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Algal Biofuel, Feb 5, 2010

Harry Reid Center, University of Nevada, Las Vegas

Newsletter of this Week from

Algal Biofuel

Volume 1, Issue 2, Feb. 5, 2010

Algal Biofuel

News in Brief (click link to read more)

1. UVa engineers find significant environmental impacts with algae-based biofuel (Jan-21, 2010)
2. IPCC scientist: Global cooling headed our way for the next 30 years? (Jan 11, 2010)
3. Shining a Light on Plants' Quantum Secret to Boost Photosynthesis (Feb 3, 2010)

News in Details

1. UVa engineers find significant environmental impacts with algae-based biofuel.

With many companies investing heavily in algae-based biofuels, researchers from the University of Virginia's Department of Civil and Environmental Engineering have found there are significant environmental hurdles to overcome before fuel production ramps up. They propose using wastewater as a solution to some of these challenges.

These findings come after ExxonMobil invested $600 million last summer and the U.S. Department of Energy announced last week that it is awarding $78 million in stimulus money for research and development of the biofuel.

The U.Va. research, just published in the journal *Environmental Science & Technology*, demonstrates that algae production consumes more energy, has higher greenhouse gas emissions and uses more water than other biofuel sources, such as switchgrass, canola and corn.

"Given what we know about algae production pilot projects over the past 10 to 15 years, we've found that algae's environmental footprint is larger than other terrestrial crops," said Andres Clarens, an assistant professor in U.Va.'s Civil and Environmental Department and lead author on the paper. Clarens collaborated on the

paper with Lisa M. Colosi, also an assistant professor in the Civil and Environmental Engineering Department; Eleazar P. Resurreccion, a graduate student in the department; and Mark A. White, a professor in U.Va.'s McIntire School of Commerce.

As an environmentally sustainable alternative to current algae production methods, the researchers propose situating algae production ponds behind wastewater treatment facilities to capture phosphorous and nitrogen – essential nutrients for growing algae that would otherwise need to be produced from petroleum. Those same nutrients are discharged to local waterways, damaging the Chesapeake Bay and other water bodies, and current technology to remove them is prohibitively expensive.

While the researchers found algae production to have a greater environmental impact than other sources, it remains an attractive source for energy. Algae, which are grown in water, don't compete with food crops grown on land and also tend to have higher energy yields than sources such as corn or switchgrass. Additionally, algae's high lipid content makes for efficient refinement to liquid fuels that could be used to power vehicles, according to the research.

"Before we make major investments in algae production, we should really know the environmental impact of this technology," Clarens said. "If we do decide to move forward with algae as a fuel source, it's important we understand the ways we can produce it with the least impact, and that's where combining production with wastewater treatment operations comes in."

As an example of the importance of completing the environmental life cycle study, Clarens points to the 2008 ethanol boom which created a spike in corn prices worldwide and raised complex ethical issues that could have been avoided by producing separate crops for food and fuel.

"People were investing in ethanol refineries, but then we realized that it takes a lot of petroleum to grow corn and convert it to ethanol," Clarens said. "By the time you get done, you've used almost as much petroleum to make ethanol that you would have if you just put the oil straight into your car."

The research group's plans include conducting demonstration projects for the wastewater production methods. They are also pursuing complementary research on the economic lifecycle of algae compared to other bionenergy feedstocks.

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The research paper is available online at http://pubs.acs.org/doi/abs/10.1021/es902838n.

Souse: http://www.eurekalert.org/pub_releases/2010-01/uov-uef012110.php

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2. IPCC scientist: Global cooling headed our way for the next 30 years? (11 01 2010) from http://wattsupwiththat.com

UPDATE: The subject of this article, Mojib Latif, has challenged the Daily Mail article and it's interpretation. In another story at the Guardian, Latif says the interpretation by the Daily Mail and a similar story in the Telegraph is wrongly interpreting his work.

Read the Guardian story **here** and decide for yourself. If anyone knows of a contact for Dr. Latif, please leave it in comments as I'll make this forum available to him should he wish to elaborate further.

h/t to WUWT reader Werner Weber for notifying me.

UPDATE2: Werner Weber writes to me in email:

> I have send him an e-mail, pointing out what happened during the night
> and invite him to take the oportunity to present his views in one of the
> leading sceptics blogs.

