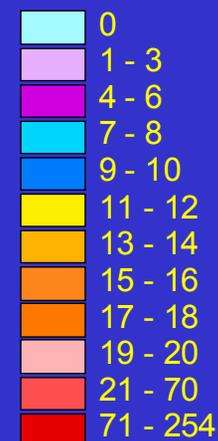
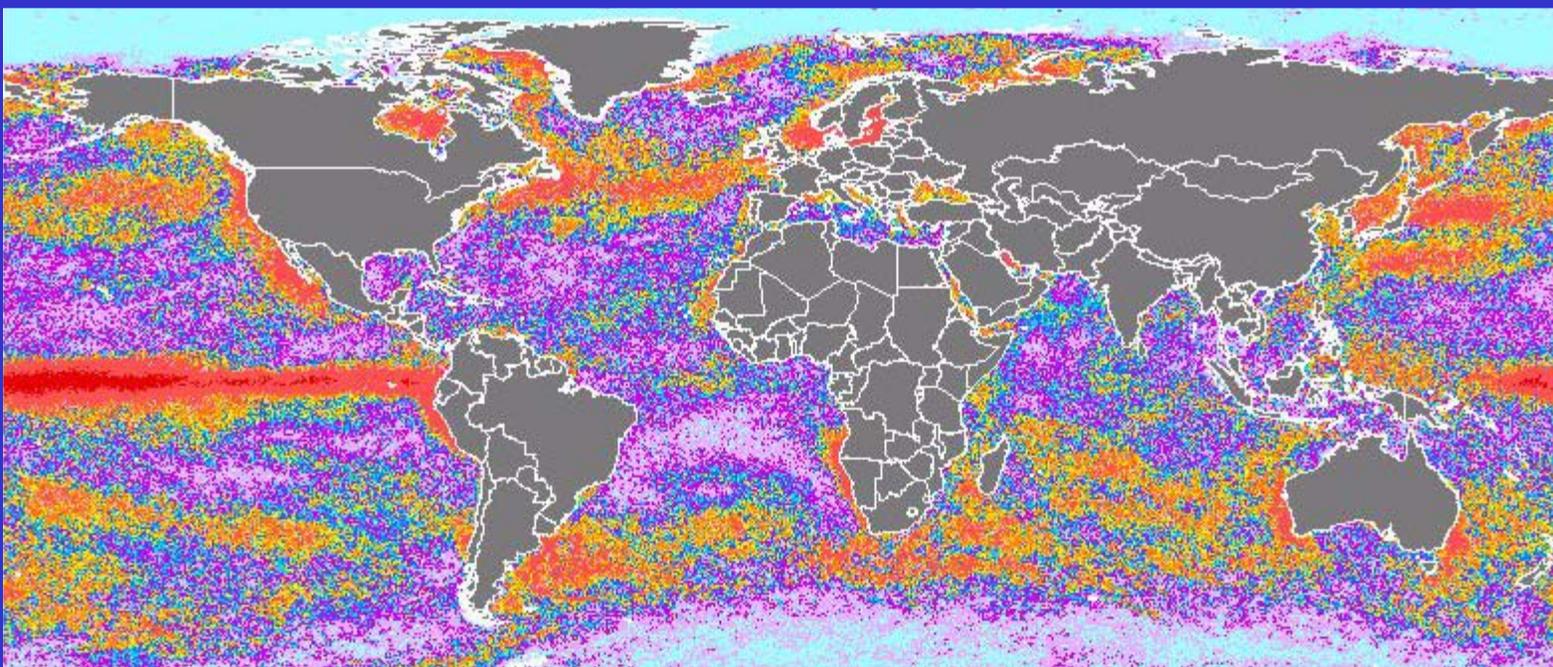


**Are there places that have never experienced a warm-season thermal anomaly?**

- global scale
- new AVHRR Pathfinder 9km pentad SST climatology (MPMC)
- integrating 3 disparate data sets - UNEP-WCMC coral reefs, NOAA MPMC, ReefBase bleaching records

