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IMPACT Working Group meeting
Atlantic Oceanographic and Meteorological Laboratory
August 15, 2011

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NOAA Participants
- Joe Clarck, National Weather Service, Detroit MI Forecast Office
- Pamela Fletcher, Florida Sea Grant
- Lew Grammer, Atlantic Oceanographic and Meteorological Laboratory
- Ben Haskel, Stellwagen Bank National Marine Sanctuary
- Jim Hendee, Atlantic Oceanographic and Meteorological Laboratory
- Catherine Marzin, Office of the National Marine Sanctuaries
- Doug Pirhala, National Center for Coastal Ocean Science
- Varis Ramsey, National Center for Coastal Ocean Science
- Karsten Shein, National Climatic Data Center
- Ruben van Hooidonk,

Academic participants
- Scott Sheridan, Kent State University, geography department
- Cameron Lee, Kent State University, geography department
- Chuanmin Hu, University of South Florida
- Henry Briceño, Florida International University

August 15, 2011
Participants: Scott Sheridan, Cameron Lee, Karsten Shein, Doug Pirhala, Chuanmin Hu,
Joe Clarck, Lew Grammer, Henry Briceño, Jim Hendee, Catherine Marzin, Varis Ramsey.

Introduction:

Catherine Marzin and Doug Pirhalla

Doug Pirhalla – NOAA's IMPACT
NOAA wide partnership
From science perspective, IMPACT is about integrating water, climate and weather obs to
generate analytical tools for sentinel site managers, end users and the public
Why? To understand the interactions at relevant management scales. Not fully investigated yet
Expected products: historical climatologies, climate impacts scenario models and predictions,
MPA managers tools/products/fact sheets
Includes all NOAA line offices apart from NMFS
Conceptual model: from global patterns to weather types, to water responses, to climate impacts.
Use [progressive, holistic approach to define linkages between weather and water
Focus on available data series across multiple platforms
Hind cast models of weather and water responses tied to coastal issues (nutrient pollution,
thermal stress/habitat degradation, toxic blooms…).

1. Research plan:
Weather clusters to water response

Technical approach: take relevant atmos datasets, combine data to come up with climate states/clusters to come up with analogous states in ecosystem response. Look for statistical relationship
Output = scenarios, climatological maps

Interim outputs: weather types: circulation patterns, weather frequencies composite mapping, weather frequency response --correlation coefficient

Scott Sheridan/Cameron Lee presented their effort to develop Synoptic SLP patterns & their relation to <u>chlorophyll levels</u>.

Looked at different datasets to see how to develop synoptic climatologies/weather types.

1. Cameron: generating weather types

Goal: Create synoptic patterns
   Simplification of atmosphere – relate to oceanographic variables

Data = NARR (1979-2009) sea level pressure data over southeast region and SeaWIFS
   chlorophyll data (1997-2009)
Data permutation to format data prior to analysis to relate best to specific env. events: tried raw data, temporal anomaly, combined 5-day lag, 5 day filtered (pre-PCA)
   ➔ Chose to use daily spatial anomalies – mean daily SLP, highlighted daily pressure gradient (daily average pressure anomalies relate most to chlorophyll)
Methods: 1) Principal component Analysis:
   o Eliminates high degree of spatial autocorrelation
   o Identifies primary modes of variability
   o Reduces redundant data
   2) Cluster analysis: 2-step clustering component in SPSS- 12 SPSS remaining, sorts every day into one of 10 clusters
One measure to try to determine clusters – how discriminate specific events - problem with fewer clusters across seasons, loose discrimination – some clusters have preferential seasonal occurrences. Looked at distance metrics of some of the permutations. Keep scores,

(Q: Henry: use score, SD, median, and Median Absolute Deviation for each PC, so that rely on magnitude of change, and incorporate variability: show when mean value is constant, but seasonal variability is not – retain scores for each station events, then calculate for each stations (can be used for pixels to run with pixel analysis) used for spatial analysis
Q: Lew: weighing clusters with equal weighing. Issue with PCA is enforced orthogonality between the modes (2nd mode is an offshoot from 1st) was there another independent analysis before clustering? Alternative methods? A Cameron: No rotation/weighting. Purpose of the clustering analysis not to do that. A Scott: tried to retain fewer clusters on another project. End result was ended up trivial effects on classification.
Q Henry: Cluster gives discrimination power to tie up to physical phenomena. Scott- more concerned if were interested in

Q Karsten: choosing clusters statistical or tied to physical interpretation? A Cameron Classification is purely statistical then can analyze the physical quality of cluster. Henry: For water quality data, each principal component has distinctive physical meaning. Karsten, would tend to go from physical to statistical. Cameron in synoptic

Q Lew: NARR - very high res time + space, but literature on ground truthing of NARR at smaller scale were giving poor results (precip, cloud covering…) how sensitive is methodology to this issue? A Cameron: Have not yet studied this. A Scott: Doing with pressure because more continuous. Don't think effects would be substantial. A Joe: On NARR – Sea level pressure field pretty accurate. precip, cloud cover, more touchy compared to larger scale models would be better than NARR especially for a direct analysis. Assimilate different sources of data. State of the art. But there are discontinuities in land-sea boundaries.

