

Επιπτώσεις Αλλαγής Κλίματος, Φυσικές Καταστροφές, Οικονομία (και πώς να προσαρμοστούμε)

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Περίληψη:

Οι πρόσφατες εκθέσεις της Διακυβερνητικής Επιτροπής για την Κλιματική Αλλαγή (IPCC), δείχνουν ότι οι επιπτώσεις που απορρέουν από την κλιματική αλλαγή είναι πολλές και ποικίλες, επηρεάζοντας ζωτικούς τομείς του περιβάλλοντος, της κοινωνίας και της οικονομίας. Οι επιπτώσεις της κλιματικής αλλαγής είναι σημαντικές, επηρεάζοντας τον πληθυσμό τόσο των αστικών κέντρων όσο και των αγροτικών περιοχών. Οι συνεχώς αυξανόμενοι φυσικοί κίνδυνοι και καταστροφές αποτελούν πλέον *σαφή και υπαρκτό κίνδυνο της παγκόσμιας αλλαγής*, η οποία καταδεικνύει επιπτώσεις μεγαλύτερες και από αυτές που προβλέπονται από την IPCC. Η κλιματική αλλαγή είναι ένα φαινόμενο που εξελίσσεται σε μεγάλες χρονικές κλίμακες, αντίθετα με τους φυσικούς κινδύνους που προκύπτουν από αυτή, οι οποίοι εμφανίζονται σε μικρότερες χρονικές κλίμακες, με συχνά, καταστροφικά αποτελέσματα. Αυτοί οι φυσικοί κίνδυνοι αποτελούν πεδίο μελέτης για την ανάπτυξη τεχνολογικών στρατηγικών προσαρμογής με στόχο την αντιμετώπισή τους.

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Η επιστήμη της παγκόσμιας αλλαγής του κλίματος

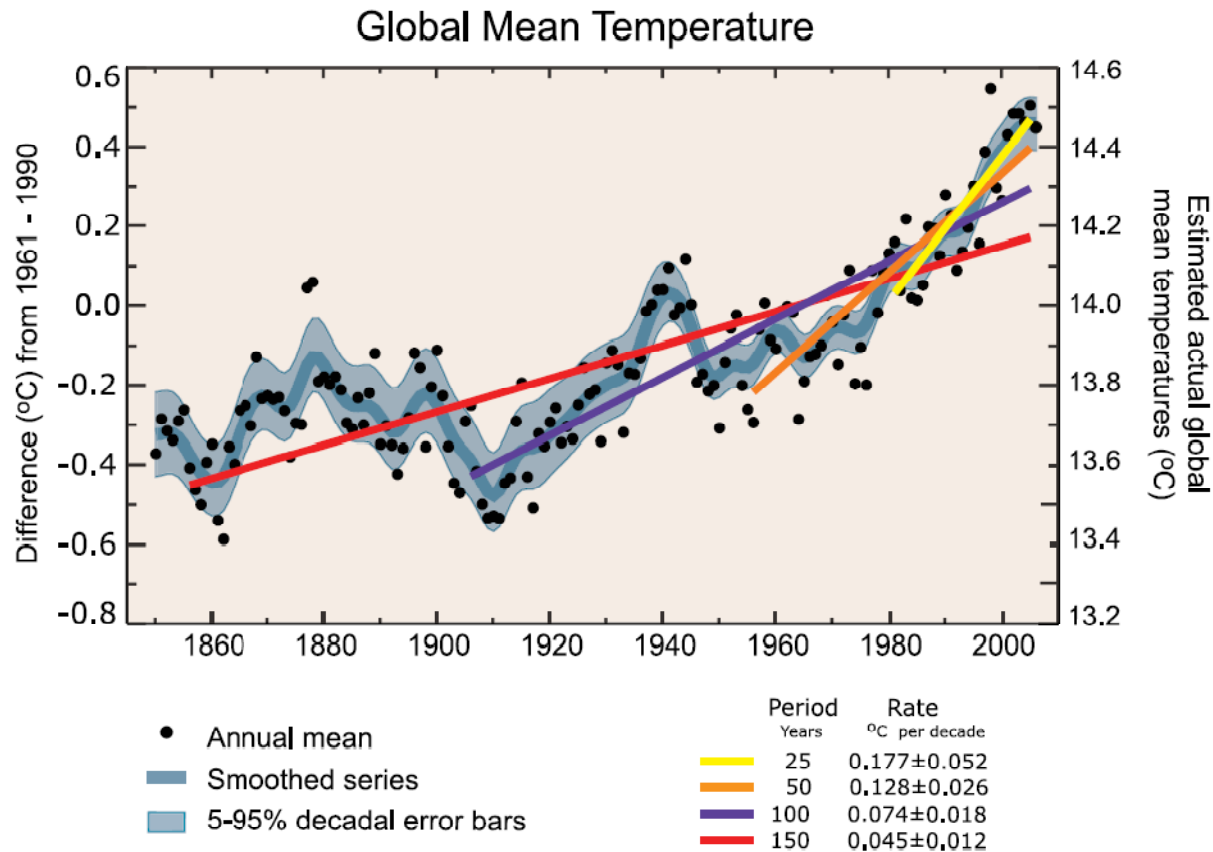
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Παγκόσμια αλλαγή, αλλαγή του κλίματος και θέρμανση του πλανήτη

- **Global Change**
 - Occurs naturally
 - Earth is dynamic, under continuous changes, planet
- **Climate Change**
 - Long term, naturally occurring (Earth & space-related effects)
 - Over 100,000+ years (glacial, interglacial phases)
 - Over millions of years, e.g. Cretaceous-Tertiary
 - Extinctions (e.g. Neanderthals, dinosaurs)
- **Global Warming**
 - It has been occurring in the past 15,000 years since the last Ice Age
- **Αυτά τα τρία δεν είναι τα ίδια**

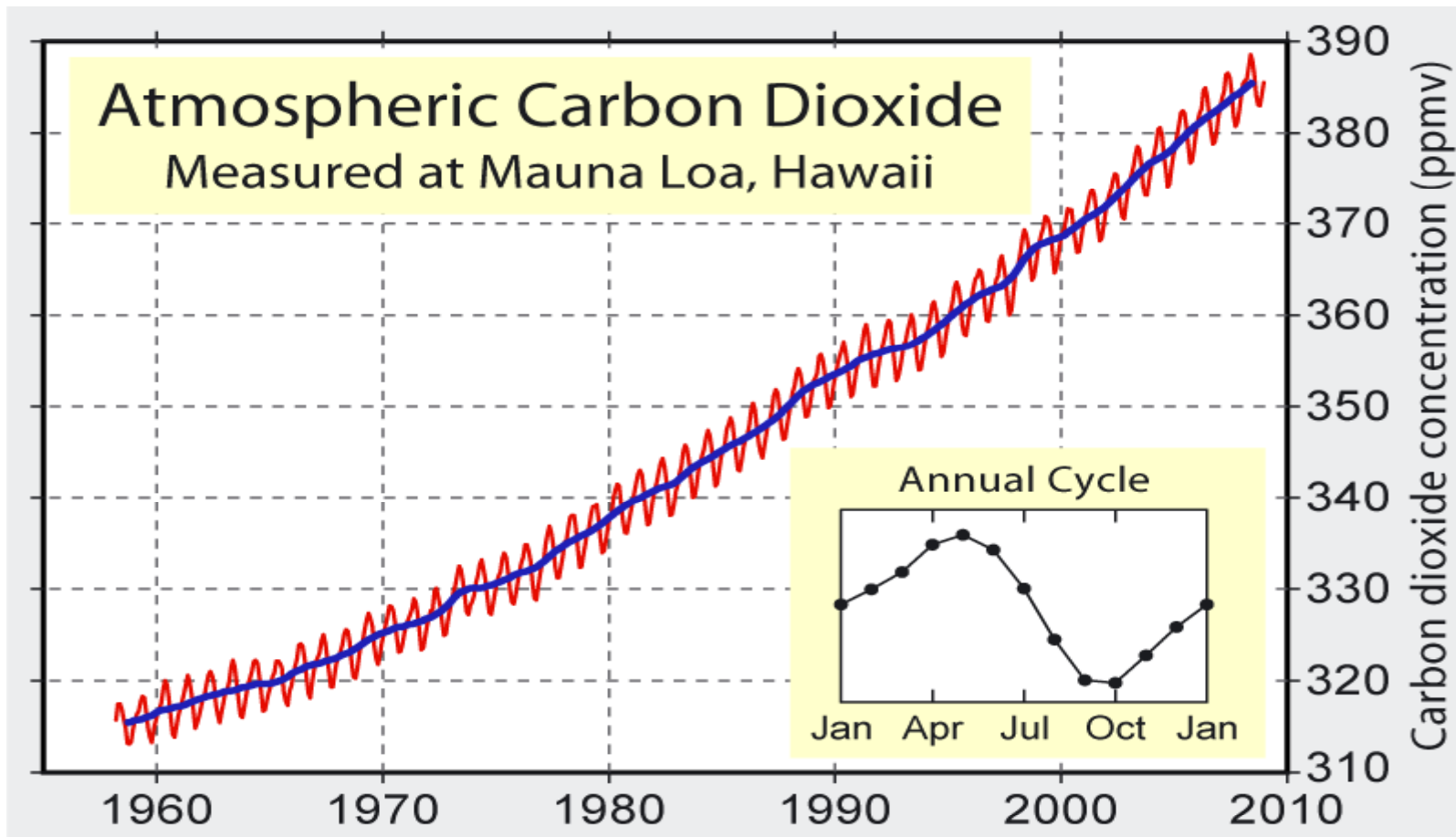
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παγκόσμια θέρμανση

