

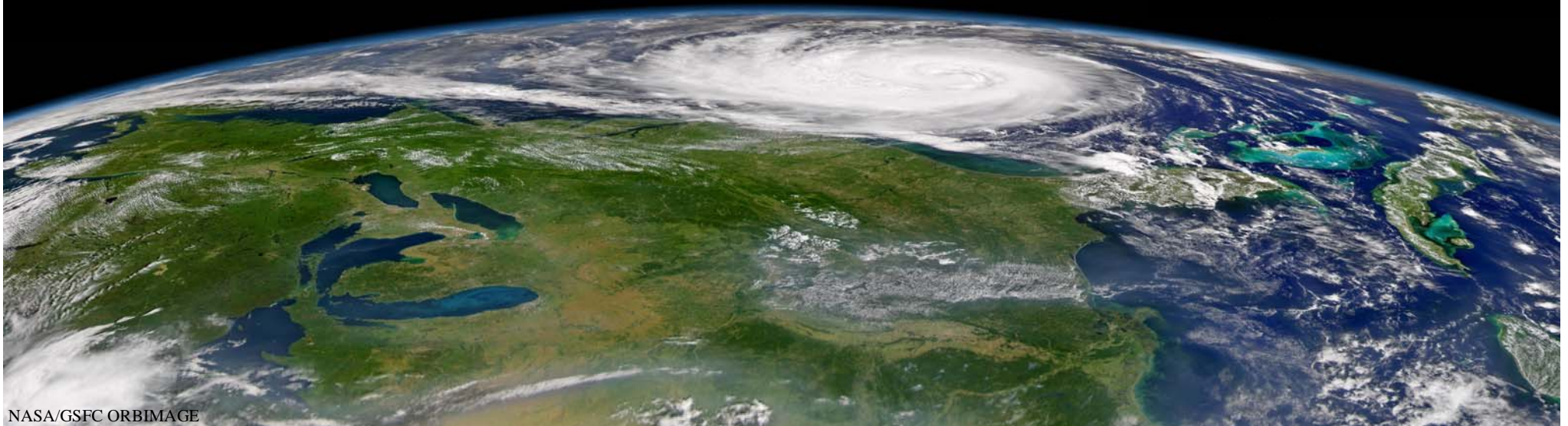


Globális klímaváltozás és a természeti katasztrófák

JÁNOSI IMRE

ELTE TTK KOMPLEX RENDSZEREK FIZIKÁJA TANSZÉK
KÁRMÁN KÖRNYEZETI ÁRAMLÁSOK LABORATÓRIUM

<http://www.atomcsill.elte.hu>



New Orleans, 2005. aug. 31.