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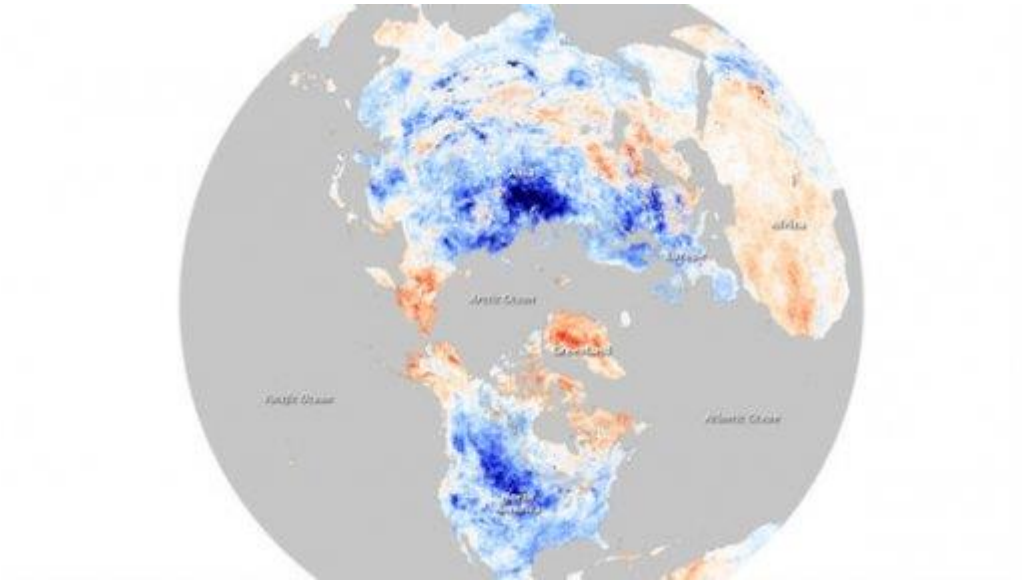
We've been covering a lot of the recent cold outbreaks under the "weather is not climate department" heading. This story however is about both weather and climate and what one IPCC scientist thinks is headed our way.



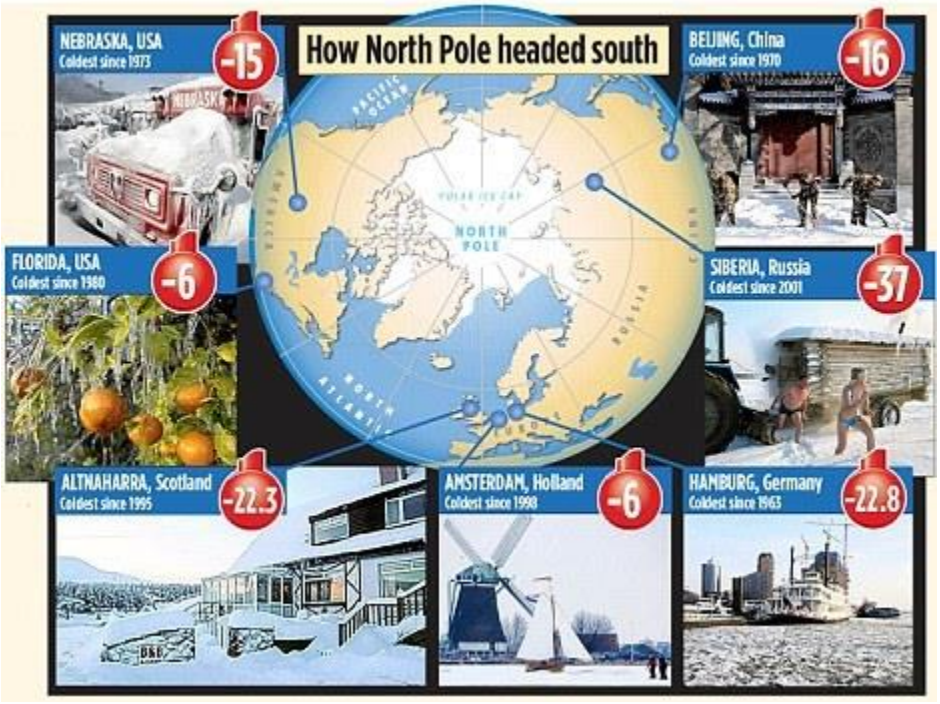
From NASA Earth Observatory: December temperatures compared to average December temps recorded between 2000 and 2008. Blue indicates colder than average land surface temperatures, while red indicates warmer temperatures. Click for source.