Henry: how many variables used in PCA? All 400. But 12 account for 98% of variability)

Results:

- o Chlorophyll regions
- o Pattern 1: tropical low – mean anomalous pressure map _ low pressure center south of FL Keys. Scale: low pressure in pink, high in blue (in N CA)
- o Bargraph show seasonality of pattern. Increase frequency in Sept
- o Table: relate sea level to chlorophyll in 3 different regions – numbers represent relative ratio of sum 0-5 day lag Chlorophyll levels (how much is present vs. relative to average of this month.
- o For Pattern 1: during sept-nov dec increase ch levels in central Florida shelf (97-2009)
- o Pattern 2: Carolina lows: low pressure in Georgia-CA. Peak in November and March. Low in summer. Higher CL level in feb-mar . Keys not same response as other 2 geo region.
- o Pattern 3: Nor'easter: low pressure in gulf of Maine, weak high over Mississippi level. Dec-march. Strong relationship to chlorophyll in Feb-April.
    - Q: Hendee: How those high CHl match to fisheries productivity.
- o Pattern 4: East coast high: low over broad East Coast region. Spring – Fall. CH level lower than average in first part of the year to May (anomaly in Feb) – during 2 peaks in FL Keys, May and Oct have increased CH in Keys
- o Pattern 5: Approaching front: coming from the west (high in Gulf, low offshore). Sept – May). Relationship to CH levels muted
- o Pattern 6: Means summer flow - summer sea level pressure . peak in May June July -- occurs more than 50% of time in July. IN off peak below averages, during peak: average levels of chlorophyll. Pattern occur so offend than represents averages.
- o Pattern 7: Southern Plains Front - Highs in the west. Seasonality is spring dominant – relationship to CHl: increased level in Jan Mar. close to average CHl in summers
    - Q Joe: check for lag in CH variability – plus special scale Henry – how to explain strong shifts in CHl levels from month to month from very high to very low ratio in CHl. Chuanmin: maybe jumping due to uncertainty in satellite data. If in some month, strong wind there may be more signal but it is not CHl. In March, clearest month, but pick up sand bars on bottom – so data would be biaised
    - Q: Lew: A lot of features are translating rapidly. For spatial anomalies, how to account for frontal passages, and other local weather variations A Cameron:

explored when looking at control, plus including sum 0-5 day lag. A Scott: use something like larger scale synoptic circulations to capture mores until component of circulation. Karsten: could cluster variables for each pattern.

- o Pattern 8: Western Gulf Low: Low in west coast High over north FL to NCal– dominant in early winter. Relationship to CHl: see some gains during spring. And fall. But more muted relationship during peak seasonability.

   Q Henry: Interested in pursuing developing a global seasonality using all the patterns to try to relate to water quality data to find relationships – to compare distribution of water quality to Chl seasonality Question: in terms of climate: does it make any sense. Karsten: interested in comparing seasonality with in situ climatologies of climate extremes. Scott: what is hard for us is to aggregate/group/ synthesize.

   Q Jim: See utility of aaproach if can explain it in layman sense. Could use same approach for turbidity/water clarity products, not just chlorophyll.

- o Pattern 9:Weak Trough: not a lot of pressure gradient – dominant in summer June-Aug) not a lot of relationship with CHL during peak seasonality.
- o Pattern 10:Cold Core High: high pressure in central US. High frequency in winter non existent in summer. High CHl in summer.
- o Pattern 11
- o Pattern 12

Summary – patterns do a good job in capturing daily SLP variability in the region- further investigation shows precip; CHl levels high with low pressure: late winter and spring (pattern 2 and 3) and automun (pattern 1); CHl lowest in pattern 6 high pressure to the east of study area

2. Scott: How weather types vary/respond to climate variability
How patterns respond to interannual variability: tropical low – tropical activity – mean response southwest of FL Keys – anything with low pressure in southern FL.

Season in 2005 # days had 38 days with this category but 2006 only 7.
- ➔ With only 10 categories, does a good job identifying seasonal patterns/high hurricane seasons.

Spatial synoptic classification. El Nino and circulation types: Aggregate Circulation patterns can vary – just for winter: during El Niño events – get more active activities in the east coasts - 5 additional days of coastal lows, and cold core highs. Cause: ENSO impacts are more consistent than others. La Nina associated with increased frequency of Pattern 8. Looking at pattern 10, ambiguous results – largest and smallest year both in El Niño events. How useful are mean values in the first place?

   Q Joe: Suggestion -- look at MEI not just SST for a more comprehensive physically meaningful index than just SST.

   Lew: Circulation is larger scale. P&A may be more strongly related to ??? Time of transition can have big impacts early El Niño vs. late El Niño year as opposed to looking at strong or weak El Niño years.

Analytical questions:
- How to statistically analyze circulation patterns vs. water variables
   - o Incorporate lag time

- o Aggregation of frequency or anomalous frequency
- o Composites for anomalous water events
- Aggregation of circulation patterns into groups
  - o E.g. Cyclonic patterns – Pattern1,2,3, there is strong cyclone in the region – can we aggregate the 10 patterns around cyclonicity index? Associate it with Chlorophyll in C fl shelf in winter/spring?

Q Doug: how to aggregate clusters is a big question. Not seeing how they do occur through time. Manuscript is half written – getting closer to pick up what to hit on most in manuscript is a topic for today.

A. Scott wants to make sure focus on what is relevant for IMPACT project

Q Henry – for our classification of water quality types for South Florida, relate to specific changes at high resolution – Henry have more bio-chemical variables – Scott: Wanted to have more patterns rather than less: approximate number of patterns in order to have more flexibility..

Joe Boyer: NOAA IMPACT: North American Regional Reanalysis

Outline
- Applicability of NARR composites vs. using local measurements
- Comparison: observed variable distribution at a point to a NARR composite
- Synopsis of wind fields by cluster using mid season month
- Questions

Reanalysis vs. obs: filter out local effects and noise (sea breeze, turbulence, or poor instrument location
- Spatially coherent and self-explanatory
- Temp in particular is sensitive to instrument location especially land vs. sea
- Concerned with conditions over water where obs tend to be sparse
- Win seems of particular interest – models are better
- Cons: only as accurate as model – considered state of the art – not perfect, but best

Obs distribution vs. composite NARR a little low on temp – but t be expected because inst over land, NARR over water. NARR generally tends to handle temperature well.