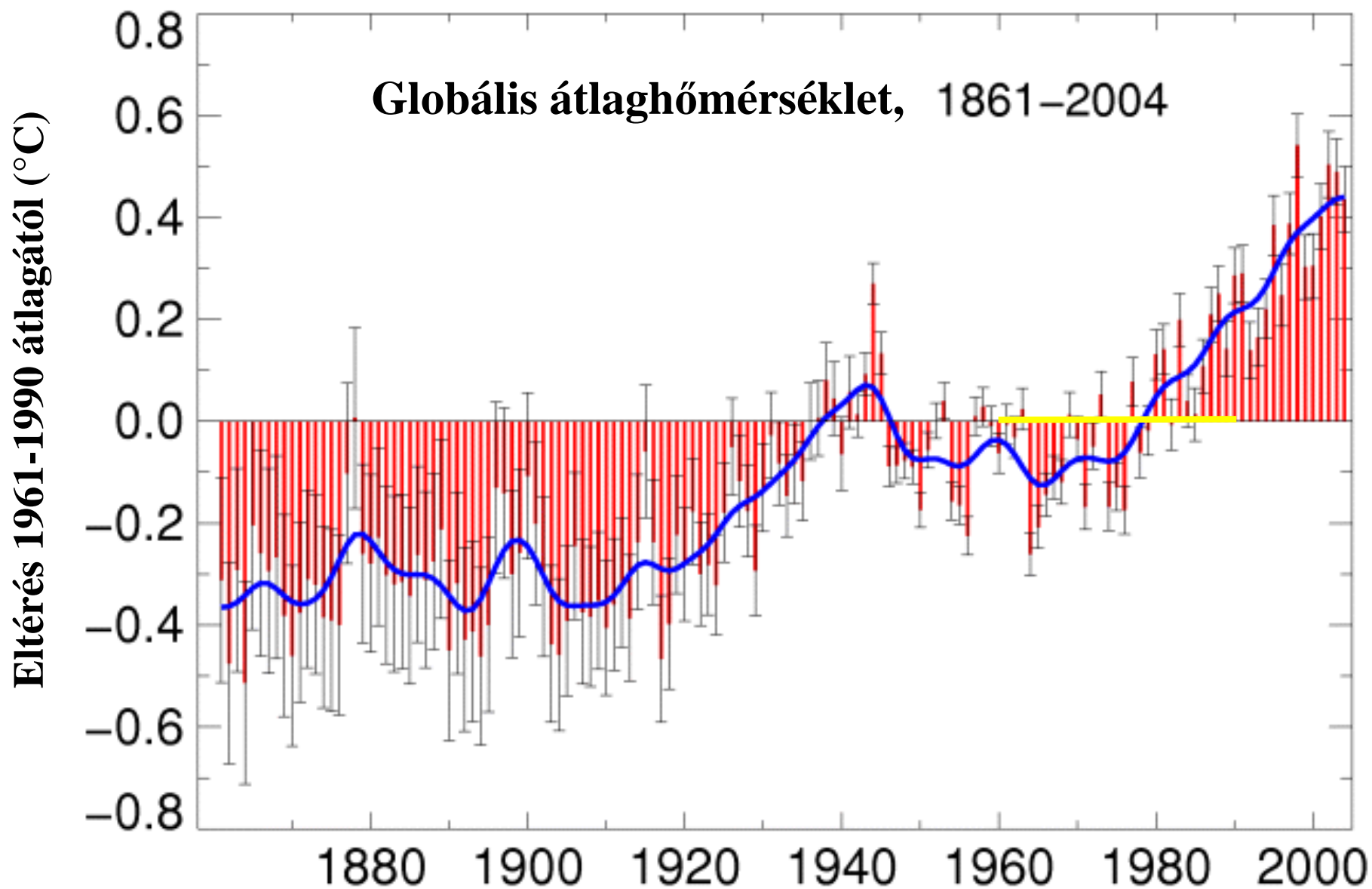


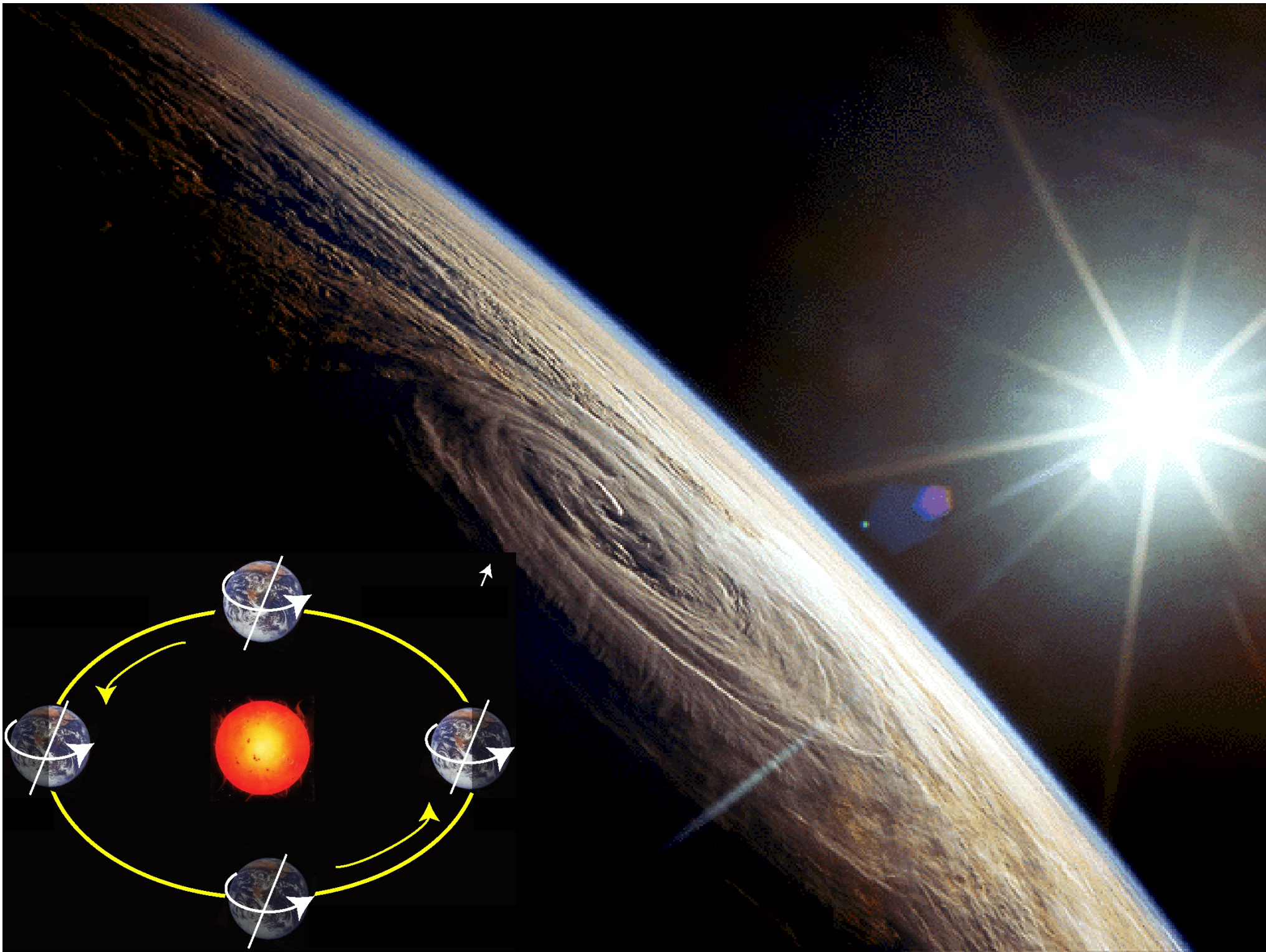




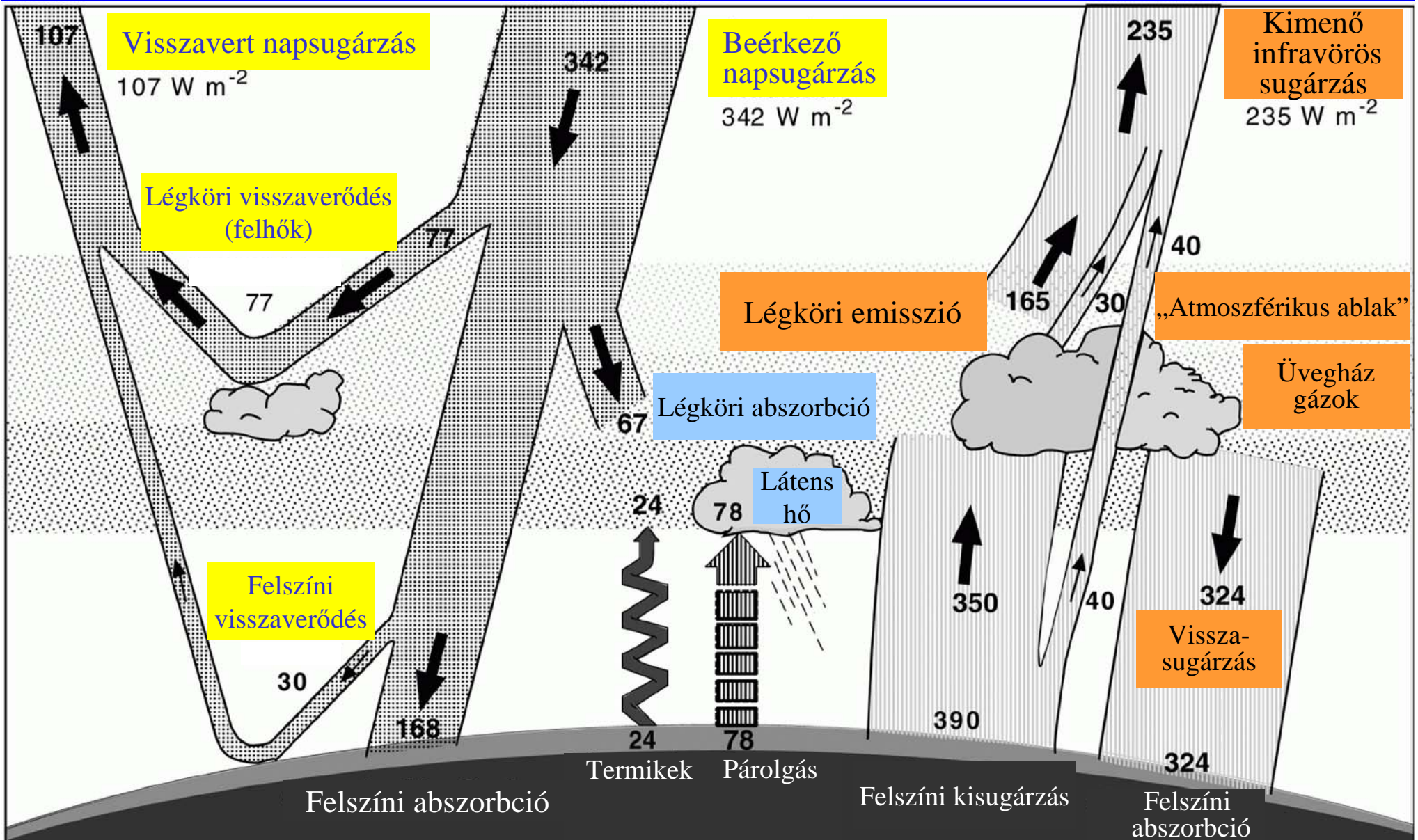


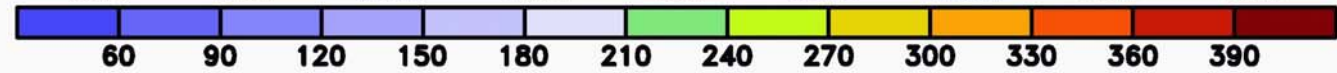