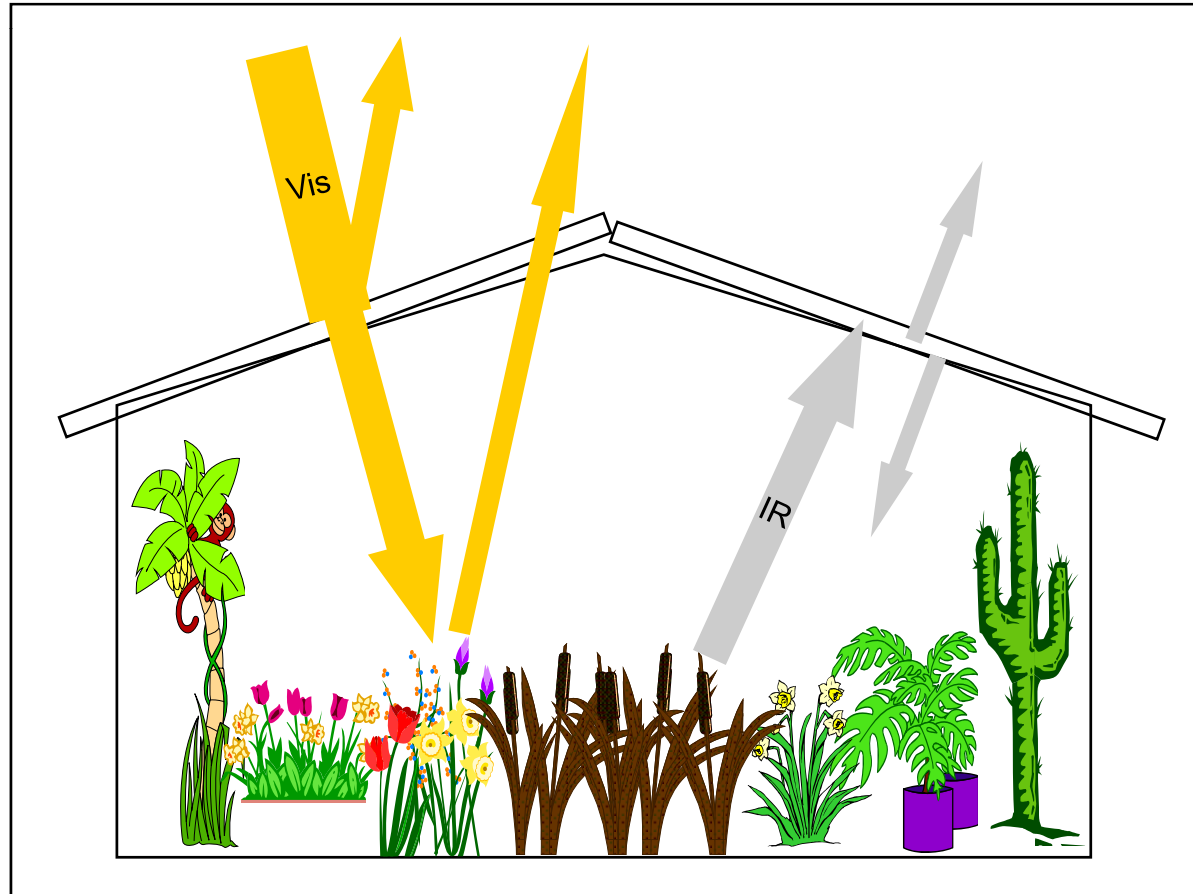


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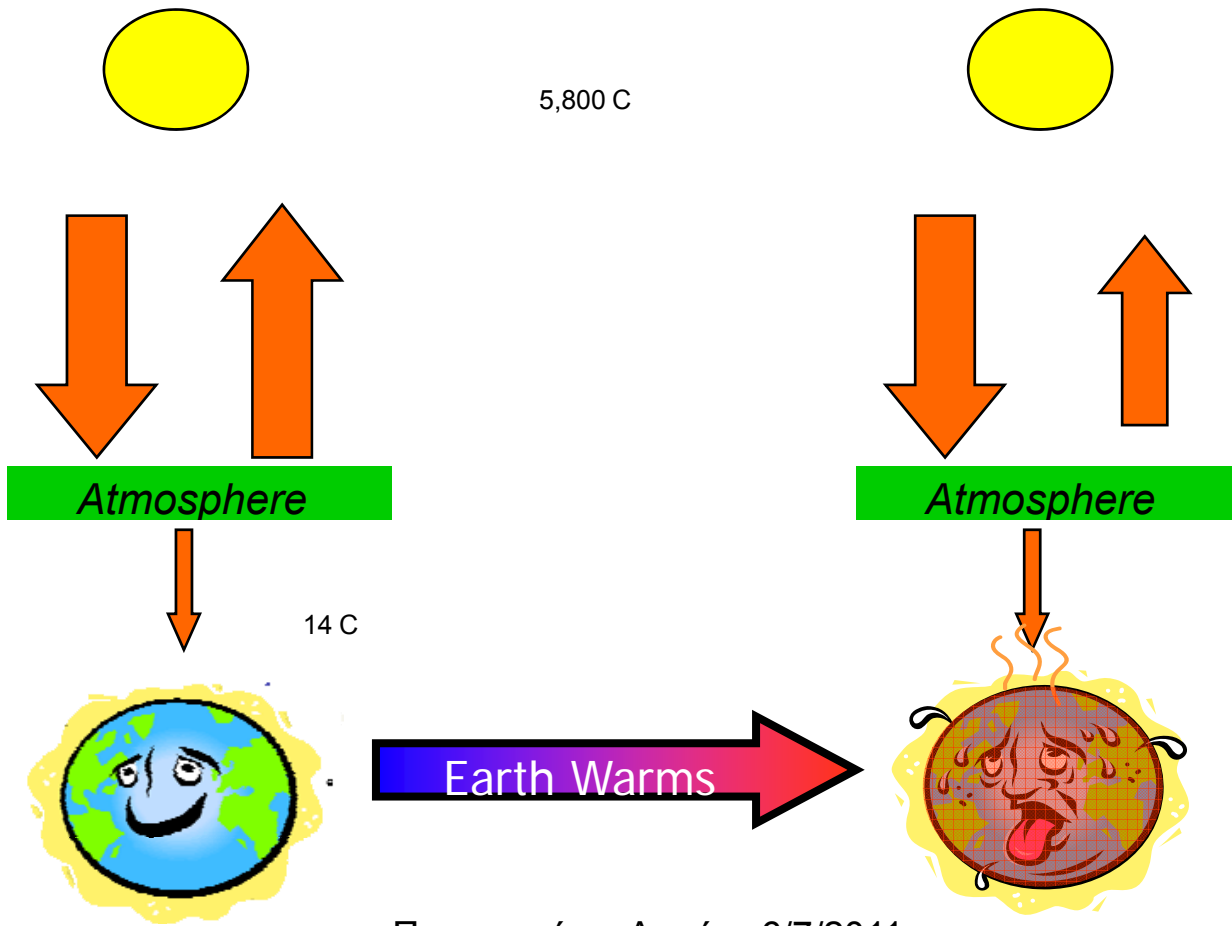
- According to the recent report Διακυβερνητικής Επιτροπής για την Κλιματική Αλλαγή (IPCC), the mean global surface temperature has increased by 0.74°C over the last 100 years (1906-2005)
- 11 of the 12 warmest years have been recorded in the past 12 years



το φαινόμενο του θερμοκηπίου



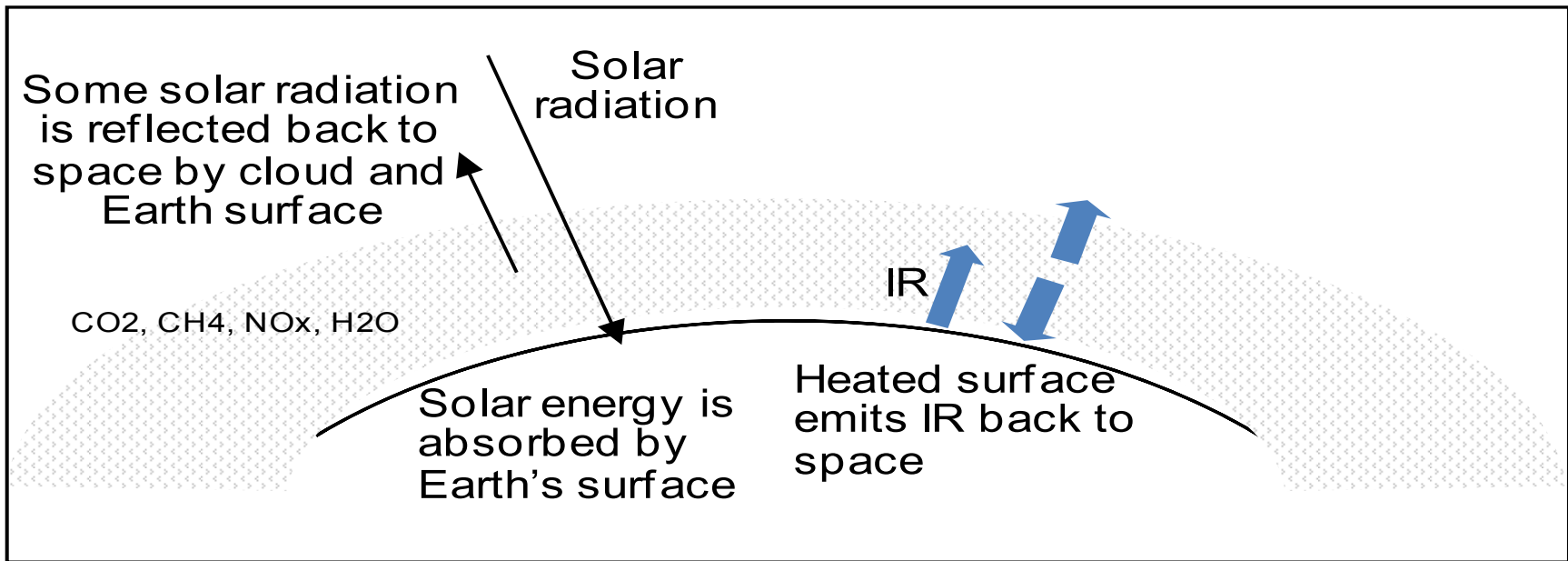
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But
Warmer
World

