NOAA SCIENTIFIC PUBLICATIONS REPORT

NOVEMBER 19 - NOVEMBER 30, 2012

CONTENTS

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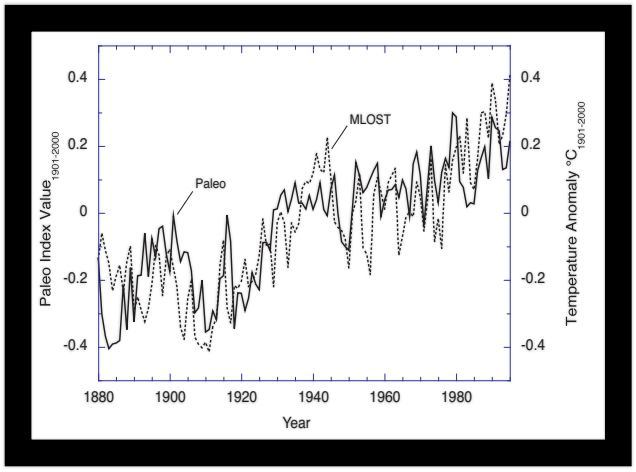
1. HIGHLIGHTED ARTICLES

1a. Title: *Global warming in an independent record of the last 130 years*



Journal: Geophysical Research Letters

Authors: Anderson, D. M., E. M. Mauk, **E. R. Wahl,** C. Morrill, A. Wagner, D. R. Easterling, and T. Rutishauser **(NESDIS)**

Significance:

- Independent evidence supports the warming trend observed in the thermometer record, including the increasing trend of the past 15 years.
- NOAA's data archives provide powerful sources of information regarding past climate and environmental change.
- Paleo proxy evidence (tree ring, ice core, coral) provides valuable support for the adjustments and corrections made to the thermometer-based records.

Summary: The thermometer-based global surface temperature time series (GST) commands a prominent role in the evidence for global warming, yet this record has considerable uncertainty. An independent record with better geographic coverage would be valuable in understanding recent change in the context of natural variability. We compiled the Paleo Index (PI) from 173 temperature-sensitive proxy time series (corals, ice cores, speleothems, lake and ocean sediments, historical documents). Each series was normalized to produce index values of change relative to a 1901-2000 base period; the index values were then averaged. From 1880 to 1995, the index trends significantly upward, similar to the GST. Smaller-scale aspects of the GST including two warming trends and a warm interval during the 1940s are also observed in the PI. The PI extends to 1730 with 67 records. The upward trend appears to begin in the early 19th century but the year-to-year variability is large and the 1730-1929 trend is not significant.

Expected Publication Date: December 21, 2012

Rollout Plan: Planning highlights information for media, online and social media stories, and short video on the work.

1b. **Title:** *Resiliency of juvenile Walleye Pollock to projected levels of ocean acidification*

Journal: Aquatic Biology

Authors: Thomas P. Hurst (NMFS/AKFSC), Elena R. Fernandez, **Jeremy T. Mathis (OAR/PMEL)**, Jessica A. Miller, Charlotte M. Stinson, and Ernestine F. Ahgeak

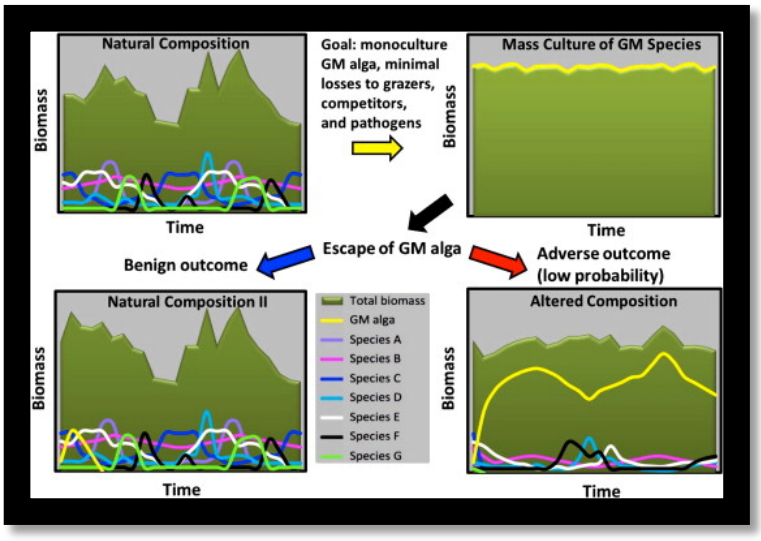
Significance:

- Projected levels of ocean acidification will not significantly affect the growth energetics of juvenile Walleye Pollock, which support significant commercial fisheries
- There are other potential effects of ocean acidification on Walleye Pollock that have not been tested yet
- Temperature variation during the Walleye Pollock's early life period has a persistent effect on growth potential

Summary: Ocean acidification at high latitudes will result in predicted decreases of pH by 0.3 to 0.5 units by 2100, with several biological consequences. This study examines the potential response to ocean acidification by Walleye Pollock, a temperate and boreal species that supports major fisheries. In two experiments, the authors examined the growth responses of juvenile Walleye Pollock at ambient and three elevated CO_2 levels. In a 6-week experiment with yearlings, there was no significant effect of CO_2 treatment on growth or condition. In a 12-week experiment, growth in length of sub-yearlings at 8°C was 7.2% faster in the two higher CO_2 treatments (>1200 µatm) than in the lower CO_2 treatments (<900 µatm). Growth of sub-yearlings measured during 11 subsequent weeks of rearing at 2.5°C did not differ among CO_2 treatments. While not exhaustive of potential interactive environmental factors, these experiments demonstrate a general resiliency of growth energetics in juvenile Walleye Pollock to the direct effects of CO_2 changes predicted for the Gulf of Alaska and Bering Sea in the next century.