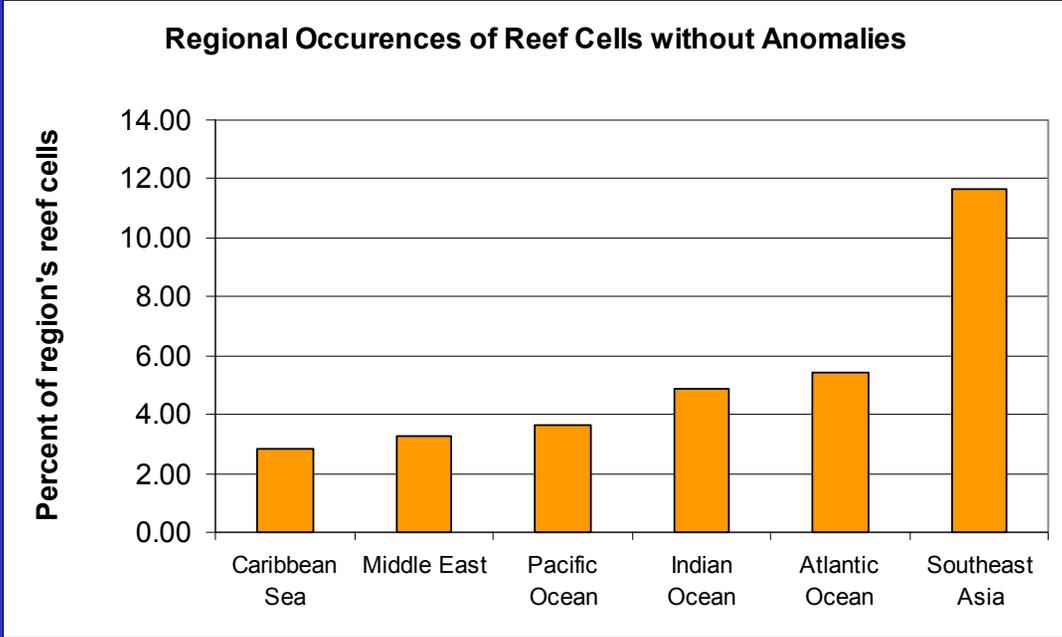


# Searching for areas resistant to bleaching

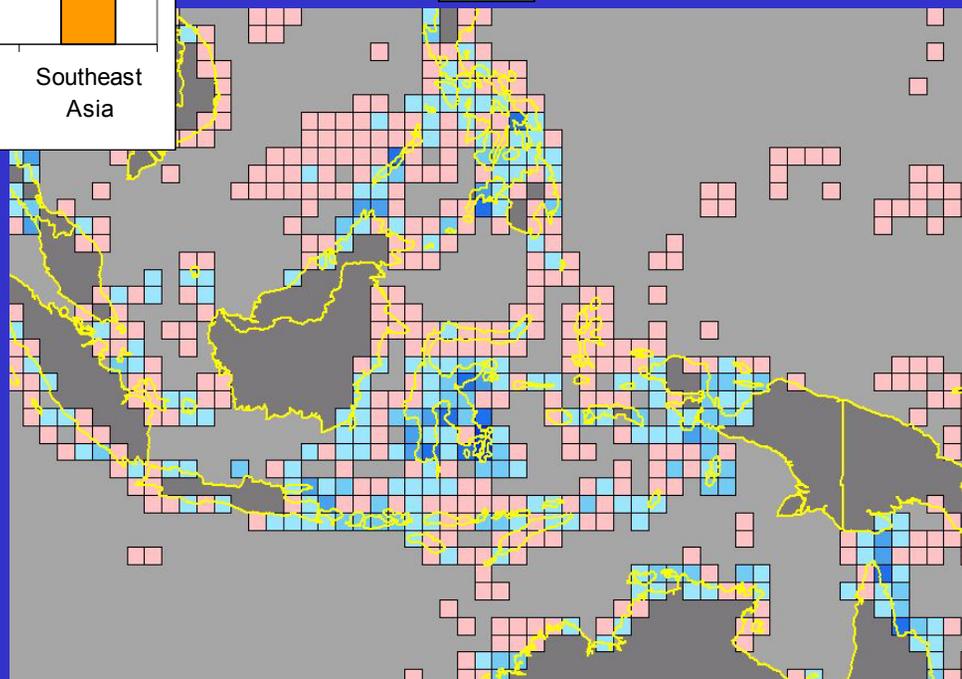
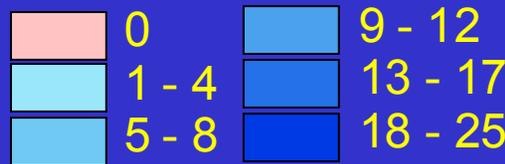


Frequency of warm-season thermal anomalies in 9 km cells from MPMC (1985-2000)