Character of Winds by clusters
- Cluster 1: E SE wind with defined low pressure nearby, NW in winter
- Cluster 2: S-SW wind with SW-NE oriented convergence zone (e.g. front)
- Cluster 3:N-NW wind with high pressure over the Gulf States. Very few summer samples. Influence of continental air from the north seems probable
- Cluster 4: E-NE wind with high pressure over the east
- Cluster 5:ESE-SE wind with SW-NE orientation
- FL Keys on the warm side
- Cluster…
- Cluster 10 NE-N winds with strong high pressure upstream over the …..

Q Doug – winter storm clusters of interest. For cluster 10 – wind field as relate to synoptic types. Is pattern 10 related to frontal passage? A Joe: probably – in cluster 10, wind coming to se into gulf, then diverging n to Florida indicating a front. Near zero wind speed over FL straights. Not sure why. Get same signature in January. Pattern 10 winter dominant pattern

only 1 day with this pattern in July. Keys is right over frontal zone. → Assume some precip. associated with this pattern

Doug: If put them into a transition mode – 3 would be after 10 assuming they are dominant in the winter

Varis Ramsey - trend analysis
10 clusters
Looking at water responses in Chlorophyll.

Looking at Turbidity.

Normalized anomaly = instantaneous daily – (minus) median of day / (divided) standard deviation
Allows us to compare data from different spaces and time, and to get rid of limitation of ocean color data.

Can find expected frequency for any given day.

The histogram bars represent the frequency of that weather type in the previous 5 days.

The upcoming probability plots of weather patterns high chlorophyll responses were computed as follows:
Pick weather of interest and note its dates between 98-2000
Extract surface Chlorophyll on these dates (not month specific) and along a transect
Count number of highs and lows Chlorophyll

Tropical Low – Cluster 1.
Probability of observing high and low chlorophyll

There tends to be a trend in Cold Core high (cluster 10.
Mean summer flow - Lows and highs go n different direction probability of observing high and low chlorophyll. Eliminating extreme noises

All months
 → Rom scatter plots to map plus stratify the data by month
 → Probability of observing low chl. As increase weather frequency deviation, probabilities change
Our of 14 days, how often does the weather pattern occur before getting high chlorophyll
"the number of ### highs the previews ## days when "cluster pattern #" occurred ### % of time."

For mean Trough
As weather frequency increases, fewer high chl days

Southern Plans front:

Conclusion: there are trends that can be used to booster the proof of concept

Q Chuanmin: there is trench between shoreline and offshore water. (cold core high). Why? No answer

DOUG: Correlation patterns

Chlorophyll deviation maps by weather cluster.

There are trends in the data, but not quite explaining what is going on. Month to month shift in Chl response to a particular weather cluster can be confusing.

Climatological deviation/ frequency of each weather cluster:

  When look at frequency of clusters, we are measuring 30 days prior to an event. → gives relative frequency.

For cluster 1. Climatological norm. 04 and 05 where extremes in hurricane frequency
Cluster 2 has no co-occurrence in 2005, but co-occurrence with 2005.
Same with Cluster 10. → Show that there is a lot of variability within a short time span. [based on transect]

First ?? statistical frequency analysis correlation coefficient
Tropical low weather cluster frequency and chlorophyll time series. Showing decent patterns for some of the transec. 30 day prior frequency deviation

Persistence of a cluster prior to an event. Dealing with transitions from one cluster to another. Need statistics to see coincidence of two clusters. Multivariate correlation not much association across 97-2009.

DISCUSSION
Likelihood of high or low chlorophyll
CHUANMIN: Chlorophyll anomalies may be the key for managers (for the shelf, not for the keys). Turbidity is not manageable. Also Chlorophyll (tied runoffs). Managers may not care offshore as much as inshore. What is considered a bloom on a shelf? >.5 or 1. What is the level that kills fish? >.5-1. >.5 have to close shelf beds. >1 close beaches. So can we predict these absolute anomalies?

   ⇨ For management support need to look at absolute values too. For coastal waters, the higher concentration, the more accurate the value

Henry: Use weather type as a gradient for Chl and derive water quality

Suppose within a month Cluster 1 there are 5 values of Chl. Number of days vs. Chl. Then another samples… compare time series… doing it for each locations.

Lew: trying to go up trophic scale – starting with water quality

If can predict water quality conditions – benefit will be for a lot of people as opposed to generic climate forecast.
Chuanmin
Step 1: white paper with possible applications of the approach → discuss success rate of predicting events.
Step 2: tie to particular management implications (fine-tune approach for particular application, regional specific, ..)

Scott: for first paper: do we need to show predictive capability? Can still show

Lew: step 1: be iterative. Once think of particular applications then could fine-tune weather types to get different clusters if need be.
Look at applications for funding

Scott: do we need a paper out to show did that or just the connection?

Proof of concept already there, Weather types relate to these properties.

CRCP looking for better predictions of climate weather and associated coral reef variables. Cold snaps, clarity, turbidity. As part of RFP.

Chuanmin: Can you explain why there was extreme cold even in Jan 2009 and Dec 2010 using clusters? Manatees and fish die-offs, coral bleaching … What caused this?
Think publishing on it would be interesting
Scott: could look at link with circulation patterns
Could be done. Larger scale anomalous events.
Or could look at teleconnection values in and of themselves to get that much of a response.

Joe: when in January 2010? First half of Jan. went below threshold for coral mortality Jan 10-17. Winter stands out because arctic oscillation went below. A week in mid Jan when pattern relax during that same week that was atypical. Lew. Could be shown by daily weather type analysis. But: if freak events may be difficult to study. Scott could do composite of synoptic conditions prior to these events.
Need to go beyond scientific papers to actionable information for managers, even if for extreme events. (take turtle out of water, close certain activities, etc).