The cold this December and January has been noteworthy and newsworthy. We just posted that December 2009 was the Second Snowiest on Record in the Northern Hemisphere. Beijing was hit by its heaviest snowfall in 60 years, and Korea had the largest snowfall ever recorded since record keeping began in 1937. Plus all of Britain was recently covered by snow.

The cold is setting records too.

Oranges are freezing and millions of tropical fish are dying in Florida, there are Record low temperatures in Cuba and thousands of new low temperature records being set in the **USA** as well as Europe.

There are signs everywhere, according to an article in the *Daily Mail*, which produced this graphic below:



According to IPCC scientist Mojib Latif in an article for the *Daily Mail*, it could be just the beginning of a decades-long deep freeze. Latif is known as one of the world's leading climate modelers.

Latif, is a professor at **the Leibniz Institute** at Germany's Kiel University and an author of the U.N.'s Intergovernmental Panel on Climate Change (IPCC) report. Latif is a prominent scientist in the UN's IPCC climate research group.

Latif thinks the cold snap Americans, Brits, and Europeans have been suffering through is the beginning of another cycle, this one a down cycle. He says we're in for 30 years of cooler temperatures. While maybe it is a harsh prediction, he calls it a "mini ice age". That phrase is sure to stick in the craw of more than a few people. His theory is based on an analysis of natural oscillations in water temperatures in the oceans.

According to his He believes our current cold weather pattern is a pause, a "30-years-long blip", in the larger cycle of global warming, which postulates that temperatures will rise rapidly over the coming years.

At a U.N. conference in September, Latif said that changes in the North Atlantic Oscillation could mask over any "manmade global warming" for the next few decades. He said the fluctuations in the NAO could also be responsible for much of the rise in global temperatures seen over the past 30 years.

In a stunning revelation, he told the *Daily Mail* that:

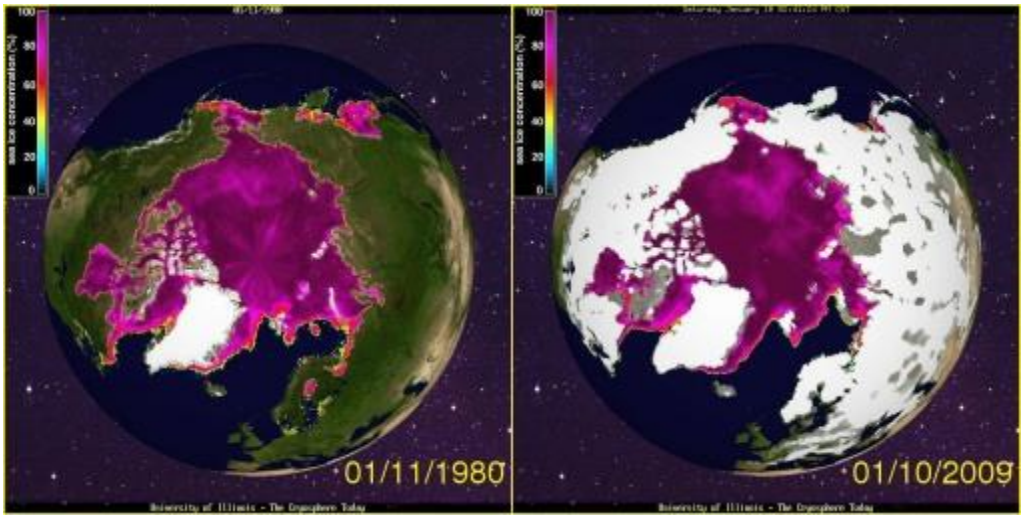
"a significant share of the warming we saw from 1980 to 2000 and at earlier periods in the 20th Century was due to these cycles – perhaps as much as 50 percent."

Quite a revelation, and a smack down of much of the climate science in the last 30 years that attributes the cause mostly to CO2 increases.

In other news, Arctic sea ice is on the rise too.

According to the **U.S. National Snow and Ice Data Center** Arctic summer sea ice has increased by 409,000 square miles, or 26 per cent, since 2007.I'm betting that summer 2010 will have even more ice retained.

Right now, there doesn't appear to be much of that **"rotten ice" that one Canadian alarmist researcher squawked about to the media just a few weeks ago**. In fact, we aren't looking bad at all compared to 30 years ago.



Click for larger image - Source: Cryosphere Today

Note that 30 years ago, the technology didn't exist to display snow cover on the left image, but today we can see just how much our northern hemisphere resembles a snowball.

Now, watch the warmists throw Latif under the bus.