# Searching for areas resistant to bleaching



Number of generalized 90 km reef cells with zero warm-season thermal anomalies



See also: poster by Andrew Barton



# Searching for areas resistant to bleaching



## Major issues in development of analysis

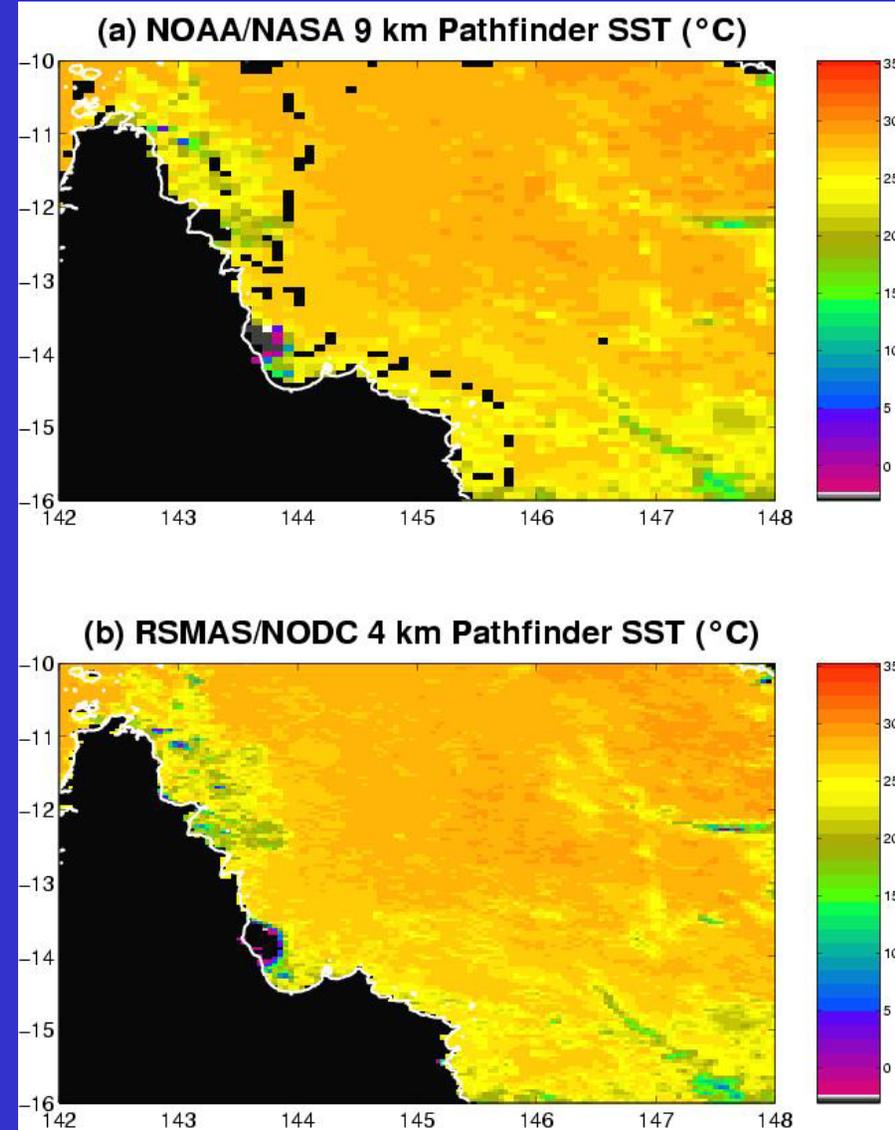
- incompatibility of data sets (scales, extents)
- lack of consistent, well geo-referenced bleaching and/or recovery records
- technical issues with the SST data
- Much data processing required before analysis

## Management implications

- every region has areas that could be less prone to thermal anomalies and should be considered as part of a conservation strategy
- the Coral Triangle region has the most areas free from past extreme thermal anomalies
- resistant areas may be one facet of an MPA network strategy to spread the risk of thermal bleaching