Application: do not need direct management usage of climate variability map but get another link. Need to

Define boundaries of MPAs – the least variable waters.
MPAs reference control sites.

Emphasis on identifying refugia –significant coral covers

To relate water quality change to resource shift.

What is doable: if can predict precip several month in advance, will have implication on toxic waters. If predict lots of precip, proba of over flow in nearby estuaries. Directly related to decision making.

Rain water and nutrients are closely related. If man-made nutrients can control it.

What is the threshold. Can't start from .5 because it is too high. For a large portion of FL Bay and FL Key. Need lower. Oligotrophic in S Fl. "Black Hole for Nutrients.!"

Chuanmin: Precipitation and water quality
Satellite based water quality in the Florida Keys.

TO understand how to trust satellite data and when, whether

On one product: water quality (not Chl)

Emphasize accuracy and linkage to river discharge

Using FIU data. Found some problems.
Data from NOAA AOML cruise 1995-present
In 2 years from Jan 2009 to Dec 2010, every 2 month, all stations when light penetration sensor

Of the half stations that are good, looked at satellite data for concurrent same day within 3 hours.

Off 66 data points in 2 years. No data over the keys

At surface there is wave effects so need to visually judge that below 3 meter. So use iterative process to get optical depth. Shows that if change K change depending on depth

Can model difference on cloud free day. Compare measurements with model irradiance. If measurement agrees well then trust data. If not discard data.

Note: if K high, water quality is low.

Satellite data water quality products: 1) blue green pan ratio – Mueller 2000. 2) Chl based product Morel et al. 2007. 3) based on optical property of the water Absorption scattering Lee et al. 2002&2005)

Influence of the bottom on water color. Light blue tends to overestimate by eye and satellite. Can see the bottom, but it doesn't mean water is dirty. If large value R is big, bottom effect is small. Bottom effect can affect measured Kd.

3 products generated with Aqua and Terra - range from blue to coastal water is smaller than the Lee algorithm. Means algorithm 1 and 2. Means 1-2 platos earlier smaller range than 3.

How shall we trust the data? Range from .03 to .7. trust if satellite kd falls within this range.90% of time all year long in shelf waters, but close range less than 10% of time. Fl straight
Even if not in situ data in the FL Keys, can still trust satellite data. BUT can't trust data closed-in in the gulf.

How to trust data in FL Keys area: Use reflectance data from other cruises above water reflectance measurements to understand how contamination skews water quality satellite data. – use modeled reflectance. What is in the water, what is in the bottom, what is at depth.

Derive from satellite vs.
Below. 3 can't predict water quality
Above .3 one extreme point.
If satellite data is <.2

Problem with FL Keys because Keys water is so clear that you see bottom effect so much. Conclusions: Lee et al algorithm is preferred; Kd>.3 m -1 is always valid; Other than reef tract and inner FL bay, and 10K islands Kd is valid for .3-?

How to use the data.
Effects of precip and shark river discharge on ocean color parameters:
Three stations around Fl Keys are selected. Several products of Modis /Aqua are used

Choose 3 locations downstream of shark river. Looking at monthly discharge, and precip climatologies. See precip precedes discharge. Kd seems high (dirty water) is not corresponding to river discharge by one month delay

Relationship between discharge anomaly and Kd anomaly (1 month lag) is plotted in the following figure. The data are divided into with and without hurricane, tropical storms, ….

Discharge anomalies vs. Kd Anomalies for 3 stations without hurricanes and winter high winds, .there is some correlations with the rest of the year when include all the data.

Q Henry least square line has lower slope than the line with organic correlation. Use the slope of SD of the X axis divided by SD of Y axis. Intersect: average x to average Y.
Slope larger than ordinary least square fit.

Station C Benthic consequence of discharge is benthic algal bloom over Coral growth.

Still not confidence for Fl Keys water quality and Modis Chl

Even if can't tell time series for this range, we can count how many extreme events, only counting satellite data at higher range.

Henry: there are complete profiles but have not been used yet.

Quality control takes a lot of time.

Weather to Kd to Management
NASA is interested in any use of its data. The more uses, the better for NASA.

Only look at extreme thresholds (high values) in the Keys. Not enough in situ data in FK for few transects → can't use in situ dada or focus on specific transect. . See Libby and Nelson to extrapolate and make a map. Spatial extrapolation may be OK. How different can Chl be? Interpolation in temporal scale in shallow water difficult: can change very fast.

Henry Briceño: In situ validation/FIU Water Quality dataset

QA/QC of FIU datasets all analytical data has been QA/QCed and statistics have been calculated, including trend analysis and PC-Clustering for segmentation into water classes.

Chuanmin and Doug need all new dataset (final one that need to be corrected: dates, depth coordinates and time) Henry should be done by October
Chuanmin will use dataset for fine tuning/refining satellite validation

Preliminary exploration – mean difference for chl measure at FIU and SEAwifs. There seems to be patterns.
Compared monthly mean estimates

Standardized data – subtract mean, divide by SD.

Add data a running sum – a continuous rate of change of the parameter. Plotted slope means values below average. Horizontal = average, positive = values above average.

There is a general trend over the years

In Biscayne Bay, with erratic flow of nutrients, there is gradience in salinity in Bay – data shows except for 112, very nice seasonality but weird pattern of Chl Z-Cusum

Instances where pattern was the same or similar for stations that have bottom effects.

Dome shaped of the cusum is a declining trend. When V shaped, or U shaped, there is increasing
Nutrients (TP) time series show ecosystem used to hurricanes, go back to previews condition in a year. But when high input on the bay because of widening of US 1, Bloom last longer.