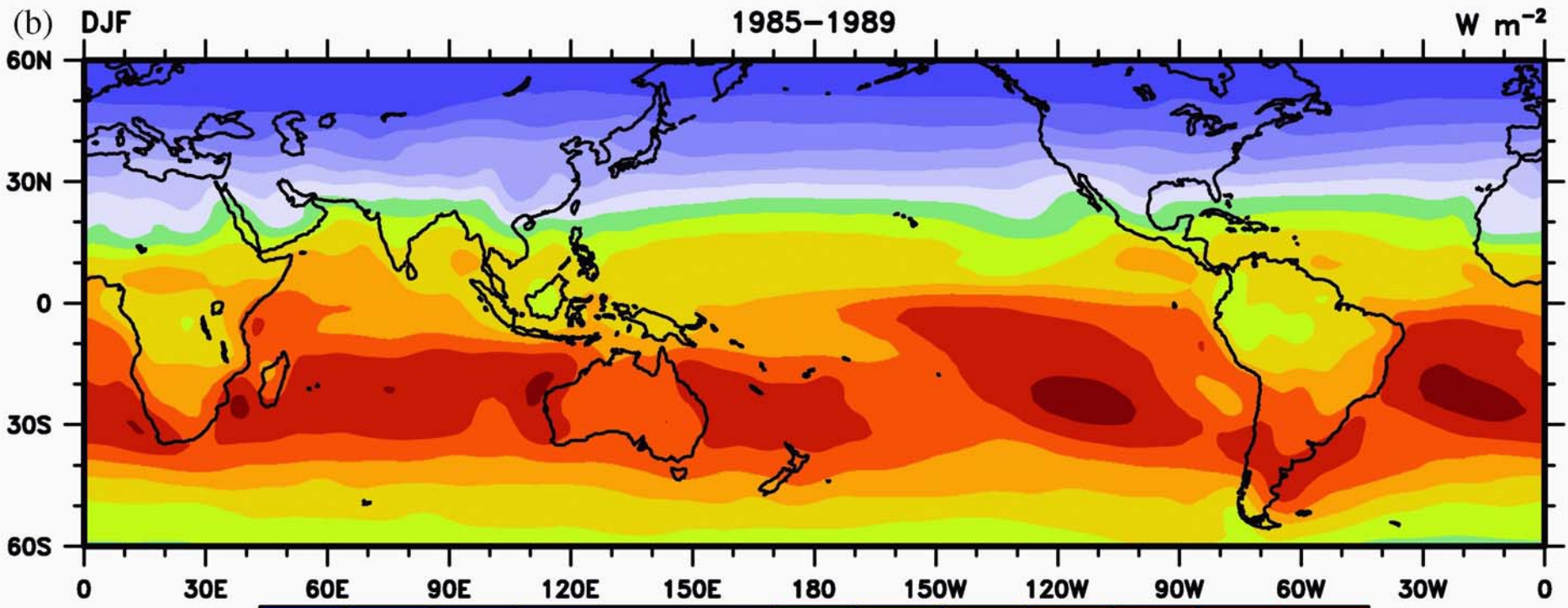
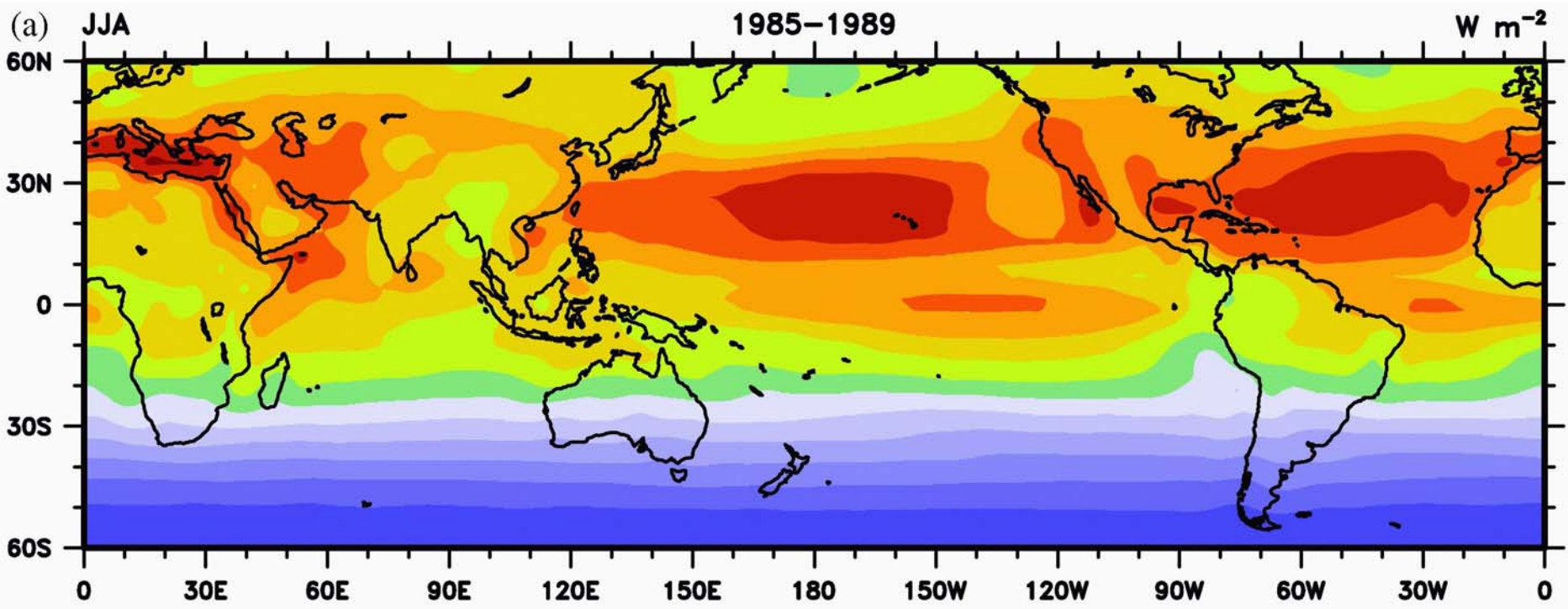
1. Katasztrófák mindenfelé..... Globális felmelegedés?