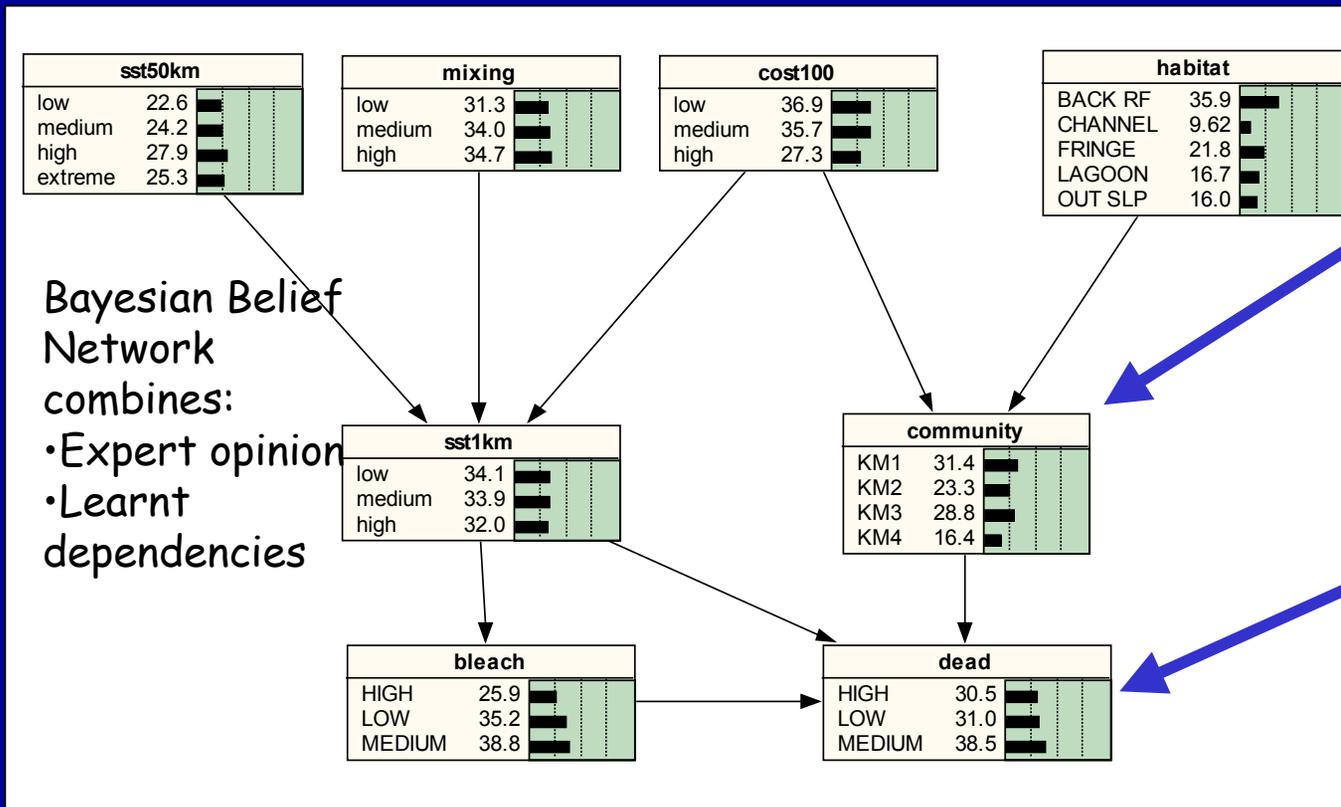
## Improvements / next steps

- higher resolution analysis globally, forthcoming 4km SST data regionally, nationally for planning purposes
- indicators of mortality, degree heating week, etc.
- incorporate other parameters that might indicate bleaching resistance and/or resilience (e.g. (u/v, water movement, etc.)



# The AIMS modeling effort – analysis informatics: active computational exploration of combining multiple variables and multiple criteria to predict effects on heterogeneous targets

See: presentation to follow



1. Four all inclusive classes of biodiversity

2. What combination of factors best predict places where mortality will be in 'low' category



## User access and applications

**How do potential users gain access to the products as tools rather than conclusions? For example --**

- **Apply alternative strategies for MPA selection (as climate changes, ‘naïve’ populations may be more vulnerable than those with ‘experience’ in surviving anomalies)**
- **Combine with local expertise or data to evaluate analogs, or the role of history in determining observed responses and conditions**

Hexacoral is serving dynamic access to visualization, comparison, and (soon) download of georeferenced SST histories and other environmental data. The existing structure can accommodate any georeferenced dataset with relatively minor modifications to the user interface ‘front end.’