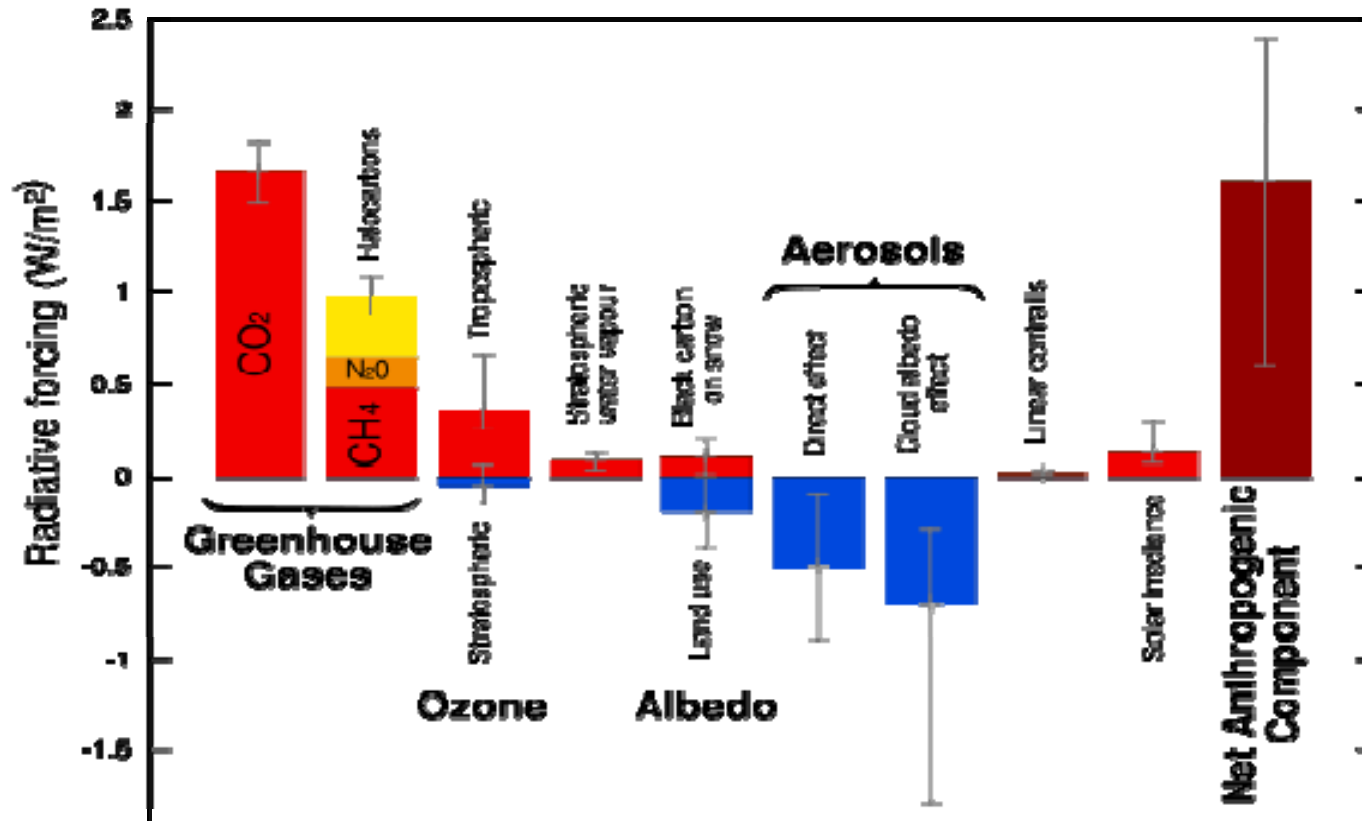
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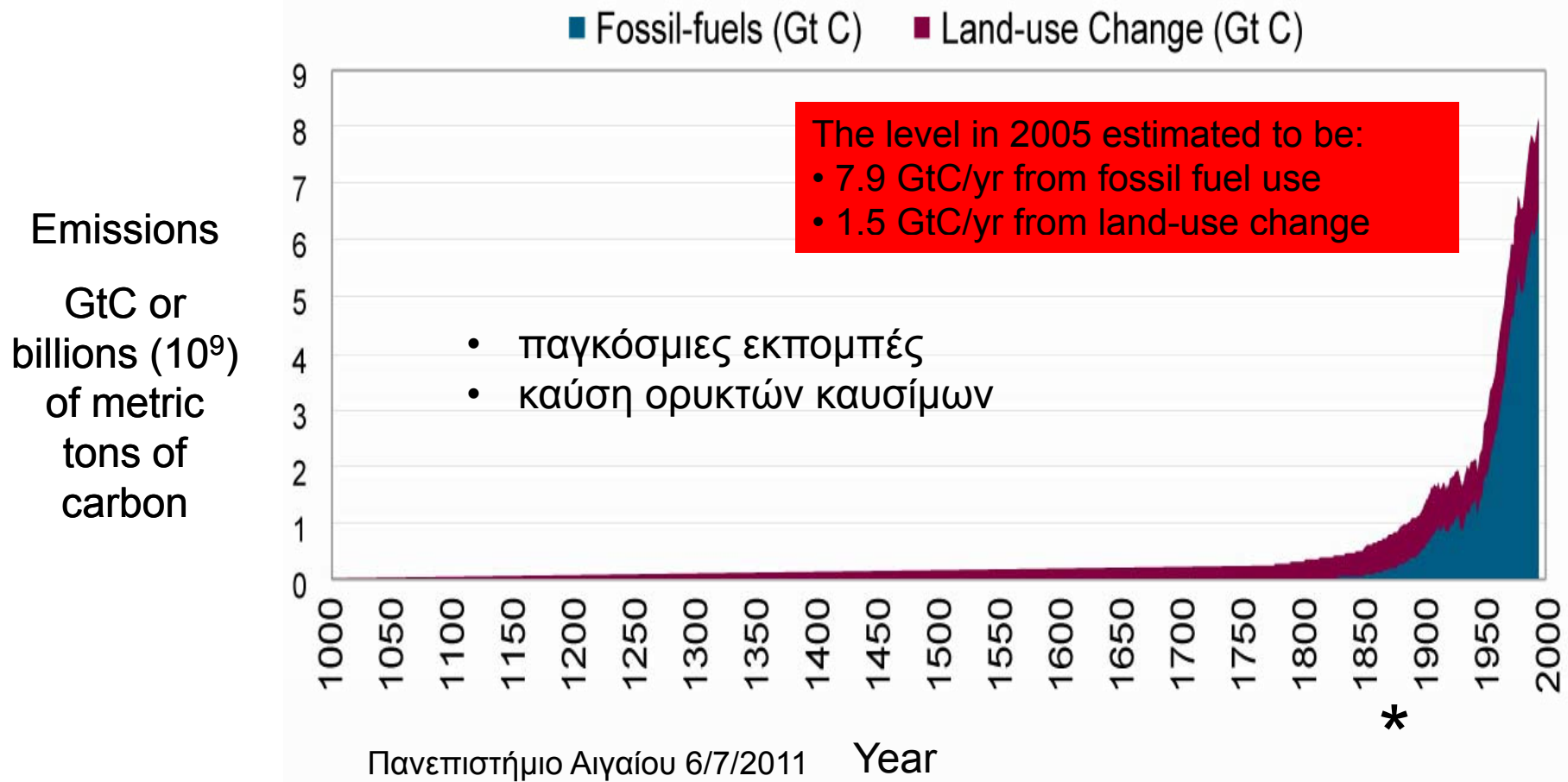