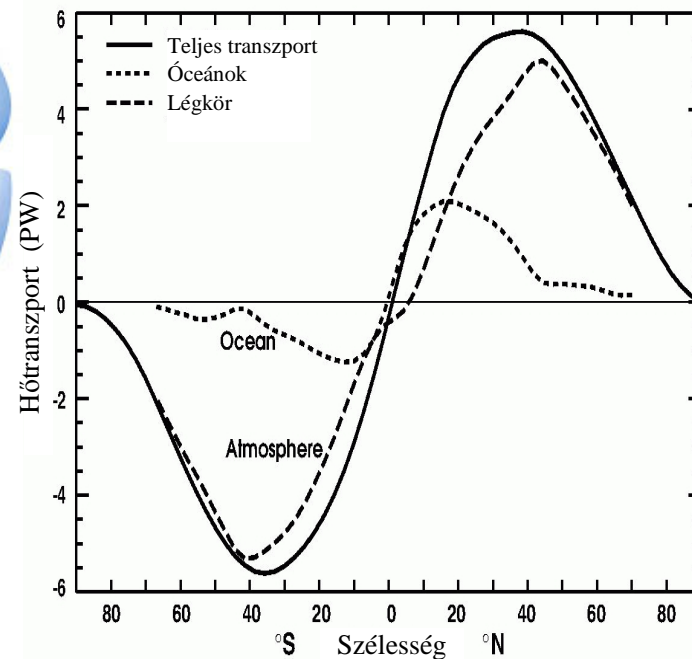
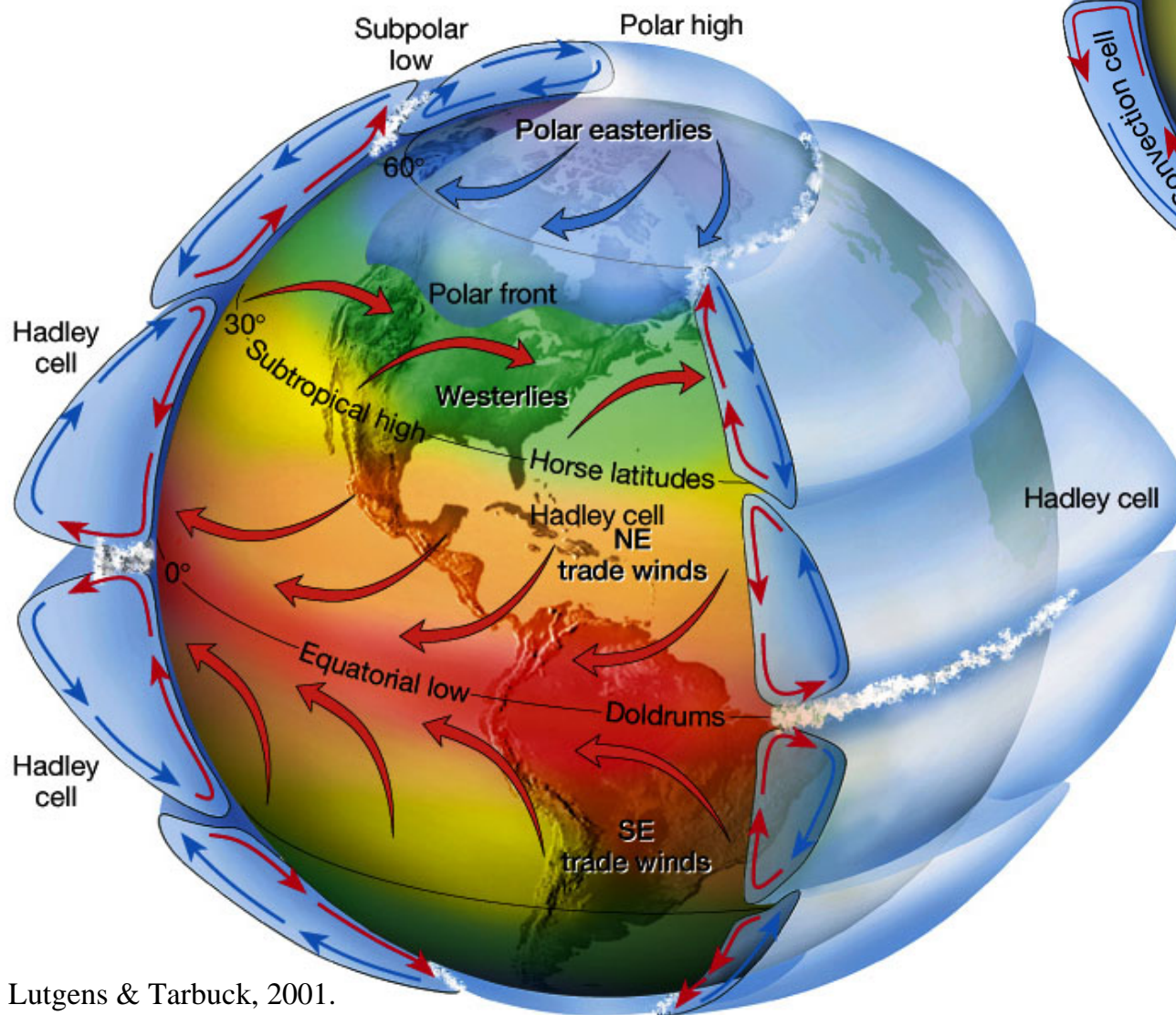
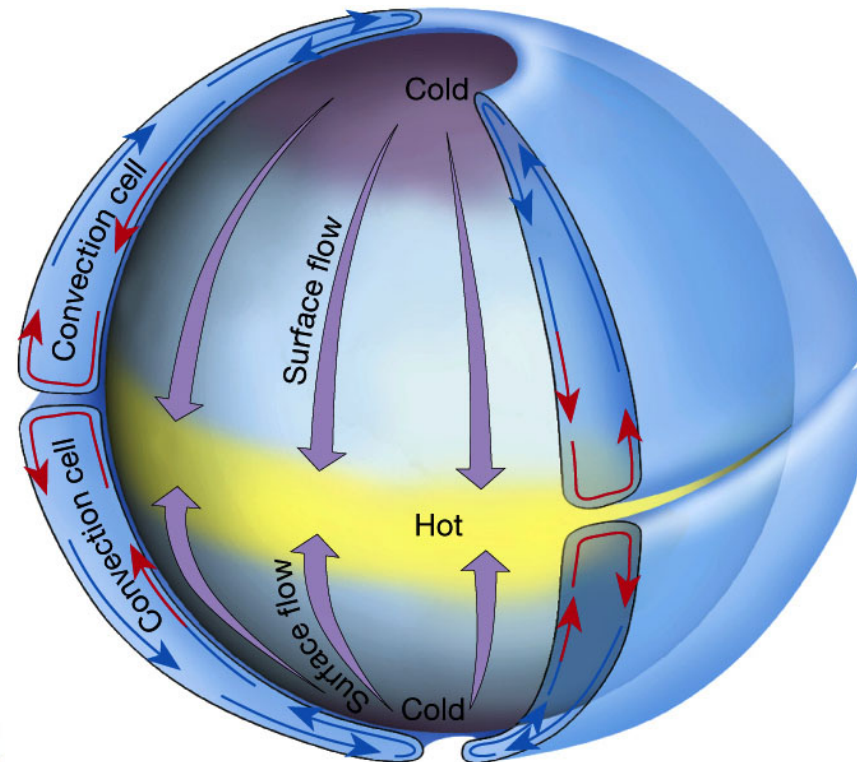
Globális energiamérleg, üvegházhatás