The Hexacorals site offers dynamic access to multiple global SST model datasets by map or form entry

Interactive map tools provide for point selection or viewing of location entry; list upload and bounding box inputs will be available soon

# Biogeoinformatics of HEXACORALS

[Home](#)

[View/Edit Cart](#)

[Locations from map](#)

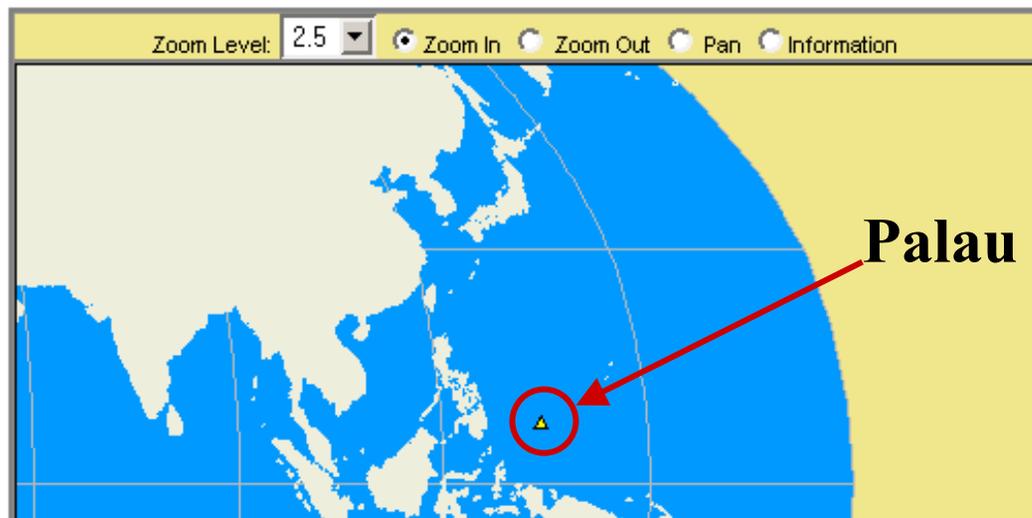
[Create Timeseries Graph](#)

Enter Locations From Map:

Locations present in your cart are indicated by yellow triangles on the map below:

To enter a point from the map :

- 1) Zoom on the area of interest by selecting "Zoom In" and clicking on the region of interest
- 2) To Select (add) a point, select the "Information" option and click the desired location on the map





Location(s), dataset(s) and time period(s) are all user-selectable for visualization...and more

The user may enter multiple locations for examination or comparisons (a deg-min-sec converter for lat-long is provided)

Enter location coordinates in decimal degrees and click the "Add Point" button:

*Geographic Conventions:*

north *latitude* and east *longitude* are **positive** numbers  
south *latitude* and west *longitude* are **negative** numbers

latitude :   
longitude :

Add Point

datasets served		
Reynolds one degree weekly SST	Reynolds two degree monthly SST	Hadley one degree monthly SST
Date Range : 1982-2001	Date Range : 1854-2001	Date Range : 1871-1999
Latitude extent -40 to 40 degrees	Whole world	Latitude extent -40 to 40 degrees
<a href="#">source/metadata</a>	<a href="#">source/metadata</a>	<a href="#">source/metadata</a>

Three different datasets are selectable

Time periods or locations may be compared

Locations in your Cart

Latitude,Longitude

Begin year :

End year :

Generate Graph

Locations in your Cart

Latitude,Longitude

7.5,134.5

Date Range 1 Begin :

Date Range 2 Begin :

Time Period of interest (years):