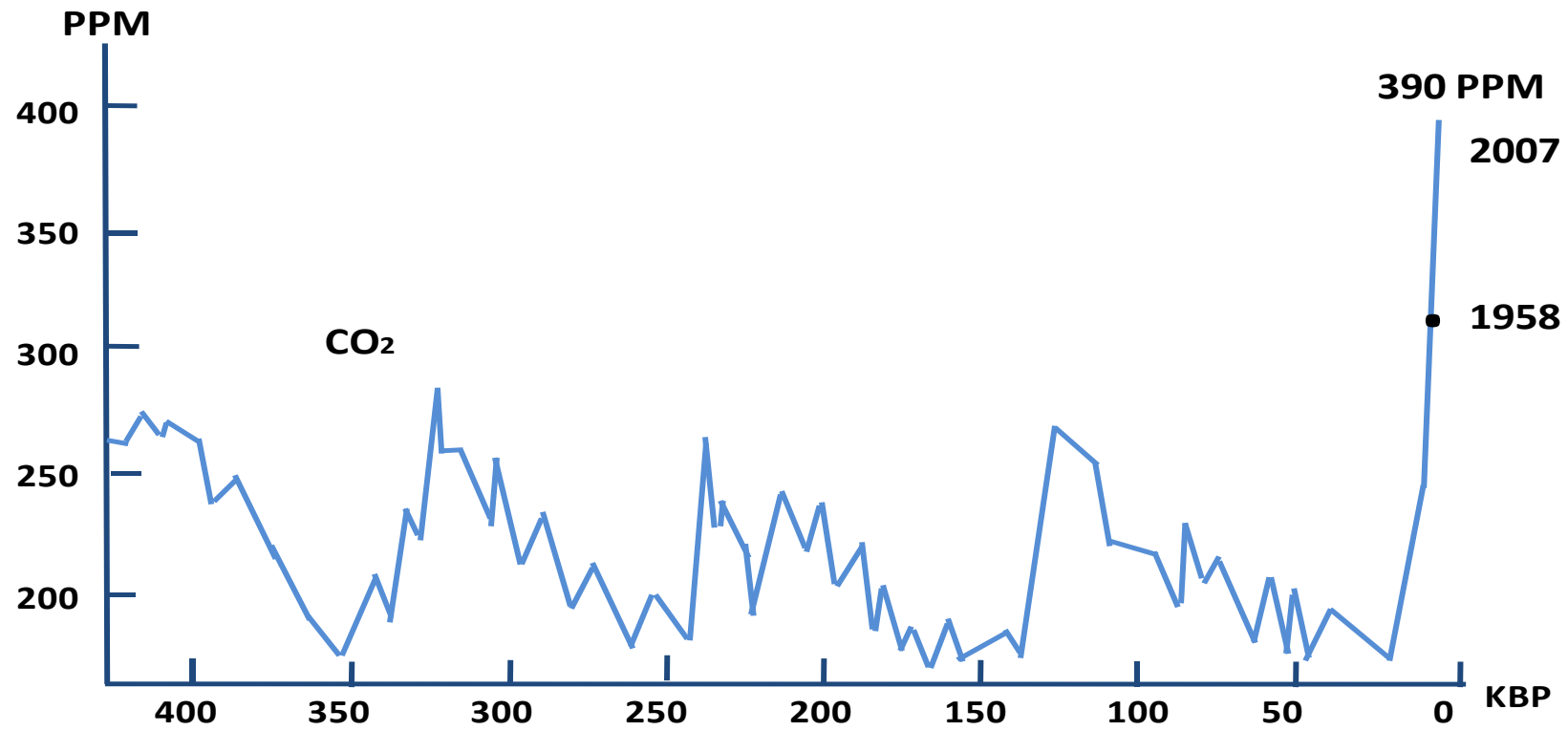
ακτινοβολιακή ένταση

Radiative Forcing Components

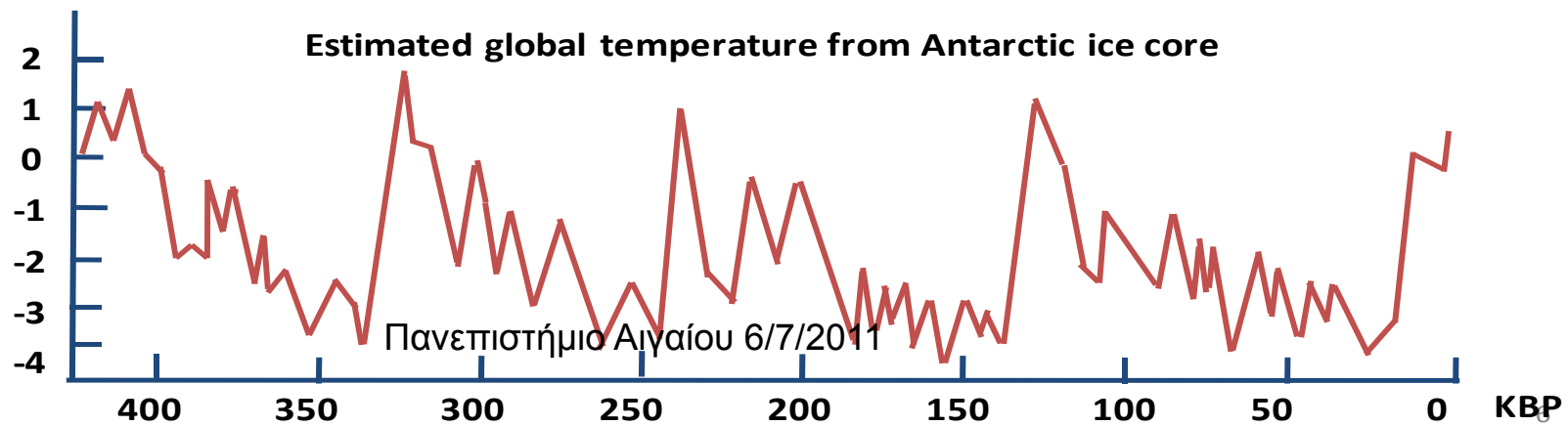
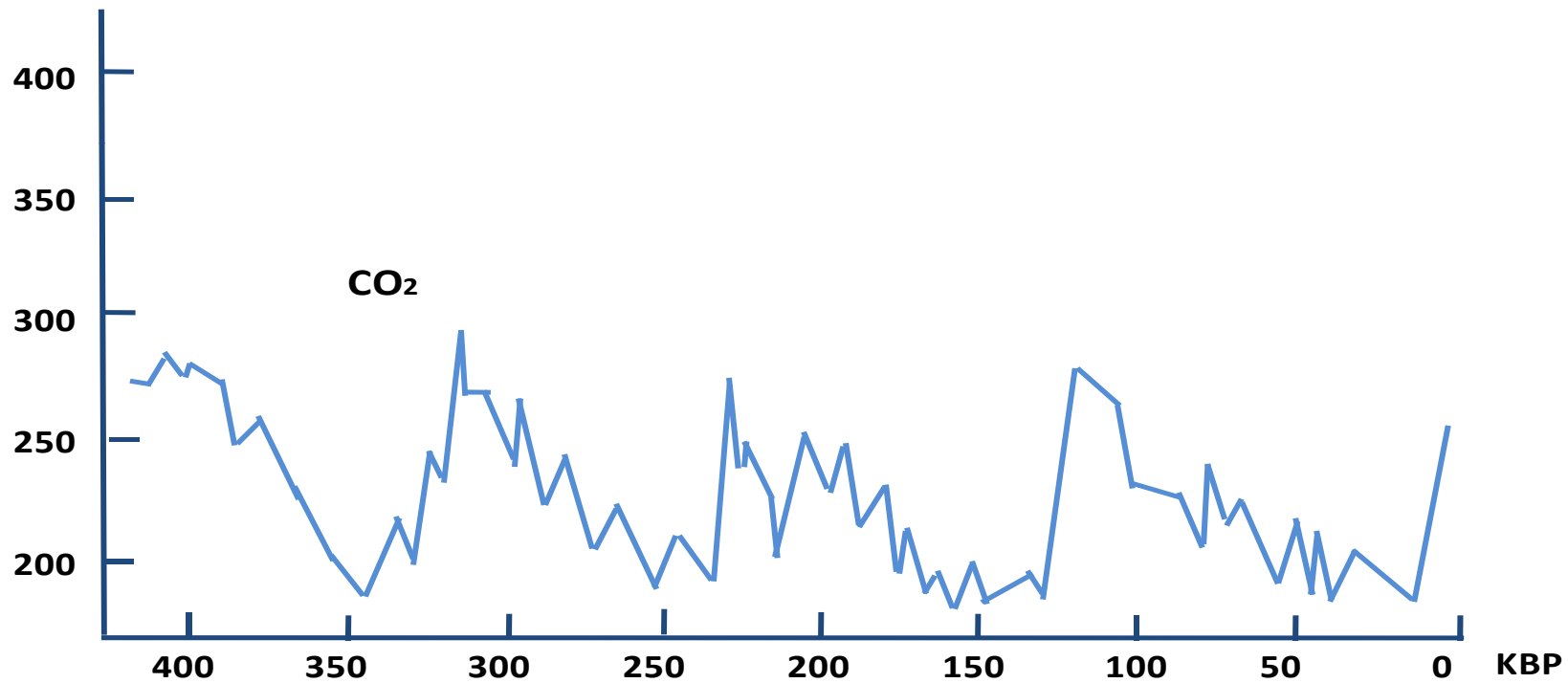


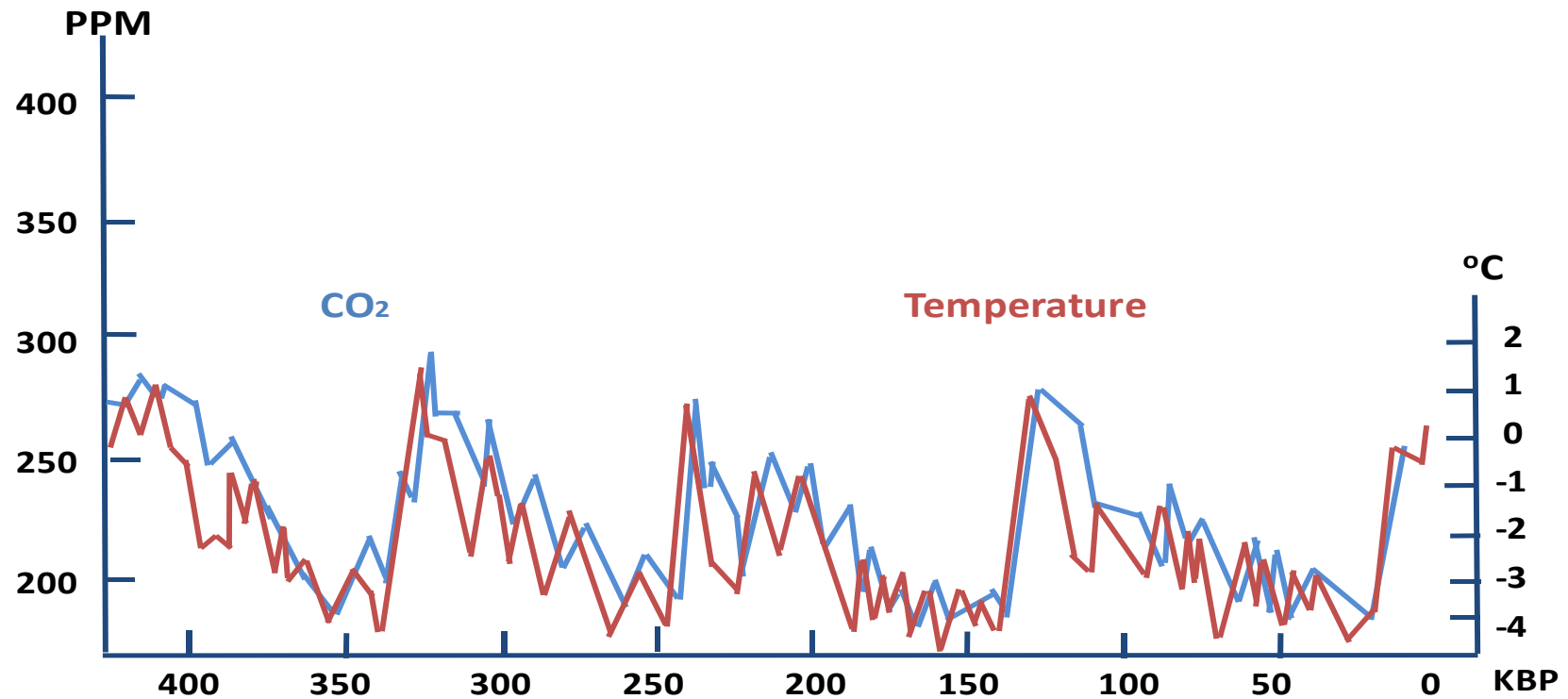
Annual global emissions of CO₂ (as C) rose during the 20th century to roughly 6.5 GtC/yr from fossil fuel combustion and about 1 GtC/yr from deforestation--and are now higher





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Warmer oceans release carbon dioxide
 Cooler oceans store carbon dioxide via photosynthesis
 Oceans are efficient in storing and releasing carbon dioxide



Climate Change */s* The Oceans

“How inappropriate to call this planet Earth when it is quite clearly Ocean.”