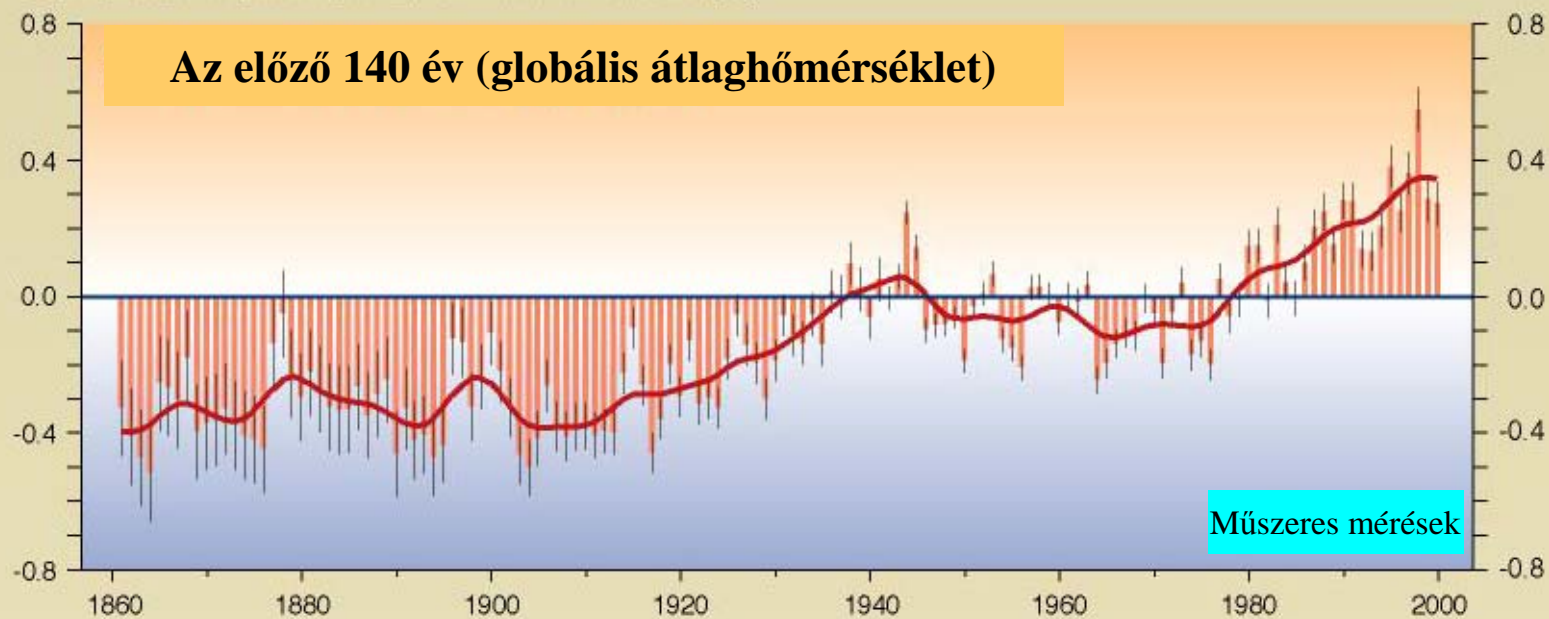




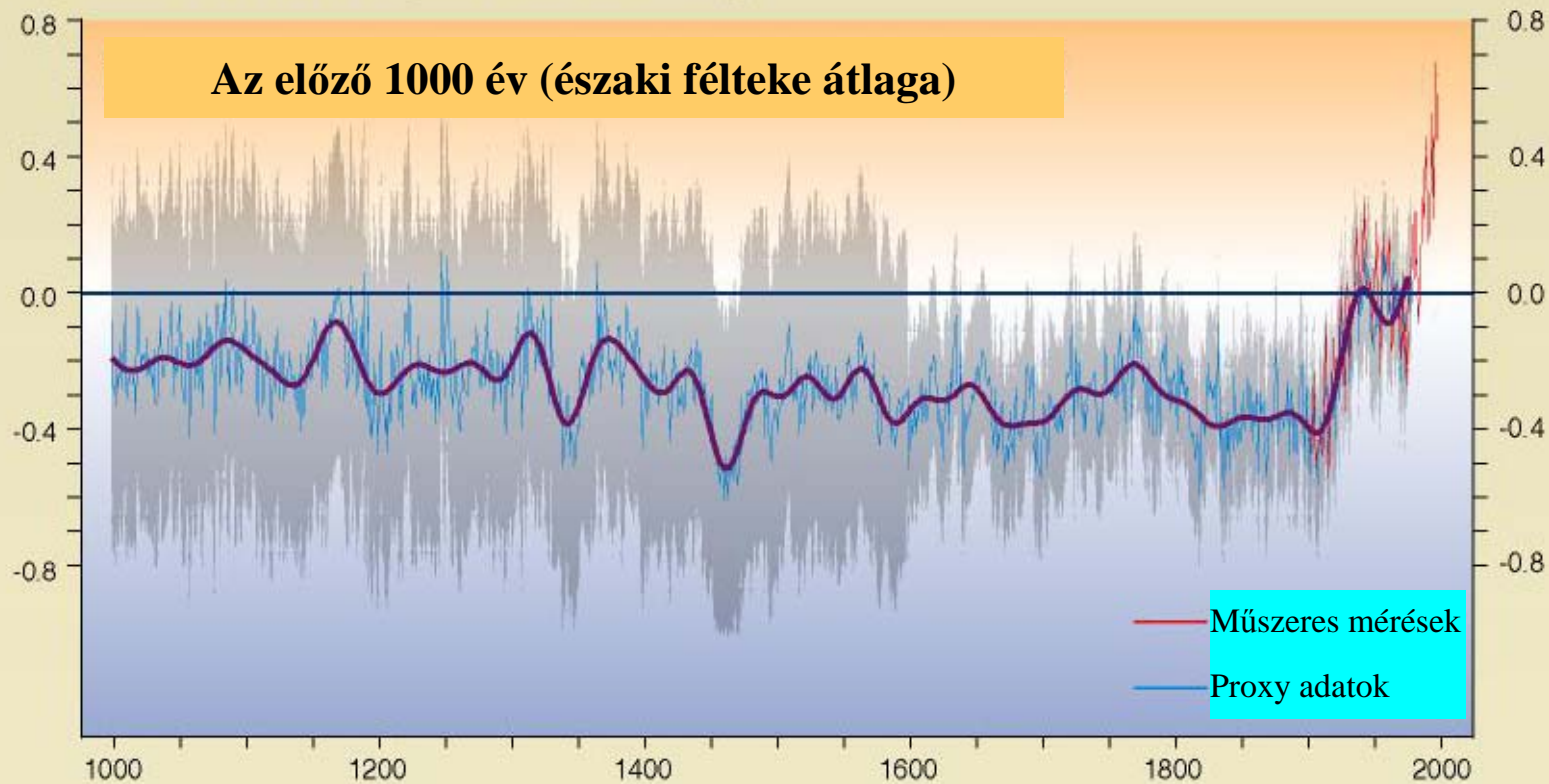
Trenberth &
Stepaniak, 2004

Energia transzport

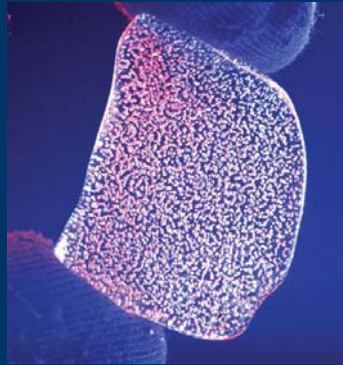




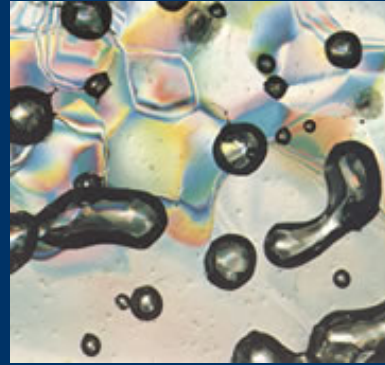
A földi klíma változékonysága: eltérés 1961-1990 átlagától (IPCC 2001)



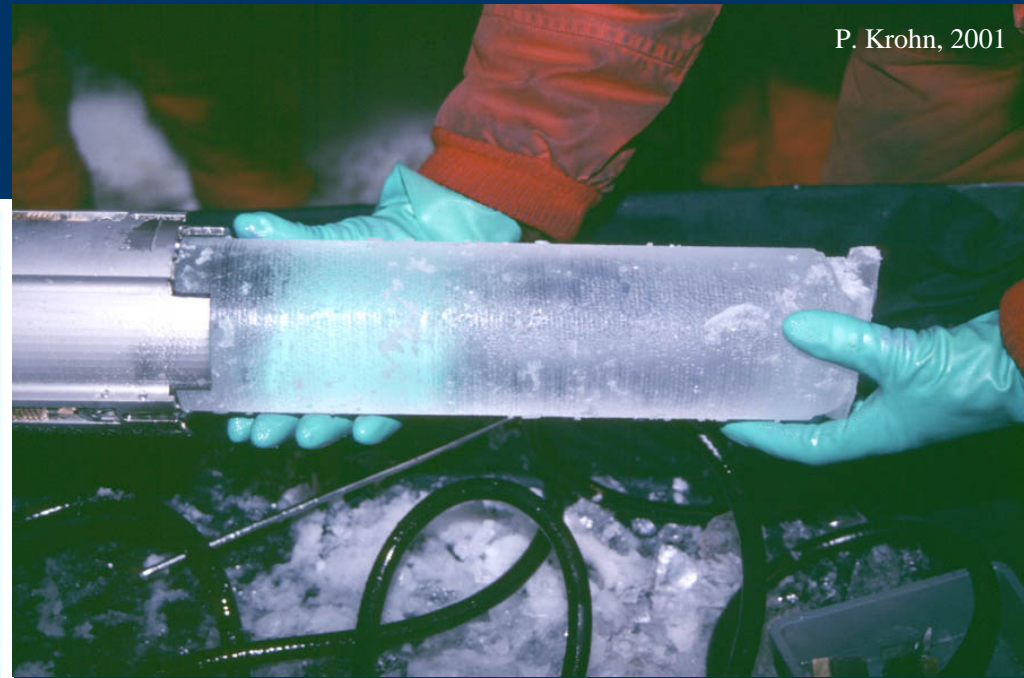
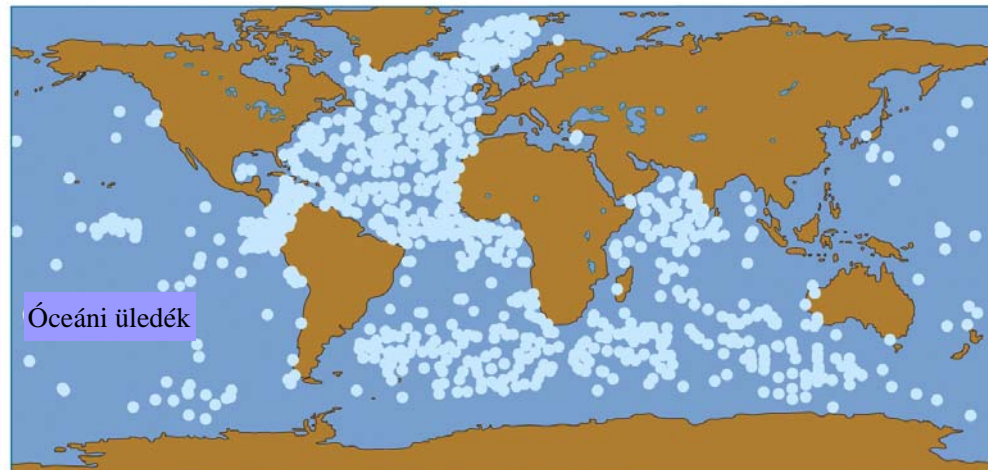
Hosszú távú klíma-rekonstrukció