Expected Publication Date: December 15, 2012

1c. **Title:** *Initial risk assessment of genetically modified microalgae for commodity-scale biofuel cultivation*



Journal: Algal Research

Authors: Henley W, **Litaker W (NOS/NCCOS),** Novoveská L, Duke C, Quemada H, Sayre RT

Significance:

- Potential ecological, economic, and health impacts of genetically modified (GM) algae that persist in and alter natural ecosystems, are considered. Most target GM algal traits are unlikely to confer a selective advantage in nature, and thus would rapidly diminish, resulting in low ecological risk.
- Horizontal gene transfer with wild organisms may be a potential risk in some specific cases. Matching of GM algal traits to unnatural cultivation conditions would reduce risk. Genetic and mechanical containment strategies should further reduce risk.
- Rigorous ongoing monitoring and mesocosm experiments are essential to meet regulatory requirements and foster public acceptance.

Summary: Genetic modification of microalgae to improve commercial production of biofuels is underway. Inevitable governmental regulations will likely address environmental, economic and human health impacts. Proactively addressing such regulatory protection goals should begin now, during early development of this new, potentially large and transformative industry. The authors present strategies for ecological risk assessment of GM algae for commercial mass cultivation assuming that escape of GM algae into the environment is unavoidable. We consider the potential ecological, economic and health impacts of GM algae that persist in and alter natural ecosystems. Horizontal gene transfer with native organisms is of particular concern for certain traits, especially when cultivating GM cyanobacteria.

Publication date: November 26, 2012

2. ADDITIONAL ARTICLES

2a. **Title:** *Lake Levels in Asia at the Last Glacial Maximum as indicators of hydrologic sensitivity to greenhouse gas concentrations*

Journal: Quaternary Science Reviews

Authors: Y. Li and **C. Morrill (CIRES, NOAA Cooperative Institute)**

Significance:

- Lakes shrank during the Last Glacial Maximum (LGM) throughout most of Asia due to decreased precipitation.
- Since hydrologic changes at LGM largely resulted from reduced atmospheric carbon dioxide concentrations, we expect wetter conditions in the future due to increased carbon dioxide concentrations.

Summary: Using monsoonal and arid Central Asia as a case study, we have compiled lake level information from proxy records for the LGM and compared these to the simulated hydrologic cycle from four model experiments. Our new review of proxy records indicates that lake levels were nearly all lower at LGM compared to the pre-industrial across Asia, which is largely reproduced by all four models and results from decreased precipitation during the LGM. Models also show that lake evaporation also significantly decreased at LGM, but that in most areas the change in lake evaporation is overshadowed by changes in precipitation. Based on the model experiments, higher LGM lake levels only existed in the dryland regions of Pakistan, Afghanistan, and north of monsoonal East Asia, which differs from previous studies that suggested that higher lake levels prevailed during the LGM in western China and arid Central Asia. A detailed atmospheric water budget analysis indicates that a combination of atmospheric dynamics (i.e., convergence) and thermodynamics (i.e., the Clausius-Clayperon relationship) were responsible for decreases in LGM precipitation in Siberia and monsoonal Asia. Our results support the idea that monsoonal Asia will become wetter in the future due to increased atmospheric greenhouse gas concentrations. The situation is more complex for arid Central Asia, though current trends towards wetter conditions there might be consistent with the pattern we observe and model for LGM.

Expected Publication Date: January 15, 2013 (early online November 26, 2012)

2b. **Title**: *Stratospheric ozone and temperature simulated from the preindustrial to the present day*

Journal: Journal of Climate

Authors: John Austin, **Larry W. Horowitz, M. Daniel Schwarzkopf, Hiram Levy II (OAR/GFDL)**

Significance: This model uniquely includes a detailed atmosphere chemistry implemented seamlessly from the surface to the top of the stratosphere.

Summary: Results from GFDL's first fully-coupled chemistry-climate model are presented for the historical period 1860 to 2005. There is no statistically significant change in modelled stratospheric temperature and ozone prior to 1960. As the industrial emissions of halocarbons increase after 1970, modelled stratospheric ozone decreases approximately continuously until about 2000, as observed. The steadily increasing greenhouse gas concentrations cool the stratosphere from the beginning of the 20th century at a rate which increases with height. The model results show a strong, albeit temporary, response to volcanic eruptions. While anthropogenic halocarbon concentrations remain low, the effect of eruptions is shown to indirectly reduce ozone destruction by the natural catalytic cycle. In the presence of anthropogenic chlorine from the halocarbons, after the eruption of El Chichon and Mt. Pinatubo, net volcanic effect is more complex and depends on altitude. These two volcanoes lead to an ozone increase in the middle stratosphere and a decrease in the lower stratosphere. Model lower stratospheric temperatures are also shown to increase during the last three major volcanic eruptions, by about 0.6 K in the global and annual average, consistent with observations.

Expected Publication Date: May 2013 (early online Nov 19, 2012)

2c. **Title:** *Input Data Requirements for Lagrangian Trajectory Models*

Journal: Bulletin of Meteorological Science

Authors: Kenneth P. Bowman, John C. Lin, Andreas Stohl, **Roland Draxler (OAR/ARL)**, Paul Konopka, **Arlyn Andrews (OAR/ARL)**, Dominik Brunner

Significance:

- Higher spatial and temporal resolution meteorological fields needed from operational forecast and reanalysis models to improve model accuracy.

Summary: Scientists using Lagrangian modeling methods review data requirements.

Expected Publication Date: January 2013