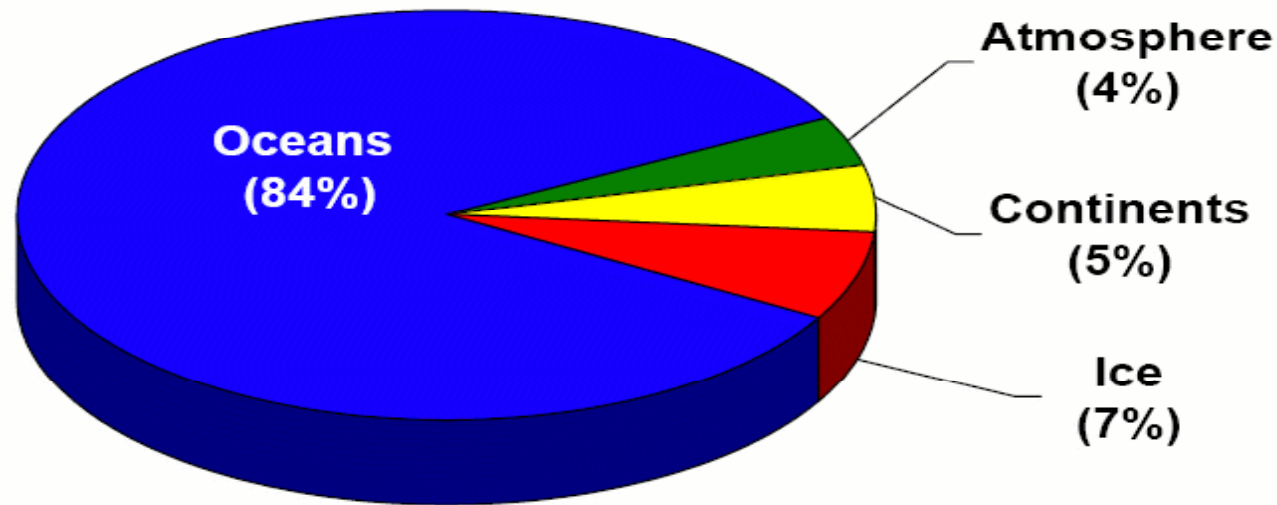
– Arthur C. Clarke –

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ΠΟΥ ΠΑΕΙ Η ΘΕΡΜΟΤΗΤΑ;

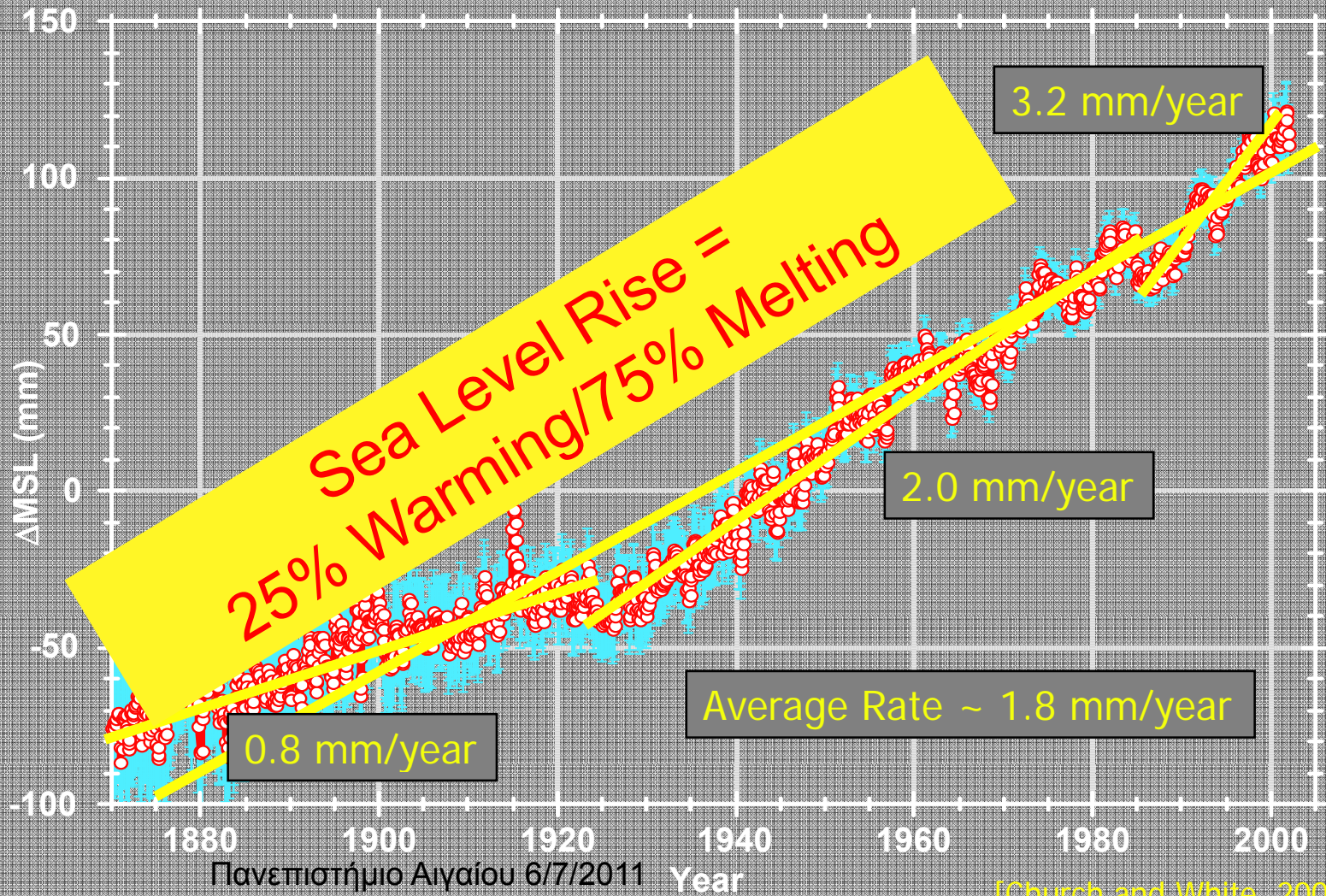
Amount of heat absorbed by different parts of the Earth's climate system over the past 40 years



ΣΤΟΥΣ ΩΚΕΑΝΟΥΣ!!

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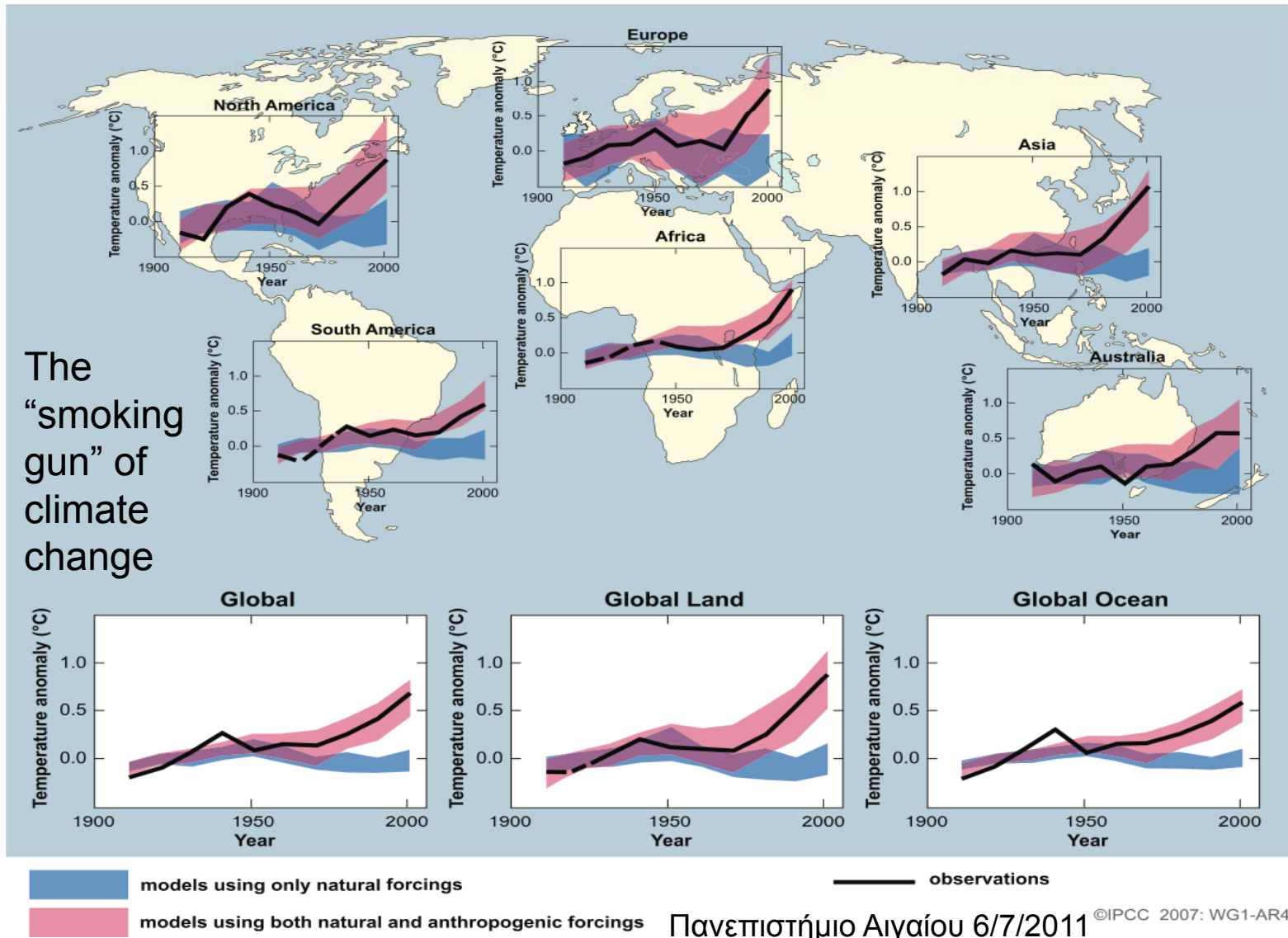
Μετρητής παλίρροιας