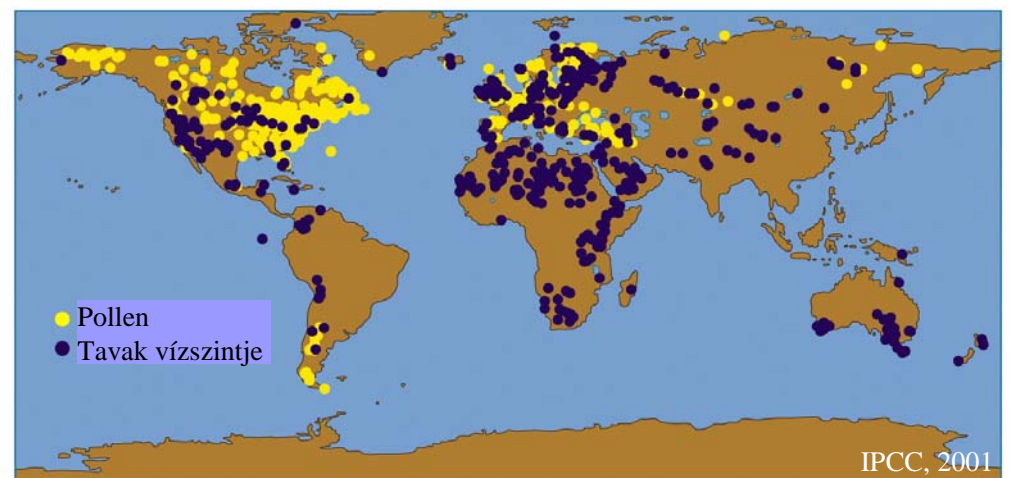
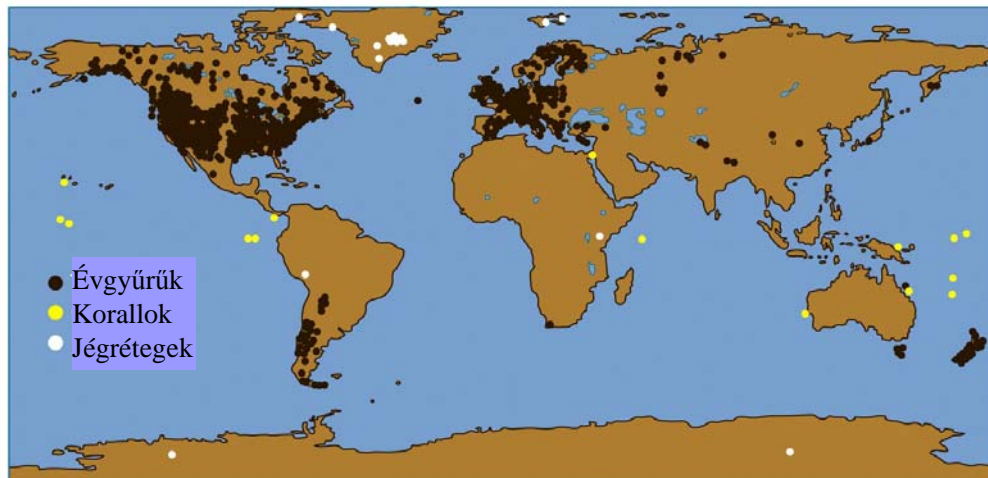
D. Etheridge, 2005



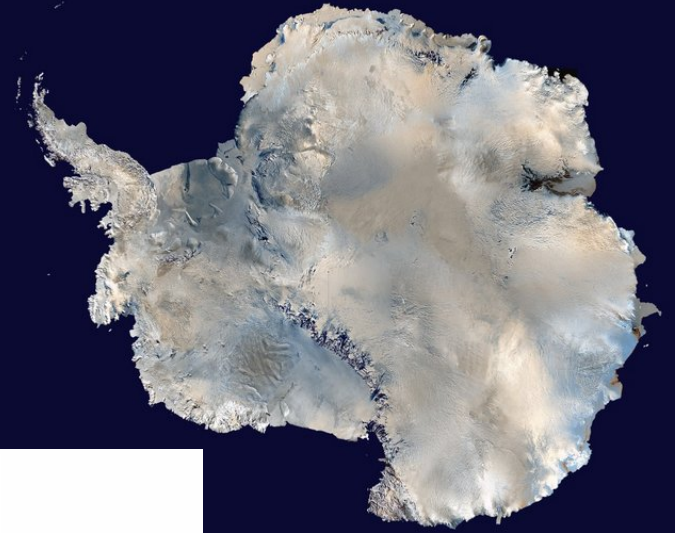
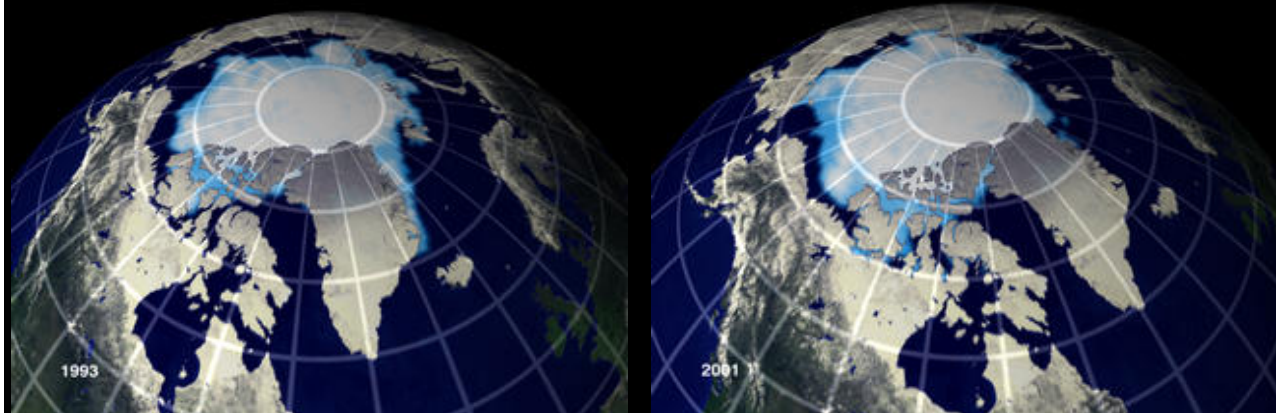
W. Berner, 2005