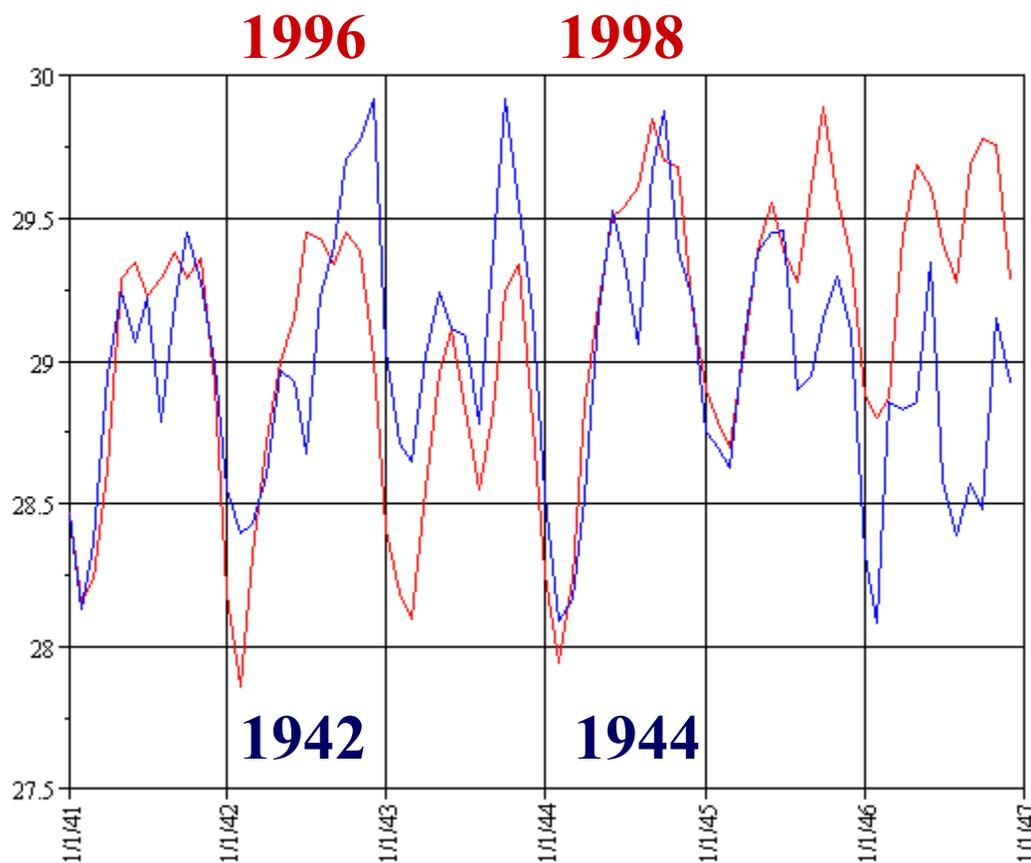
Generate Time Comparison Chart



## Hindcast models can test the uniqueness of recently documented anomalies

### Reynolds 2° SST data suggest major bleaching in Palau in 1940s

*Time Series SST Graph*



**Palau -- 1942-1944 show SST anomalies comparable to those of the 1998-2000 periods ---suggesting that major bleaching episodes are not a novel phenomenon**

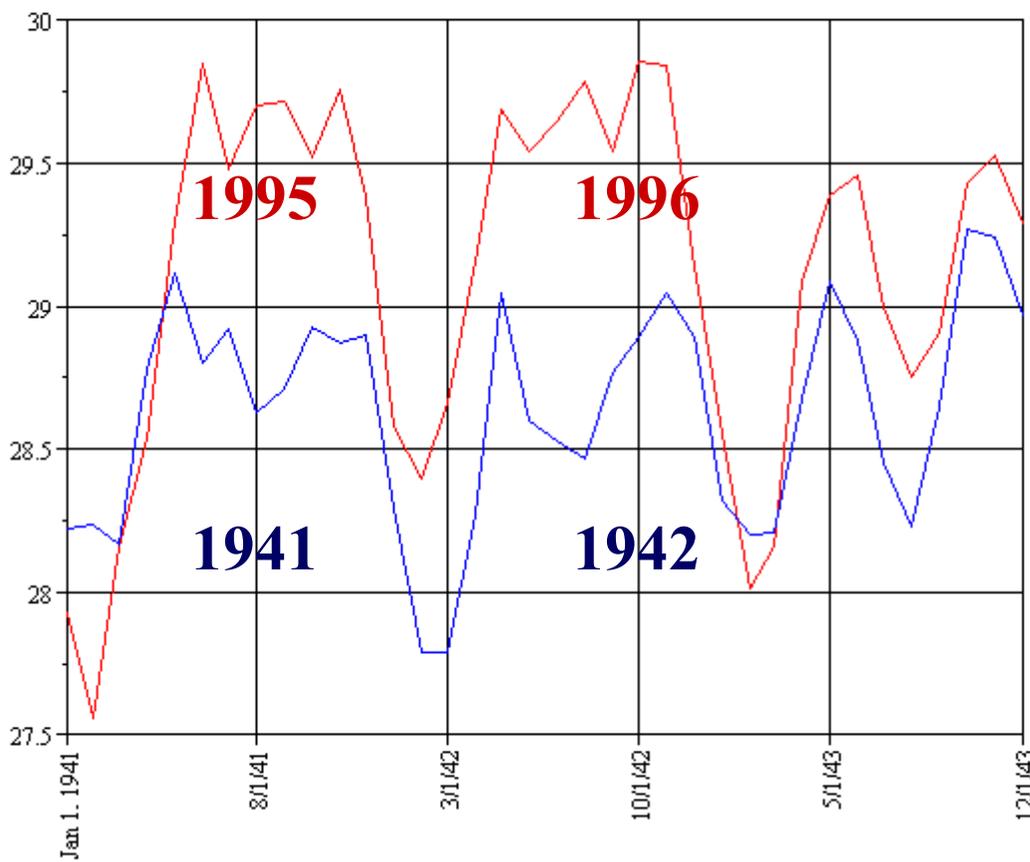
— 1995 - 2000  
— 1941 - 1946



# Comparison and selection of models -- critical for hindcasting and historical analysis

**The Hadley Centre model yields a different past.....**

*Time Series SST Graph*



**Unlike the 2° Reynolds SST reconstruction, the Hadley Centre 1° model hindcasts NO significant SST anomalies for Palau in the 1940s.**