Possibly related posts: (automatically generated)

- **Spencer on elitism in the IPCC climate machine**
- **Telegraph's Booker on the "climategate" scandal**
- **Texas State Climatologist: "IPCC AR4 was flat out wrong" – relied on …**

- Global Cooling is Here! Evidence for Predicting Global Cooling for the Nex…

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3. **Shining a Light on Plants' Quantum Secret to Boost Photosynthesis.**
(From Scientific American, Feb. 3, 2010)

Photosynthetic microbes employ quantum coherence to efficiently channel the incoming energy from photons

By David Biello

QUANTUM SECRET: Marine algae, like the *Chroomonas* pictured here, employ quantum coherence to boost the efficiency of photosynthesis.
Courtesy of Provasoli-Guillard National Center for Culture of Marine Phytoplankton

In less than one billionth of a second, plants from algae to redwoods transform 95 percent of the sunlight that falls on them—10^{17} joules per second bathe the planet—into energy stored chemically as carbohydrates. The quantum key to doing that lies in a phenomenon known to physicists as quantum coherence, according to new research published in *Nature* on February 4. (*Scientific American* is part of Nature Publishing Group.)

Quantum coherence describes how more than one molecule interacts with the same energy from one incoming photon at the same time. In essence, rather than the energy from a particular photon choosing one route to pass through the photosynthetic system, it travels through multiple channels simultaneously, allowing it to pick the quickest route. "The energy of the absorbed light is finding more than one pathway to move along at any one time," explains physical chemist Greg Scholes of the University of Toronto, leader of the research group that highlighted the effect. "We can't pinpoint the energy of that light. It's shared in a very special way."

Scholes and his colleagues isolated the "antenna" (a protein chain that propagates the incoming energy) of photosynthetic organisms known as cryptophytes, specifically marine algae *Rhodomonas* CS24 and *Chroomonas* CCMP270. Cryptophytes are special because they do not all employ the same protein to harvest the energy in sunlight, like the chlorophyll ubiquitous in green plants. "These guys customize their antenna protein," Scholes says, noting that the algae also have flagella that permit them to move around. "They're quite different colors."

The algae's different antenna colors allowed the chemists to pulse the specific proteins with femtosecond (one quadrillionth of a second) bursts of laser light. Based on atomic scale maps provided by previous X-ray crystallography, the researchers tracked the energy as it entered the photosynthetic system and progressed through it to so-called reaction centers, where the energy storage occurs. The pulses revealed that within single protein molecules the energy traveled down multiple pathways simultaneously. Thus, the protein antennae's efficiency relies on quantum coherence, such that molecules within a protein separated by vast distances (at the atomic scale) acted in a similar fashion at the same time for a relatively long period of time—more than 400 femtoseconds.

Whereas previous research had shown that purple bacteria used quantum methods to efficiently harness light—and prior experiments had shown similar quantum effects in green sulfur bacterium that had been cooled to 77 kelvins (–196 degrees Celsius)—this experiment was the first conducted at room temperature, 294 K, to replicate such effects. Basically, according to this research, an incoming photon created a series of ripples, like a stone thrown into a pond, that interfere with each other to allow the energy wave to explore all potential pathways through a given protein molecule at the same time, allowing no energy to be lost to any wrong paths. It is as if you could drive to work via three different routes at the same time, losing no time or energy to traffic delays on any of the given routes, Scholes says. That allows the photon to travel to the reaction center almost instantaneously.

"In the systems we studied, even at room temperature, you can have these quantum effects and they're rather significant," Scholes notes, adding that means the effects are "biologically relevant" (used by the cryptophytes in their daily existence.). "The short laser pulse is used to expose the phenomenon, not to create it."

Chemist Graham Fleming at the University of California, Berkeley, has shown that

such effects are visible in chlorophyll systems at low temperature. And biophysicist Gregory Engel of the University of Chicago, who was not involved in this research, argues that such effects are therefore likely to be used in all photosynthetic systems, allowing plants to efficiently transfer energy over long atomic distances. "That this effect appears in cryptophytes speaks to the generality of the process," Engel says. "This work will open the floodgates to new techniques to move and concentrate energy efficiently. It is extremely important for semiconductor devices [and] solar light harvesting."

In fact, such insights might help inform how to efficiently transfer energy over long atomic distances quickly in human-made systems to harvest sunlight—benefiting from nature's 2.7-billion-year head start in optimizing such systems. "Can it help you make a huge jump through space? It does precisely that," Scholes says. "It would be really nice to learn some tricks or what you need to think about if you want to design something that would move energy a long distance quickly."

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