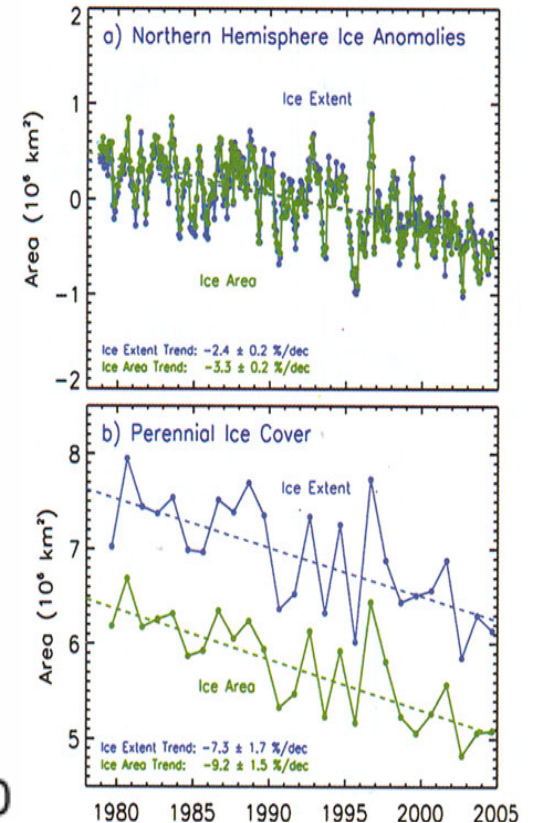
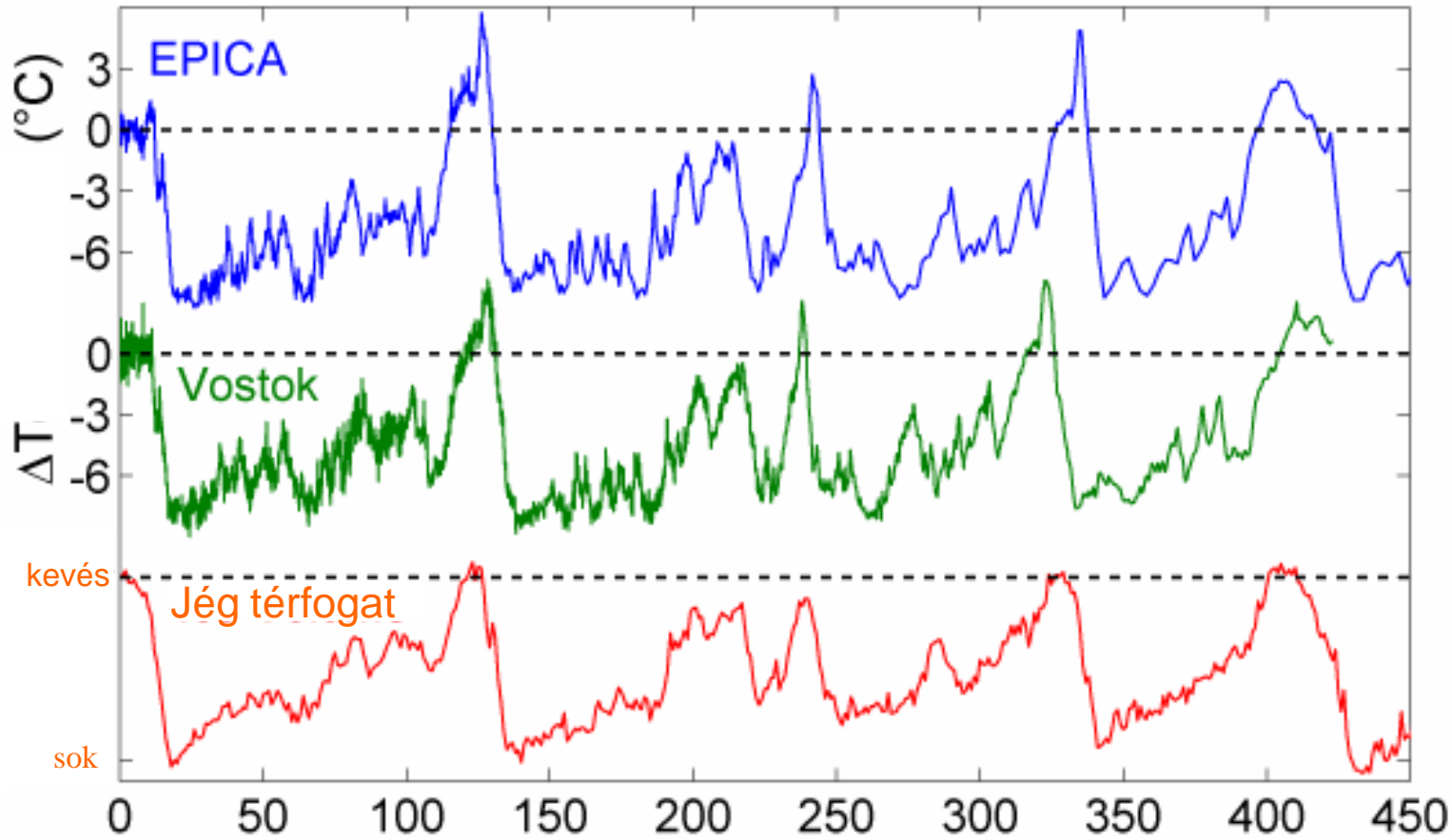
P. Krohn, 2001



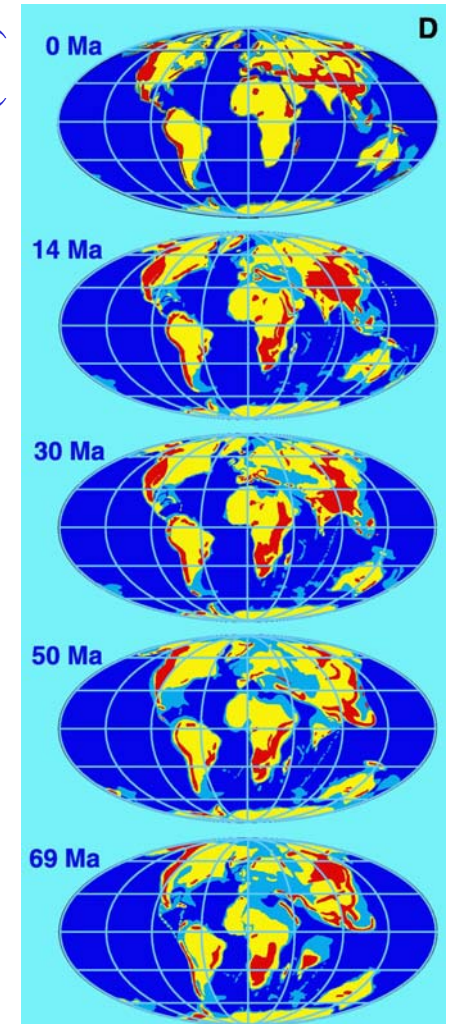
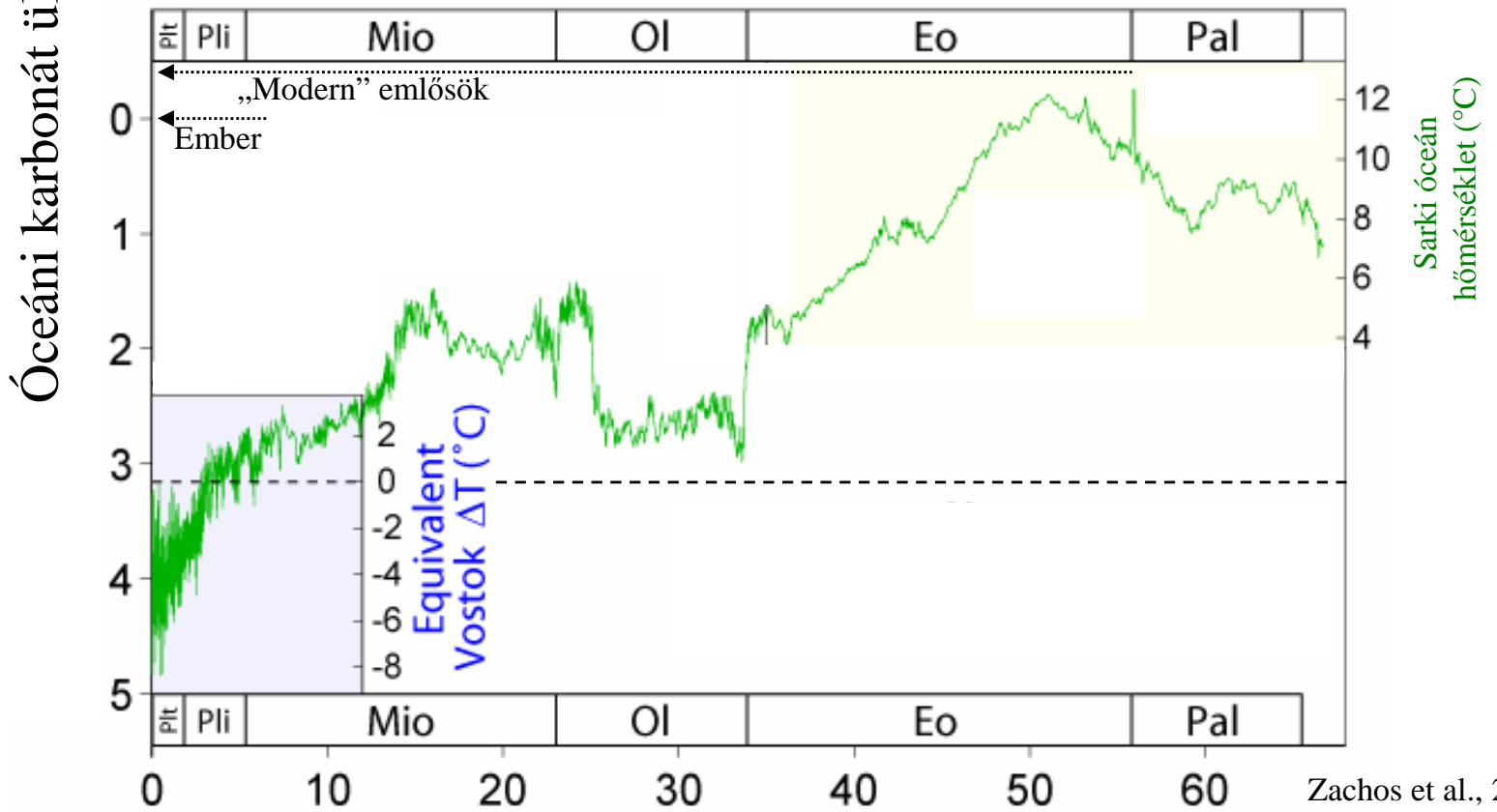
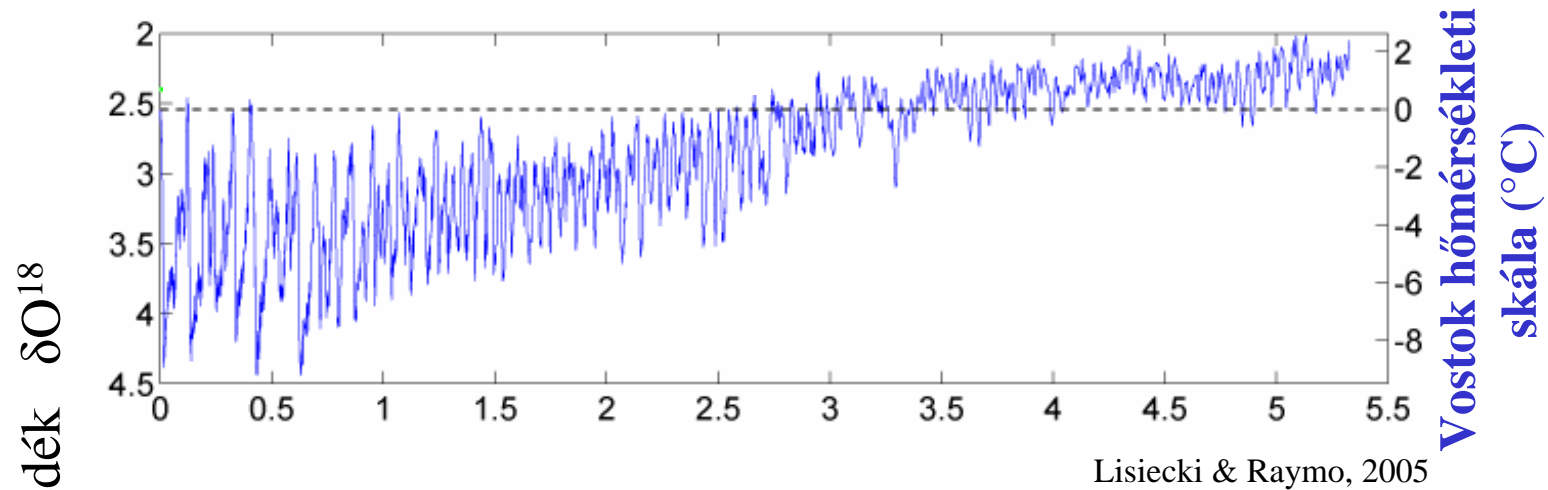
IPCC, 2001