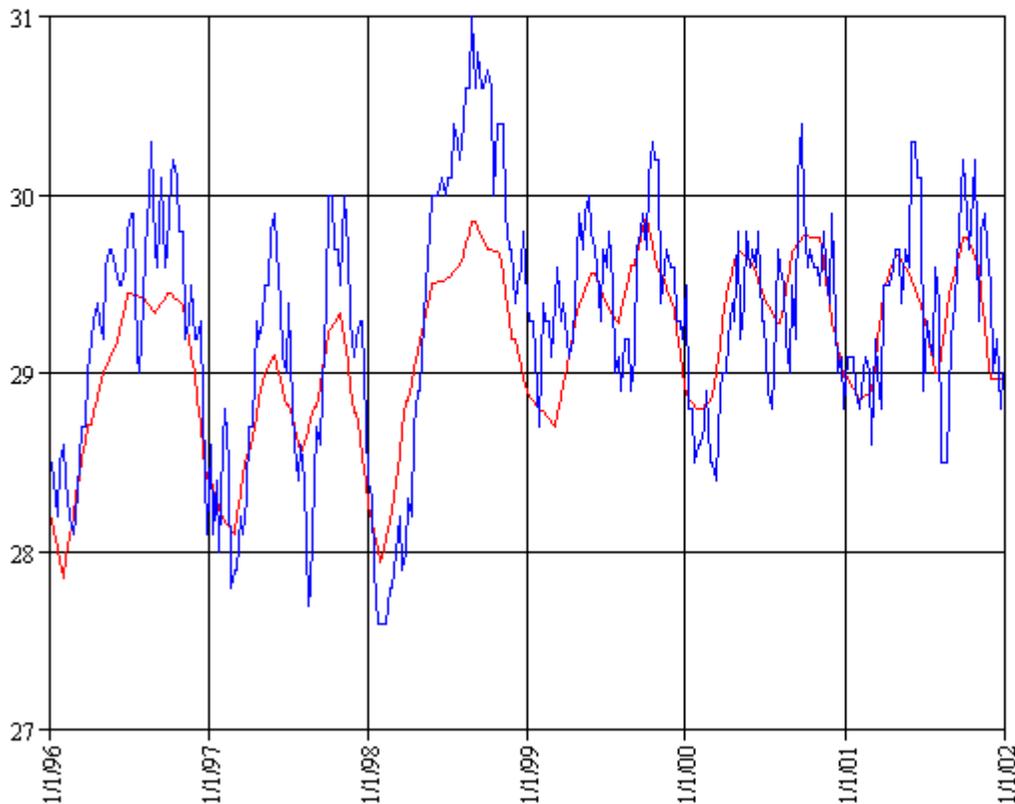
— 1995 - 1997  
— 1941 - 1943



Scaling effects, both general and model-specific, must be considered

### *Time Series SST Graph*

## Palau dataset comparison, 1996-2001



Comparisons over the same period suggest that the peak damping in the two degree model is not consistent relative to the range of excursions in the high-resolution dataset