Regional trends – no significant change over 50 years apart from nw and places in Keys

ADJOURN

August 16, 2011

Catherine Marzin – summary of day 1 – introducing day 2

Scott Sheridan – weather typing 101
Scott provided an overview of weather typing and Chlorophyll patterns for new meeting
       participants. Synoptic SLP patterns and relation to chlorophyll
Goal – 1) overview of weather typing 2) results so far
-     Scale global models to too fine a resolution – results not accurate. So if take larger scale synoptic pictures that climate models can reproduce (pressure) classify them (understand well behavior of sea level pressure field as it relate to climate) into a number of categories.
-     Use broader area than south FL to avoid small scale issues and biases at smaller scale.
-     Will look at pressure field at different spatial scale later
-     Different permutations to look at different type of classification fields – best = daily pressure anomalies (subtract mean from each data point) get snapshot of how pressure varies from mean. 31 years for 365 days to a large area.
-     Looked at 3 Chl. regions (central Florida shelf, south Florida shelf, fl keys)
-     Saw 10 different patterns.
-     For each day over 10 years classified the day by patterns. Looked at the frequency of a pattern throughout the day. Then looked at the mean Chl. value behaved for each day → Were patterns observed.
-     Main framework: can classify pressure fields into 10 categories, and then use that to try to infer other responses that want to look out. Initial results show clear connection between pressure patterns and responses.
-     Tie to climate knowledge: patterns in frequency over time. Looked at during El Nina/La Nina events what kind of patterns are more prevalent. Note: El Nino not perfect predictor.
-     Analytical questions – how statistically analyze the circulation patterns vs. water variables
  - o   Incorporation of a lag?
  - o   Aggregation of frequency or anomalous frequency?
  - o   Composites for anomalous water events?
  - o   Aggregation of circulation patterns into groups
Q_Pam: What can we do to present this to managers. Going back to couple of slides to series 1-10/. Manager will want the Chl information and anomalous MSLP… however managers may not necessarily have the background to understand all of it. Pam thinking as a manager. Looking at the slide. What are the messages for the managers?
Scott: Not yet all research completed so visuals are not yet set. What want to do is emphasize naming patterns so more familiarity. Each day categorized into 1-10 groups. Looking at

impact, less material than that. This would be more behind the scene. If looking at monthly anomalies, weather stories may be captured in more simplistic fashion.

Karsten: Is this about decision making product, or giving manager a bit of info to communicate to stakeholders. We can take this opportunity to educate.

Jim   How to tell managers that it works without going too much into the weeds.

Henry?: On causal relationship between Chl and pressure patterns. No statistical validation yet.

Scott: Working on Stat val. Need to tell manager why he should believe it.

Karsten Q: What is the rate of change of Chl levels from one day to the next, or there is a delay?

Henry A: can happen overnight. Sometimes bloom is transported from somewhere.

Doug Q: talk how synoptic is used to develop monthly forecasts of other atmos. variables?

Scott: weather types can be connected to other forecasts models/teleconnections. (North Atm oscillation circulations, el Niño, arctic… affect frequency of the patterns) for multiple weeks up to a point. Have not yet investigated but could forecast likelihood anomalies

Varis A to Pam: to pitch to managers, approach may be secondary to management. But this is state of the art.

Karsten: Getting something like this to managers in quasi operational sense and see their feedback. Not management driven, but getting feedback to verify we are getting in the right direction.

Ben: as a manager: exciting stuff and right on target and on track. Next step is how to package so that it is user friendly, attractive, easy to understand. Linkage is extremely important with many useful benefit to mangers.

Scott: applied similar methods to other products for cities (heat waves systems color coding action relative to heat events, then more basic details contained – so individual stake holders who want just what action to take it is upfront, then more info can be linked for anyone interested.

One thing about synoptic patterns, it become very intuitive.

Boiling complex info to fundamental level.

Henry – to relate what is going on naturally – link to period or week and have the time series of this weather type, and show also Chl so they can look directly in website what results were. As well as the forecast and past. Use raw data for validation and improvement.

Lew: another question from yesterday: useful step would be to break up Chl into calibration and validation subsets.

Pam: where data from? Doug: is from satellite SeaWifs. Could have other sources MERIS (EU satellite)

Catherine: Would need to simplify the wording for an unsophisticated audience. People are familiar with "precipitation", or not with pressure

Scott: nomenclature right now is intuitive to weather group but can be changed for laymen

Pam: asked for sample for discussions to science managers. May need another version for non science managers to simplify info even more. Pam wants to show during her meetings to get feedback.

Scott: no problem showing. Need to give caveat that this is a draft/work in progress.

Pam: timeline to get 10 slides plus table with (patterns with 1-5% days of Chl stats removed)? Scott before mid September a few weeks from now.

Doug: a few slides on information exchange
Forecasting aspects of typing.

Implementation framework developed a year ago – climate analysis is the step we are in, data integration scheme – to get near real time data to integrate with satellite data.
Need another 1 ½ year left on pilot project
Interim product scheme – needs assessment, guidance doc/feedback from managers, then review presentations. So we can get final MPA products.

Table: Who needs the short term scenarios/eco-forecasts for future states and ecosystem conditions

Industry end users IDs	Applications	Time Scale
Fisheries/Mapping/ Marine Protection	Vulnerability assessment	monthly - interannual
Fisheries management	Resilience and sustainability	monthly - interannual
Nutrient/LBSP management	Pathogens toxins hypoxia Beach closures	daily to interannual
Tourism	Esthetics/economics	Monthly
Public	News/Media releases	daily to interannual
Marine Stewardship	Awareness/Informed Society	daily to interannual

Pam question: Climate scenario is nested into long term. Weather is short term.