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[Church and White, 2006]

The Importance of Observations in Climate Change Decision Making *(keeping model runs honest)*



The “smoking gun” of climate change

Περιφερειακές επιπτώσεις, Πολιτική και Οικονομικά Θέματα

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Hot Spots around the World:

The clear and present danger of global change

- Melting of polar ice, snow and glaciers
- Sea level rise άνοδος της στάθμης της θάλασσας
- Strengthening of tropical cyclones κυκλώνες
- Increased floods αύξηση των πλημμυρών
- Increased droughts and changes in the precipitation ξηρασίες
- Dust storms αμμοθύελλες
- Increased wild fires πυρκαγιές
- Increased anthropogenic and natural aerosols and pollution αερολυμάτα και ρύπανση
- Health impacts: Heat waves, pollution, spread of tropical diseases, etc. επιπτώσεις στην υγεία

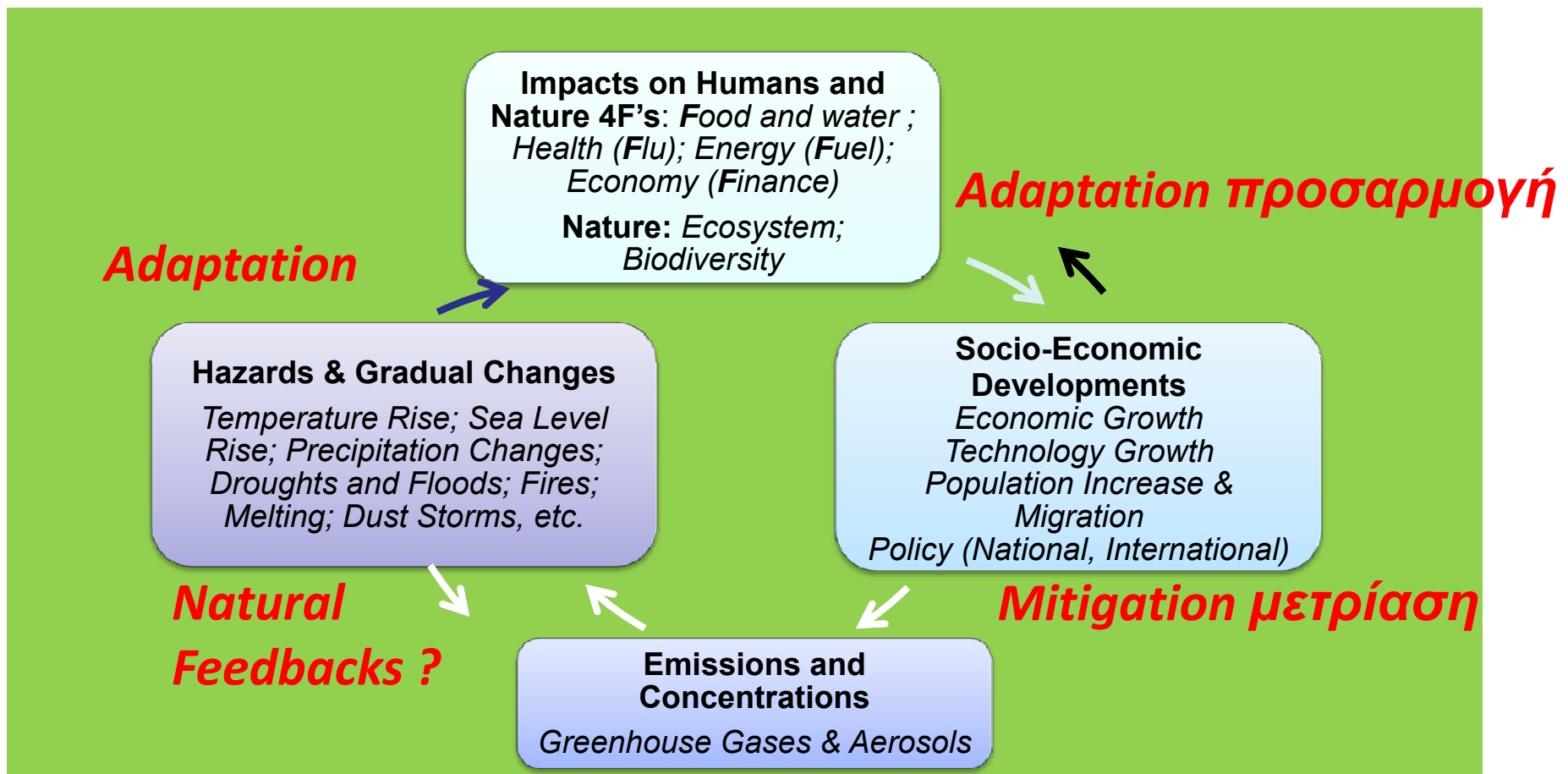
Εμπόριο & όριο -- Cap and Trade

- Market-based tool to reduce carbon emissions by groups of sources
- Sets “cap” on a given source’s emissions
 - If source emits more than cap allows, can purchase carbon credits from a source that emits less
- Promotes more environmental protections at lower costs
- Incentives to lower emissions (can sell credits for profit), consequences if too high (must purchase more credits)
- Can theoretically account for all emissions due to more accurate emissions reporting
- Each source develops its own strategy for compliance, i.e.,
 - trading carbon credits
 - install pollution controls
 - implement efficiency measures
 - alter business strategies, etc.

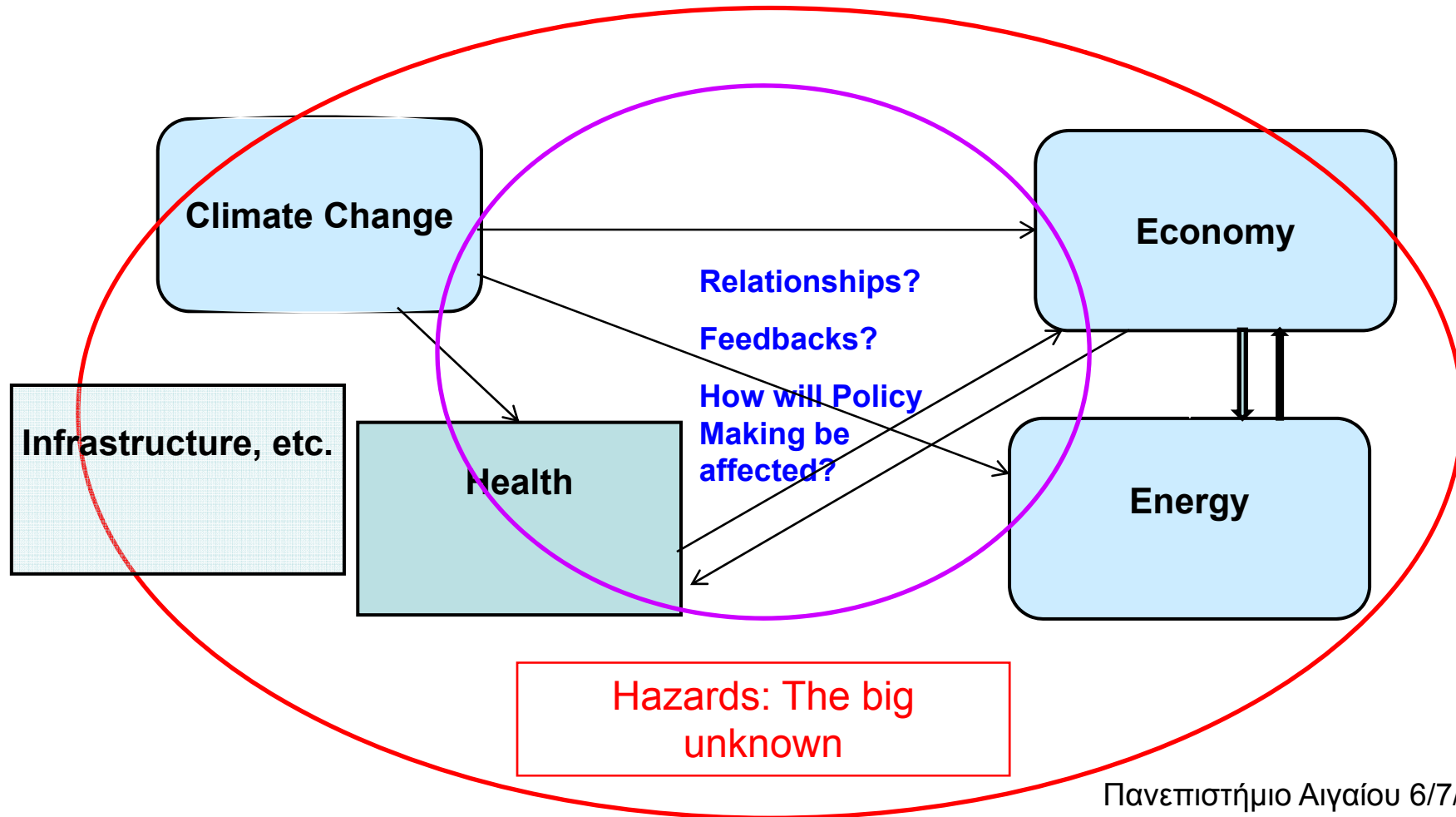
Green Growth and the Economy: Examples

- **Korea Government policy:** “New Growth industries and the creation of jobs are requisite to tide over the economic crisis, and green industries are the sole alternative.” (Senior Presidential Secretary Jae-wan Park)
- **Deutsche Bank (2009 white paper):** “Each government will have to come up with a stimulus package to shore up their slumping economy in order to preempt a recession in the next 2 to 3 years, ...this is a historic opportunity to invest in the green infrastructure”.
- Report predicts that investments in the green growth sector will surge to **\$45 Trillion by 2050 globally**. Areas such as clean energy generation, storage and other infrastructure; management of sources like water, agriculture and sewage; efficient use of energy and resources; and environmental services, will be major investment areas.