— Reynolds two degree  
— Reynolds one degree

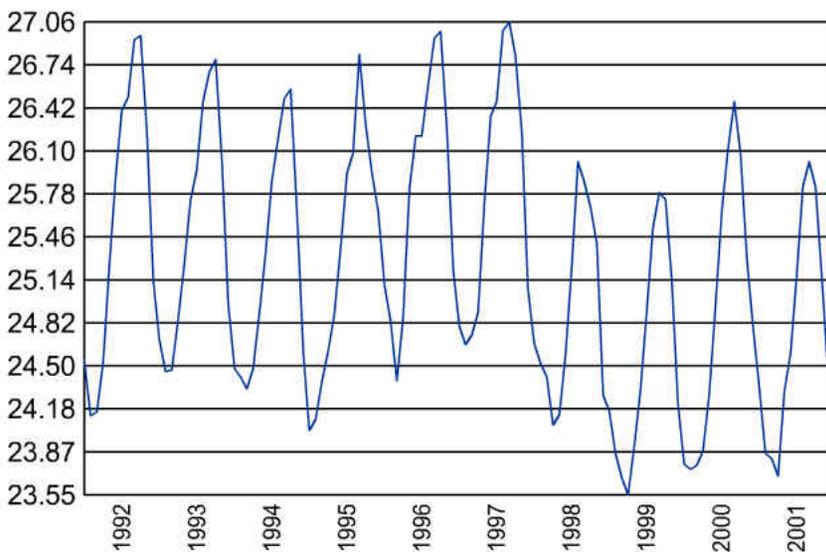


## What's next -- Hexacoral

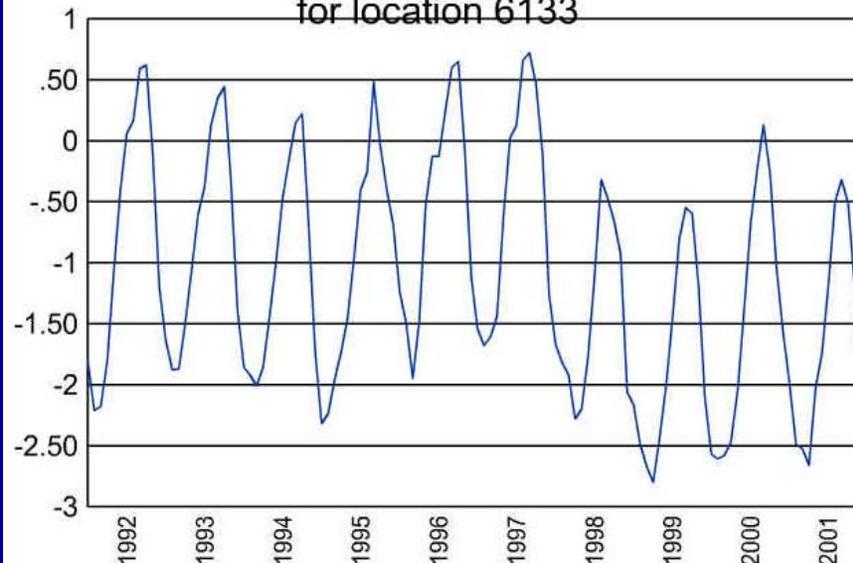
See 'poster' display

- Fully implement dataset comparison options
- Provide data download and image save options
- Tighter integration with full environmental database (concurrently query other parameters) and biological/station database components
- Provide dynamic calculation of anomalies with user specified intervals and baseline criteria

Time series for location 6133



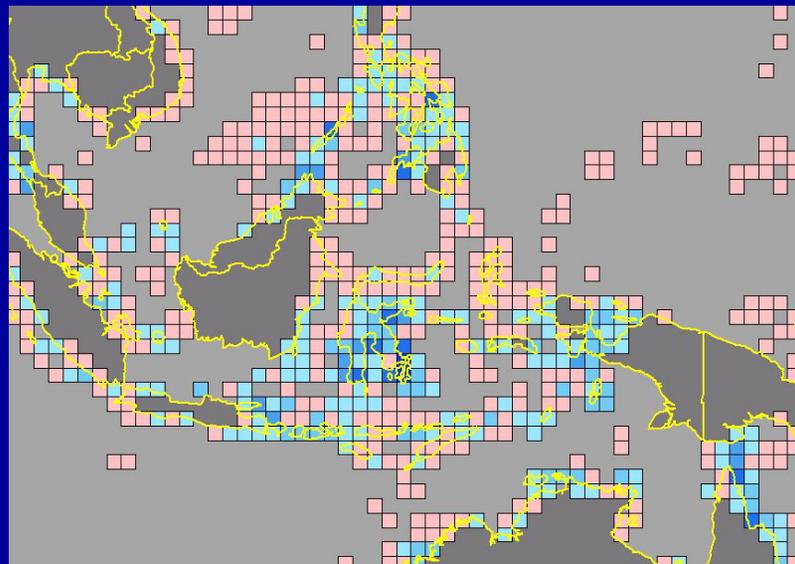
Actual SST value - Average Max Month (26.35) for location 6133





## What's next – Community suggestions

Datasets such as this can easily be dynamically served, searched, and linked to other georeferenced datasets for visualization and download within an existing informatics system structure



In the slightly longer term, bilateral database interoperability is readily accomplished (e.g., Hexacoral and NMITA; Fishbase and Cephbase with Hexacoral), and federations such as the Ocean Biogeographic Information System (OBIS) are moving toward fully interoperable distributed data/information systems