Doug: can't nest everything into long term. Ecoforecast -   whether types are based on 30 years.
        Daily weekly roles along.
Lew: terminological disconnect between climate and non-climate/policy people
        Climate is weather longer than a week to a month. Karsten: NWS daily to seasonal and
        climate service seasonal to long term. In general climatologies can be from an
        aggregation of climate over a few seconds to 30 years (needed for a climate normal) most
        climate stabilizes over 30 years.
Pam: looking at Scott presentation – if looking at longer term 30 year datasets of atmosp
        conditions have land used that is dramatically changed that is impacting nutrient
        conditions. Management may skew results
Karsten: short term perturbations become part of climatologies – master database, show up as an
        outlier. If can understand what it is can QC it out or if relevant can leave in.
Doug: go back and force on relevance of weather vs. climate models but this is a take of from
        yesterday on real end application of IMPACT. Can we define immediate applications for
        whatever time scales.
Pam Q: For this project, can we decide on a definition of climate? Is it short term? Do I avoid
        using the term climate. Want to be consistent in all IMPACT products.
Karsten: if talking short term forecast, talking about weather forecasting. Seasonal forecast -
        becomes climate. Get into transition zone to climate.
Pam – short term seasonal 3 month to a year, interannual
Pam will ask how stakeholders define climate – somewhere in between need to understand
        climatology lingo and managers lingo. So that we can clarify what we are talking about.

Joe: natural transtition at NWS: 1 week then climate predictions day 8. After day 8, use analogues, weather typing, probabilities.

Lew: agree within the room of a month by month product operationally define climate as a month or longer. All: agree

Doug: Cameron in his talk yesterday talked about variability of climate. We are talking about climate even at daily scale. But different mode of variability at temporal and spatial scale. Looking at climate variability.

Karsten: Prevailing opinion of climate as an average but in reality we are looking at how conditions are looking over a period of time and resulting impacts on ecosystems. Not just average conditions but rate of change, frequency of extremes, etc.

Jim Hendee - Update on CRCP IMPACT

Came up with different types of products report, pdf publication/handouts

Based on iterative approach with managers – discovery prototype to see what is useful what isn't

Ecosystem response – climatologies for different locations, at different seasons, report could show normals at a particular spot get it to. Use one ecosystem response we have good data for then add other knowledge info – (spiny lobsters migrate with heavy weather/precip) Long process.

CRCP – presented approach to CRCP – gave seed money for IMPACT 1 to pay for Pam to go talk to managers, travel, to develop more on a website. Doug Proposal for IMPACT 2. CRCP is keeping to their word.

Could get IMPACT 3 – multi LO approach using other investigators will be solid to get support from CRCP.

Also, Pam working on conceptual ecological model. MARES project. To simplify complex ecosystem and see how things are interrelated.

Pam   Update on IMPACT 1: needs assessment:

Goal of IMPACT 1: to identify the researcher product that could be used by managers to understand what is going on. Methodology what end users want vs. research capabilities. What can live with to improve their capabilities. One on one interviews with researchers to understand products you have as well as the mangers (from all the south FL managers. Opportunity to partner with MARES colleagues on W coast. One small group workshop would be culminating events at AOML for managers and researchers to discuss products. Format more web-based. After that – refine web pages. Talking mid-sept to Jan for interviews, refinements in the spring.

Doug Q: when need to get feedback? What need to state?

Doug A: input from C team:1) need to create a better link between IMPACT 1-2 for full proposal (due September 2). 2) refine expected products/outcomes of this effort to narrow down what those products could be. No need to create them now but need to have idea.

Pam: webpage, with refinement of the product. Need more specific – ecoforecasts down the road. It could be possible but right now with a few variables may be premature)

Department of State has partnership with Columbia and a person will be coming to US in Sept to contribute to the project.

Jim Also working with Google maps. Will suggest to CRCP that monitoring data be presented in similar interface to make it more accessible

2 websites – Lew and Doug – but will minimize duplication of efforts.

Pam – showing examples from CSCORE MARES project (over 50 PIs involved) to conceptualize ecosystem model. Can provide an interface to climate website with hotlinks with visuals. Peter Ortner(?) will be the lead.

Lew: can have static and dynamic content

(check out optical oceanography content)

Could automate update of products,

Chuanmin – hard to make automatic value added products

Doug: IOOS Data Access development

IOOS told Doug that they don't fund research. Can fund a research mtg… so IOOS is supporting this meeting.

Plan for IOOS to create a data access server.. NCCOS?CCMA is involved to create a sensor observation service (THREDDS).

IMPACT link: getting FIU water quality dataset into the IOOS stream. To make data accessible in a IOOS framework.

Chuanmin involved in SECOORA to make data to them

Idea: bring IMPACT data into IOOS framework. IOOS can fund future work. But: need to define specific applications. More refined application of water quality conditions. Could work to make data near-real time senses. Funding level is low (40-60K) but could go up.

Chuanmin – water quality products in SECOORA area for other areas such as Tampa Bay. Data is archived in own website – to get it in right format?

Henry – Chris Kebble's datasets South Florida Program.

Pam: BASE

Chuanmin – focus on FIU data see how easy access is, how work? Then we can take other datasets in.

Lew: suggestion – team members involved in applications, can provide valuable resource for water quality data as active users of it to raise issues (format, qc…) to then make it easier to

PAM: Everglades restorations clearing house has a lot of the data. Not user friendly. Chuanmin – not clearinghouse. USGS partnered to create GEM geospatial model

Chuanmin don't get too involved in data collection/archiving projects. SECOORA trying to collect al lot of data for one clearinghouse. But it is slow process. If had unlimited resources then yes, but caution against it at this time.

Doug presented plans for the IMPACT WEBSITE

NOAA NOS Special Project Office agreed to create/host IMPACT website

Work would start in second quarter of FY12 – March timeframe.

