Global Warming

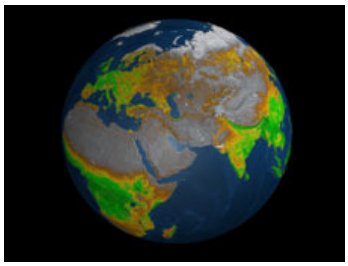
NASA Predicts Non-Green Plants on Other Planets

2012: Beginning of the End or Why the World Won't End?

slide show

To date, only some models that predict how the planet would respond to a doubling of carbon dioxide have allowed for vegetation to grow as a response to higher carbon dioxide levels and associated increases in temperatures and precipitation.

Of those that have attempted to model this feedback, this new effort differs in that it incorporates a specific response in plants to higher atmospheric carbon dioxide levels. When there is more carbon dioxide available, plants are able to use less water yet maintain previous levels of photosynthesis. The process is called "down-regulation." This more efficient use of water and nutrients has been observed in experimental studies and can ultimately lead to increased leaf growth. The ability to increase leaf growth due to changes in photosynthetic activity was also included in the model. The authors postulate that the greater leaf growth would increase evapotranspiration on a global scale and create an additional cooling effect.



› View animation

This animation shows seasonal vegetation changes on Earth in 2004, created using NASA satellite data. It is an animation of what is called the Normalized Vegetation Difference Index, which provides an indication of the health of plant life on Earth. Source: Scientific Visualization Studio, Goddard Space Flight Center

"This is what is completely new," said Bounoua, referring to the incorporation of down-regulation and changed leaf growth into the model. "What we did is improve plants' physiological response in the model by including down-regulation. The end result is a stronger feedback than previously thought."

The modeling approach also investigated how stimulation of plant growth in a world with doubled carbon dioxide levels would be fueled by warmer temperatures, increased precipitation in some regions and plants' more efficient use of water due to carbon dioxide being more readily available in the atmosphere. Previous climate models have included these aspects but not down-regulation. The models without down-regulation projected little to no cooling from vegetative growth.

Scientists agree that in a world where carbon dioxide has doubled – a standard basis for many global warming modeling simulations – temperature would increase from 2 to 4.5 degrees C (3.5 to 8.0 F). (The model used in this study found warming – without incorporating the plant feedback – on the low end of this range.) The uncertainty in that range is mostly due to uncertainty about "feedbacks" – how different aspects of the Earth system will react to a warming world, and then how those changes will either amplify (positive feedback) or dampen (negative feedback) the overall warming.

An example of a positive feedback would be if warming temperatures caused forests to grow in the place of Arctic tundra. The darker surface of a forest canopy would absorb more solar radiation than the snowy tundra, which reflects more solar radiation

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