Natural Hazards, Global and Climate Change, Socio-Economic Issues ΚΟΙΝΩΝΙΚΟ-ΟΙΚΟΝΟΜΙΚΑ Θέματα



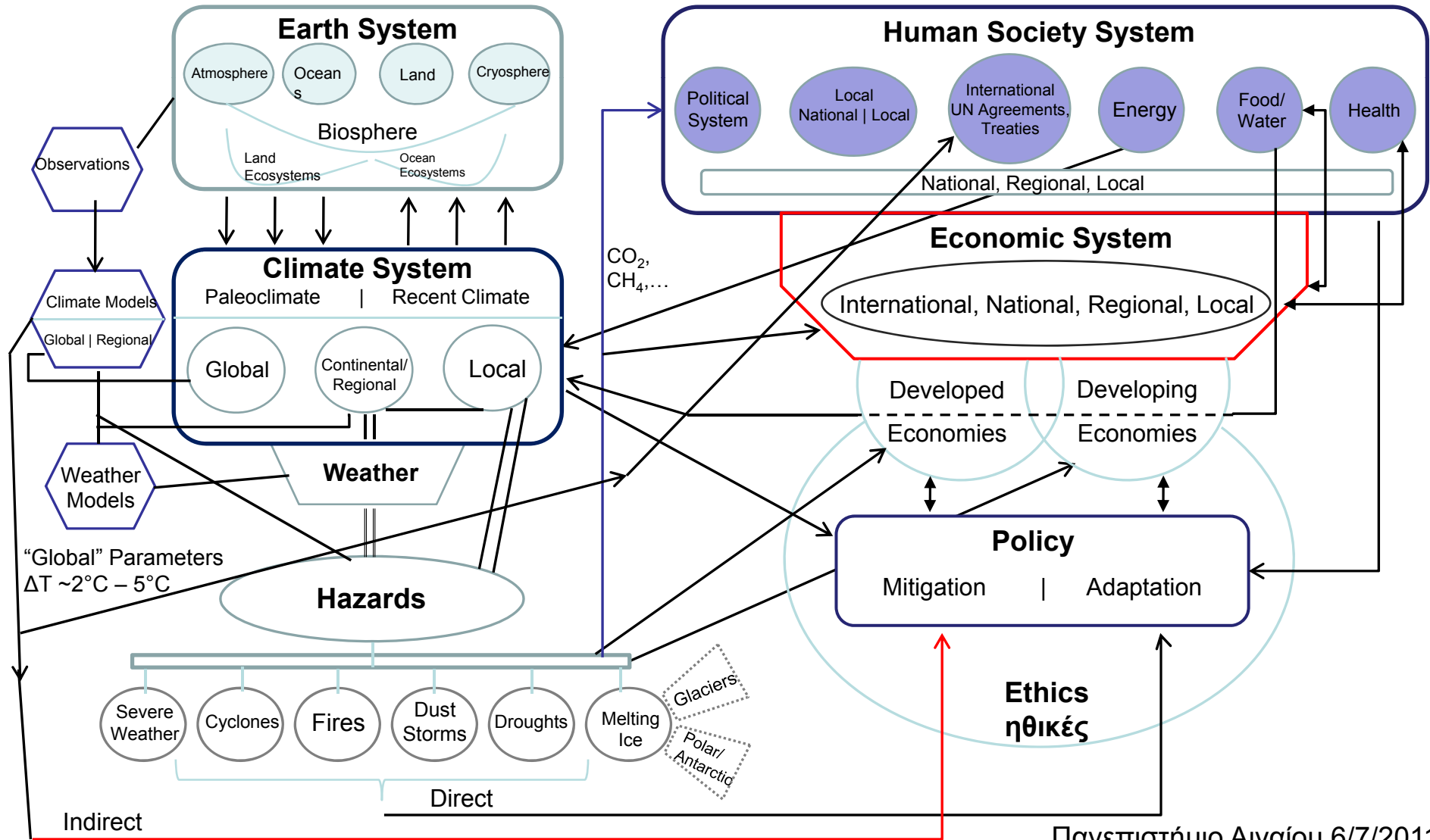
Climate Change, Economy, Energy, Health and Decision Making



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To understand the economic opportunities in climate change and associated hazards, we have to understand the costs of damage

Grand Unified Theory of Global Change



National Oceanic and Atmospheric Administration
“The 2010 State of the Climate Report”

10 key planet-wide indicators of warming climate:

- ψηλότερες κοντά στην επιφάνεια θερμοκρασίες (τροπόςφαιρας)
- ψηλότερη υγρασία
- ψηλότερες θερμοκρασίες στην ξηρά
- ψηλότερες θερμοκρασίες στους ωκεανούς
- ψηλότερες θερμοκρασίες της επιφάνειας της θάλασσας
- μεγαλύτερη περιεκτικότητα σε θερμότητα των ωκεανών
- ψηλότερα επίπεδα της θάλασσας
- λιγότεροι θαλάσσιοι πάγοι
- λιγότερη χιονοκάλυψη
- συρρίκνωση των παγετώνων

Global Climate Change, Economy and Regional Impacts: How are they related?

- Climate change is global but its effects are regional or local
- COP 15 (Convention of Parties of the United Nations Framework Convention on Climate change, Σύμβαση των μερών σύμβαση-πλαίσιο Ηνωμένων Εθνών για την κλιματική αλλαγή, UNFCCC), COP 16 in Mexico, existing treaties such as Kyoto Protocol, how the dual issues of global climate and global economy are related to each other, need to be addressed; and the emergence of China, India economies.
- A lot of emphasis has been placed on carbon trading policies and the associated economic issues but increasing impacts of hazards associated with climate change need to be addressed seriously as they are the *clear and present danger* of climate change

Οικονομικές ευκαιρίες για μετριασμο και προσαρμογή

Issues

- Investment in climate change mitigation or adaptation επένδυση
- Tools for Decision Making -- εργαλεία για τη λήψη αποφάσεων

Business opportunities (ευκαιρίες) in climate change mitigation:

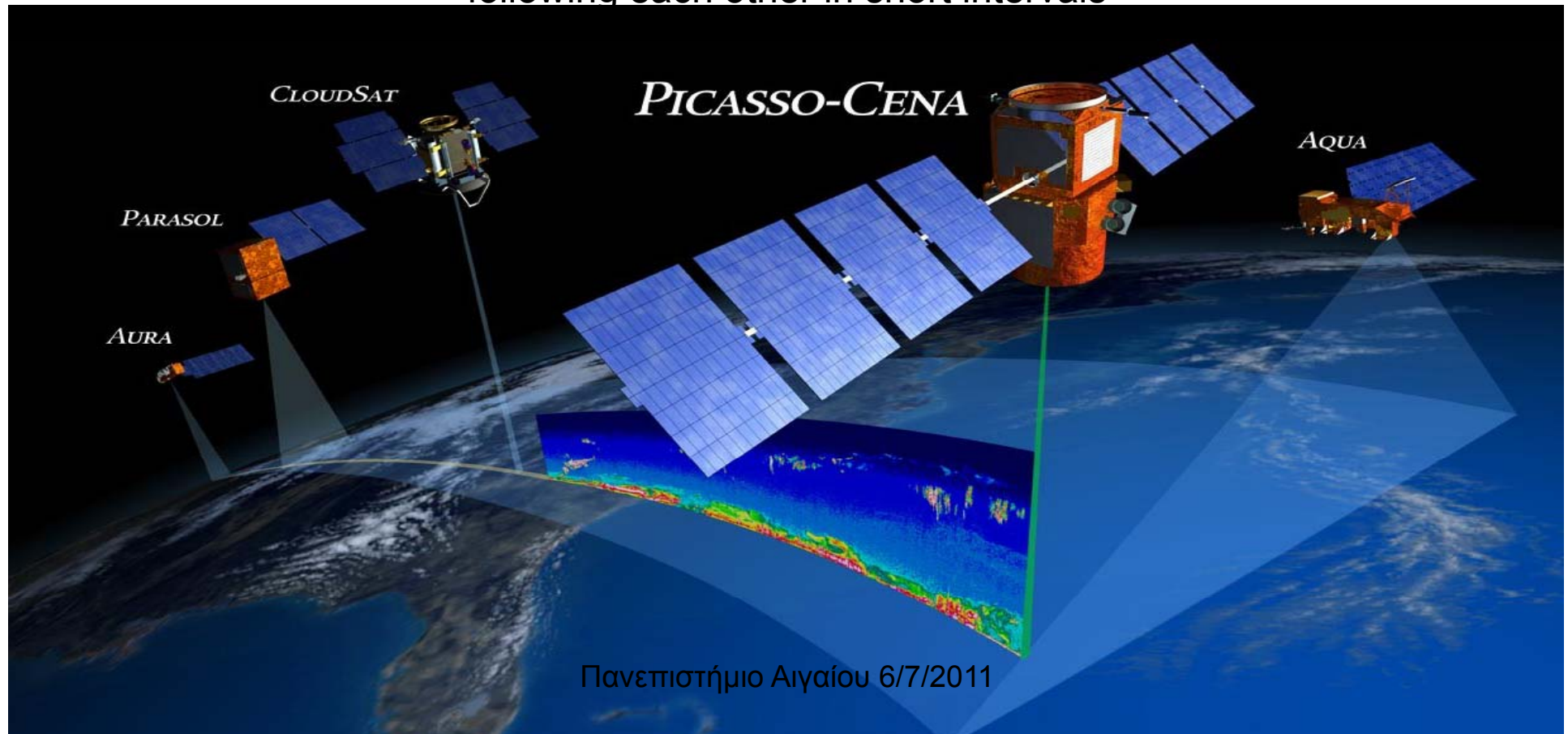
- clean energy technologies
- better energy efficiency αποδοτικότητα της ενέργειας
- biomass (βιομάζα) to energy technologies