SPO will not develop content, which will be provided by the impact team, but will focus on the presentation – putting nice layout/pictures.

Could utilize SPO for programmatic IMPACT webpage – concept, background, then links to regional website that gets into interactive/product.

We would have two IMPACT website: SPO site with more "fluff", and the AOML/ICON site for actual products

Site map for SPO
Main navigation: About; project design; tool development; expert system application; Impact
assessments
- About:
    o Secondary navigation: what is IMPACT, why needed, who benefits, patterns
      relevant websites, more info
- Project design Needs assessments climate analysis
- Tool development: Data sets; time series; conceptual models; probabilistic response
  models; eco-forecasts; other nav topics?
- Interim products: proof of concept; impact scenarios…
- Expert system applications ??????
- Impact assessments : reports.

Discussion: Very technical: SPO not interested in content so it is up to use to decide. SPO will
        not host/maintain the website. SPO only development/making pages, creating the
        interface. So up to us to host. AOML could incorporate the content.
Jim: Google earth approach for each stations- not sure how to incorporate weather typing.
Lew: show new CHAMP pages? Jim With link for IMPACT. New interface for displaying
        integrated data.
Karsten – will be talking to climate monitoring branch at NCDC that does a lot of operational
        products to see if could incorporate the IMPACT products into their operational activities
        and start to morph some of their products into our website
Jim use Pam's conceptual ecosystem models for user interface.
Pam: For MARES: charged to dev 4-page doc to discuss biological/physical parameters of
        ecosystems. With fisheries, oceanography, etc. could also post it into IMPACT website
        in addition to MARES website.
Karsten: NCDC can customize info such as producing weekly wind field over the keys, and turn
        it into a wind trend map. Format – map with wind vectors/speed. Take most recent
        month worth of data in concept of historical conditions (coldest, warmest…) display data.
        Looking for ways to be more relevant with their products. Pam – could bring these
        products to managers for immediate feedback.
        Once Scott/Cameron/Varis published on weather typing, NCDC could operational
        weather typing to see likely probability of other weather types to occur.

Pam Fletcher – copies of the Effects of Climate Change on the FL Oceans and Coastal resources.

Ben Haskell on management of a sanctuary
Ben used to work in FL Keys from 1995-2000 as Science coordinator before heading back to
Stellwagen Bank NMS, North of Cape Cod.
Sanctuary management goals are to implement measures that would improve health of sanctuary
through the backdrop of environmental change. So the main question is:"is management
effective? Therefore we need to know past history (climatological and environmental)
And we need to manage expectations among public about the effectiveness of sanctuaries AND
what is going on within the sanctuaries in terms of changes → Climate data is very important.
Questions Ben would anticipate of what public would want to know in N.E. (can be extrapolated
in FL):

Are fish species ranges shifting?
Is fish distribution changing? Is plankton distribution changing? Whales, charismatic megafauna rely on plankton which are highly susceptible to climate variations.
How will whales be affected?
How larval tuna be affected as go up the coast and become adult tuna in SBNMS?
Sand Lance populations feeding on plankton support the whole system
Effect of N Atl Oscillation and other major oscillations on the whole system?

IMPACT can provide forum and venue to answer some of these questions.

Looking at Northern Regional Association for Coastal Ocean for some of the answers…NERACOOS looking at trends in different parameters, being able to do queries an combine different variables

Some sanctuaries boarder land. (Most do not.), such as the MBNMS and Olympic Coast → land use effects. Teasing out land use vs. climatological effects.

Mostly interfacing with public and managing their expectation on what can be achieved through direct management and what can e achieved through climate change. Explaining what is going on in the system. Public most often see changes before SBNMS and ask what is going on. Ask why things happen. SO it would be good to be able to explain causes of changes.
.
NERACOOS only site where can delve into datasets. Ben attempted to do it when big storm event to see wave heights associated with the storm. As a manager can't spend a lot of time clicking/manipulating data. A few clicks for a quick trend analysis.

Both need climate info for job and for representing issue to public.

Need to infuse data with climatological perspective. Need long term, yearly-plus kind of perspectives and their synthesized products, like some of what Scott was showing, is what Ben was envisioning.

Ruben van Hooidonk: presented work at the Pahanamokuakea Marine National Monument for the coral response to Sea surface temperature anomalies.
Ruben asked to make products for monument. Jim mentioned see temperature. On response plan to coral bleaching – need tool to see stress corals experiencing and the implications. High res (9 km resolution) sst anomalies then can look at each atoll and see the SST anomaly for past year, with added the thermal stress so that you can get optimal threshold to see what islands at most risk of bleaching for cruises monitoring.
Methodology – combination TMI and SST from MODIS data to get degree heating weeks.

Pam Fletcher presented the ecosystem conceptual models being developed by the MARES program. Homepage: www.sofla-mares.org
MARES is 3 year project to be done in December 2011 to develop conceptual ecosystem models. MARES divided South FL into 3 regions. Most PIs have been involved in everglades restorations identifying drivers of the ecosystem, adding human dimension to the project with

ecosystem services, and state models – water quality, corals, sea grass, oysters, lagoons all the different parts of the ecosystem. At MARES workshops: researchers were presented tool box/wire diagrams to add the connections on whiteboard. From there, Cartoons were drawn for researchers and managers to coalesce around ecosystem functions and forcers. For the Florida Keys region, specific management questions were added (e.g., treasure hunting, MPAs, etc) and associated information on what type of management actions are available or in place. The cartoons were created from ADOBE illustrator, using open source clipart. Took all the sketches and incorporated them into Illustrator file. Next step is to create the integrated models.

Discussion: IMPACT can be a springboard from MARES

Jim: Might be able to use this for IMPACT – effects in October then could see what is going on to resource in context to climate.   Picture of an ecosystem, drilling down. Chris Keble has done some conceptual ecol models. More of box and wire

Q_Ben Haskel: If want to see box and wire diagram, can we see them or only end product graphic?

Pam: Still being discussed how to attached the more info to the end product.
Note with MARES the 50 PIS coming for consensus so all CEM reports will be published do managers to refer to as needed.

Q_?:   Land sea interface transect. Always see of id land sea linkages that is very data driven or categorically driven though to gage with Conceptual models. Idea of linkages but also how much of an influence one pressure is over the other.

Pam: In cartoons yes. In boxing-wire diagram, can delve into data plus information. Problem with BW diagrams is that they get complex/overwhelming easily. Tough to understand fully what is going on. Need text to go along with links.
In Florida Bays Status of Indicators are selected and shown color-coded: Red: looking at substantial deviation from ecosystem targets
Yellow – not meeting targets
Green system conditions is good trends have reached targets

Q_Karsten: As it relates to IMPACT: should we look at very basic plug and play decision tool vs. more complex box-wire. For MARES indicators are based on a mandate. For IMPACT this is different: we can choose different indicators.

Q_Rubin: Who are the target audience

Pam: For IMPACT 1: general public, researcher to researcher, and reef managers (hard bottom coral reefs).

Ben: IMPACT can provide manager tools to explain to public WHY they CAN"T affect climate change or resolve certain problems. Need this info.

Karsten: Trying to put info out there so that managers can explain why they are making their decisions or why things are the way they are and they can't do anything about it.

Q_Ben: Question about 2-year projections – what is the basis? Predicting conditions of ChL-a? Would think they rely on climatological data to make a statement.

Pam: Pam does not know. Need samples to show to managers. As far as Climatology data, it would be nice to have fact page that could have in hand to share with people.
Structured open handed questions but will start with "what is Climate data" to you? Very different levels of understanding.

Karsten could put together a fact sheet on climate. Will look for what exist and modify it (COMMIT and UCARR came from something) audience is managers. Commissioners type at local level. Some have more familiarity than others on climate.)

Scott: Can provide slides on weather types.

Pam: Ask for Links to NCDC climate monthly products. Capability and time to make it South Florida-centric? Karsten to ask if possible by September Pam: if not, existing list with examples.

Survey will last through January. Then will populate website with the examples.

Doug: We have to be careful what we will present because the new research is still being developed. We get funded we will be refining the weather types and certain aspects of the relationship and what we want to present. Because want to bring in near real time aspect. Right now it is hindcast. Don't want to go too far out.

Pam: In EPA and NASA proposal provided examples. Can they be shown?

Doug: Agree to provide the examples.

Do not show weather types by themselves. Need to relate them in a conceptual way to the response characteristics to make it more useful.

Responded to RFP, and catered to their needs so our examples are not based on managers direct discussions.

Discussion on existing Gaps in IMPACT project

Gap 1: Indicators

?:	Water quality data/ chlorophyll is very important to South Florida.

Rubin: Can see other influence if talk about Chl. But also other factors: Wind and SST and amount of fish/herbivores present.

Doug: Coral and thermal stress studied and indicator well covered by coral reef watch.

Rubin: But could envision improving metrics by combining with local threshold, long term climatologies. Not technically very difficult to do by Rubin,

Doug: Bio geo variables that GFDL is trying to develop in their predictive models far from ready.

Gap2: Skill sets

Doug: Good shape in terms of what we have now in terms of skills resources. Right people

Karsten: Need NMFS person- Anita Hun from Beaufort Lab. Very keen on this idea. Will talk to her at SECART meeting in Asheville. To see if she would be interested in this topic. What we can offer. Sticking point with fisheries is that they are very concerned about exposure of their data – a lot of it is economically sensitive so they tend to do work in house as opposed to outside collaboration. Karsten working with Alita on this.

But need buy in from NMFS management to get NMFS scientists onboard to help us for IMPACT.

Ben:	Suggesting approaching Jim Bohnsack with IMPACT and bounce the idea off him.

Catherine: Do we need a Statistician?

Gap 3: Data

Karsten: Good progress. But not finished up on inventory of what data is out-there. Get piece meal info. But having a good database of what products and data cover south Florida would be useful. Could ask managers for datasets. Ask Pam. Chuanmin. Need to mine other's efforts.

Gap 4: Funding

Karsten: Climate service dead in the water, still trying to be revised. Congress does not want to fund things with the word climate in it. BUT commitment to ensuring forecasting and watches and warnings still come out.

Plus in good position right now because the IMPACT project touches directly on 3 of the CLIMATE service societal need and two of the next generation strategic goal and directly on NOAA's central mission. With such a focus, if we can keep it in the people's attention, could get funding as resources dwindle.

Paul Doremus had sent call in June for new emerging trends for NOAA strategic plans. NCCOS, NCDC and ONMS sent item on IMPACT type. No response.

Joe: IMPACT could be related to NWS mission too as decision support tool

Doug: SPO website is good news because will highlight any type of drivers as part of the website.

Doug: DOE still gets climate money, Interior also. .

Actions:

- **For Data QA/QC**
  Henry will complete QC of water quality data by October 2011.
  Chuanmin will use dataset for fine tuning/refining satellite validation

- **For the Needs assessment**
  o Karsten: will develop a 2-page fact sheet on climate for Pam that she can provide that will show a few examples.
  o Scott will provide slides on weather typing to Pam
  o Karsten will investigate if NCDC would be willing to develop/show customized sample products
  o Doug: Examples from EPA and NASA grants

- **For Scientific papers:**
  Scott (lead), Cameron, Chuanmin, Joe, Varis and Doug will finalize the manuscript on weather tying and Chlorophyll. (working title: Evaluating weather pattern frequency response characteristics for south Florida coastal ecosystems using synoptic climatological approach).