Opportunities in climate change adaptation:

- ecosystem restoration αποκατάσταση των οικοσυστημάτων
- forest management διαχείριση των δασών
- water and watershed (υδροκρίτη) quality improvements
- waste management διαχείριση των αποβλήτων
- move away from danger areas (not yet)
- change living and food habits (not yet)

SATELLITE OBSERVATIONS: Economic value will increasingly become greater and greater

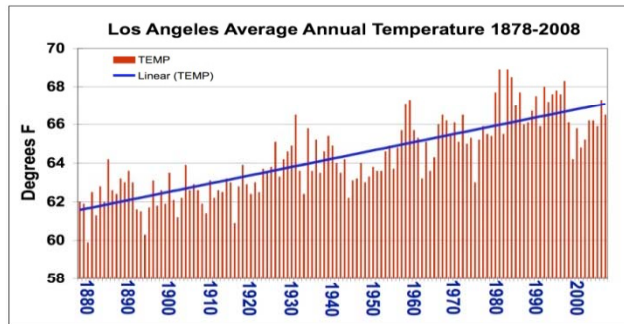
A –Train of NASA. Instruments include photometers, lidars, radar and hyperspectral, following each other in short intervals



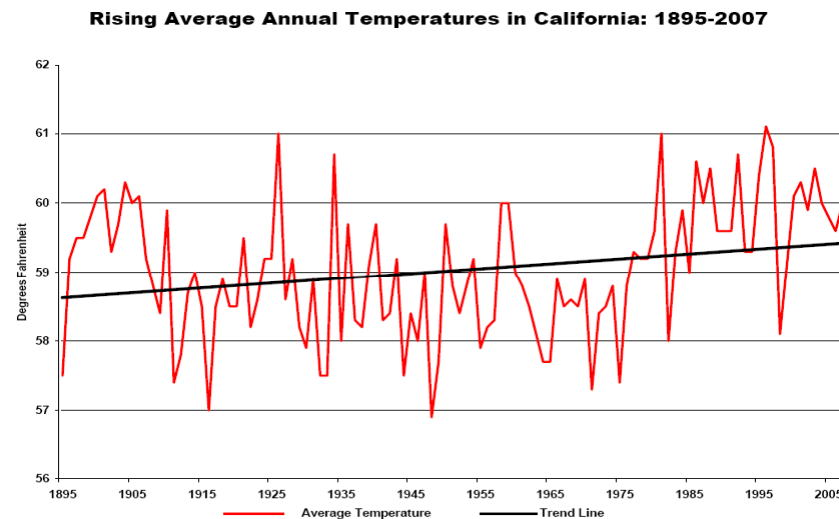
τοπικές κλιματικές αλλαγές πρέπει
να μελετηθούν και να κατανοηθούν
καλύτερα

Περιφερειακές κλιματικές αλλαγές

- Climatic changes in California



Source: NASA

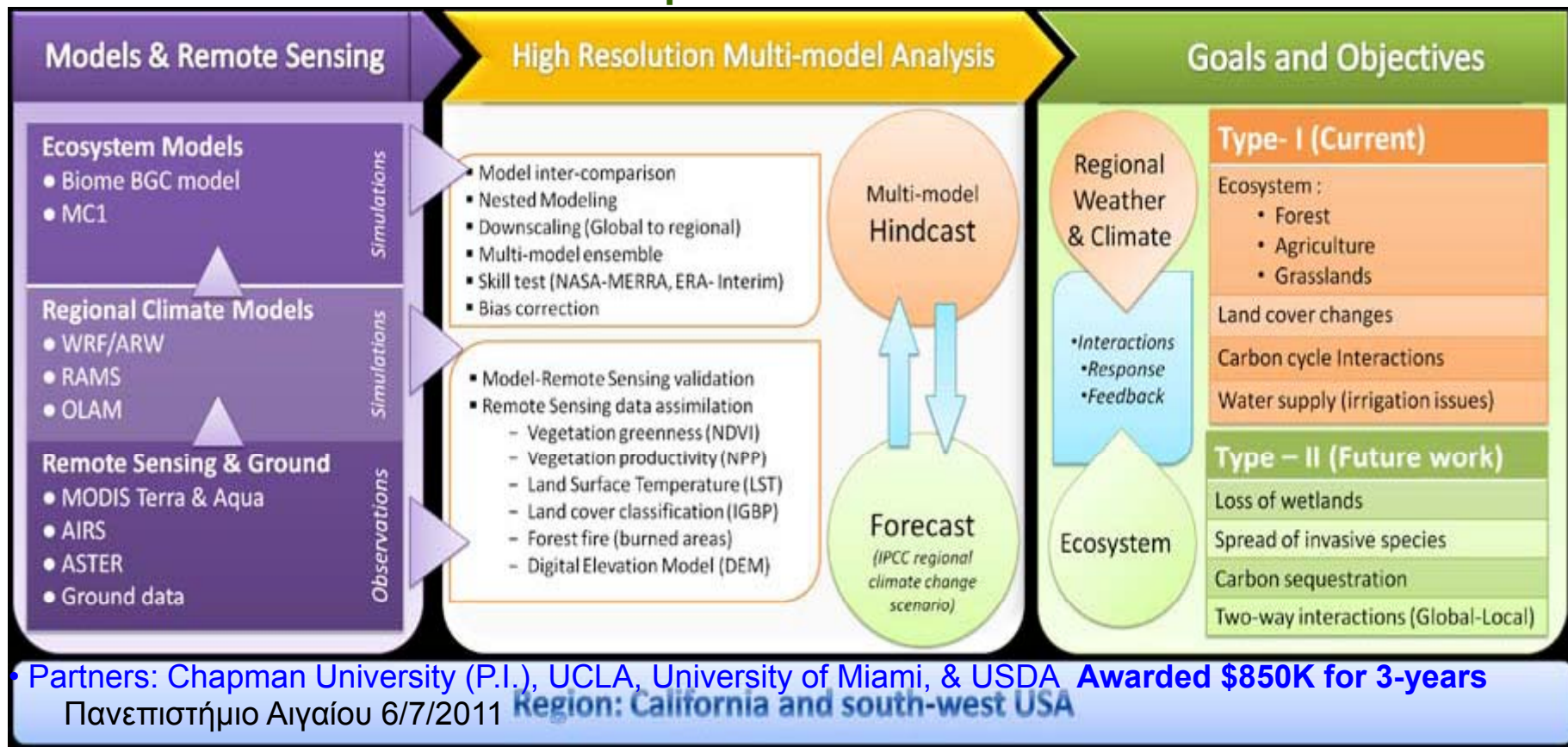


www.EnvironmentCalifornia.org

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Collaborative Research: NSF/DOE/USDA

προσομοίωση πολλαπλών μοντέλων των επιπτώσεων της αλλαγής του περιφερειακού κλίματος στη γεωργία και τα οικοσυστήματα των νοτιοδυτικών Ηνωμένων Πολιτειών



ΣΥΜΠΕΡΑΣΜΑΤΑ

- Climate variability and temperature increase over decades while hazards occur over short timescales. Not easy to establish cause and effect but increased intensity and frequency of hazards indicates a climate connection.
- As the IPCC indicates, signatures of climate change or global warming include extremes of weather, rise of sea level, etc.
- Feedback mechanisms between hazards and global climate; regional models coupled to global models, and observations by satellites and global networks need to continue.
- Impacts of anthropogenic hazards can have long-term regional effects, e.g. fires of Greece, California, etc. They may even change the local climate.
- Natural and anthropogenic aerosol, cloud interactions and connection to biosphere need to be understood more.
- International collaborations are essential. Future economic losses could be large but also economic opportunities would be large.
- More studies are needed by scientists economists and policy experts, particularly linking computer models to observations from space, economic factors, etc.

ΣΥΜΠΕΡΑΣΜΑΤΑ

The need to organize and deploy multi-disciplinary expertise at the regional to national levels, to develop adaptation solutions for the regions which are particularly at risk , will likely become an international imperative. Expertise includes a variety of practicing economists, sociologists, agricultural specialists, public health professionals, climate and hazards scientists, hydrologists, engineers, and of course policy experts with regional knowledge. Existing wealth of scientific knowledge has a great potential for addressing a multitude challenges, how to develop “policy under deep uncertainty”.

We face huge challenges of both mitigation and adaptation as the science itself of coupling global climate to regional impacts involves socio-economic impacts, energy policy, and understanding Earth system processes. *We don't have yet the science to address the total system, Earth/climate/society/economy, this would require a new interdisciplinary science (νέα διεπιστημονική επιστήμη) combining different fields.*

There are great business opportunities for investment and technology approaches. Governments and businesses generating the right solutions, will provide economic opportunities beyond their own nations.

Acknowledgements, Collaborations

Material to be used by permission only—contact Prof. M. Kafatos, kafatos@chapman.edu

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