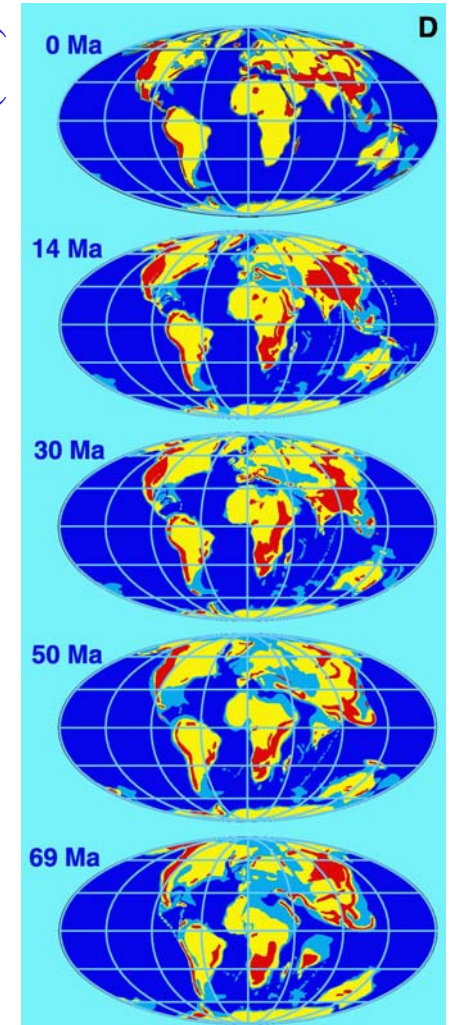
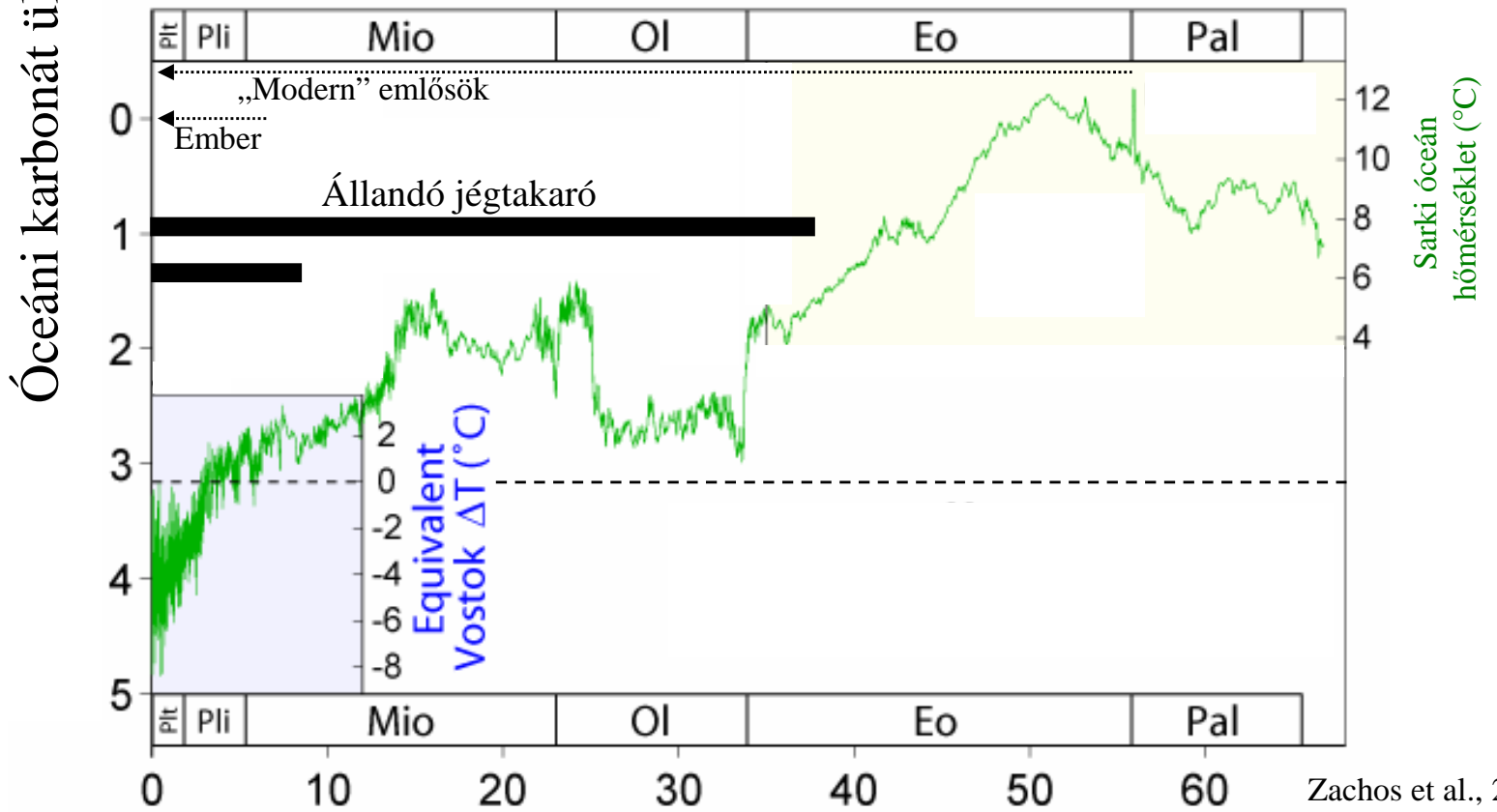
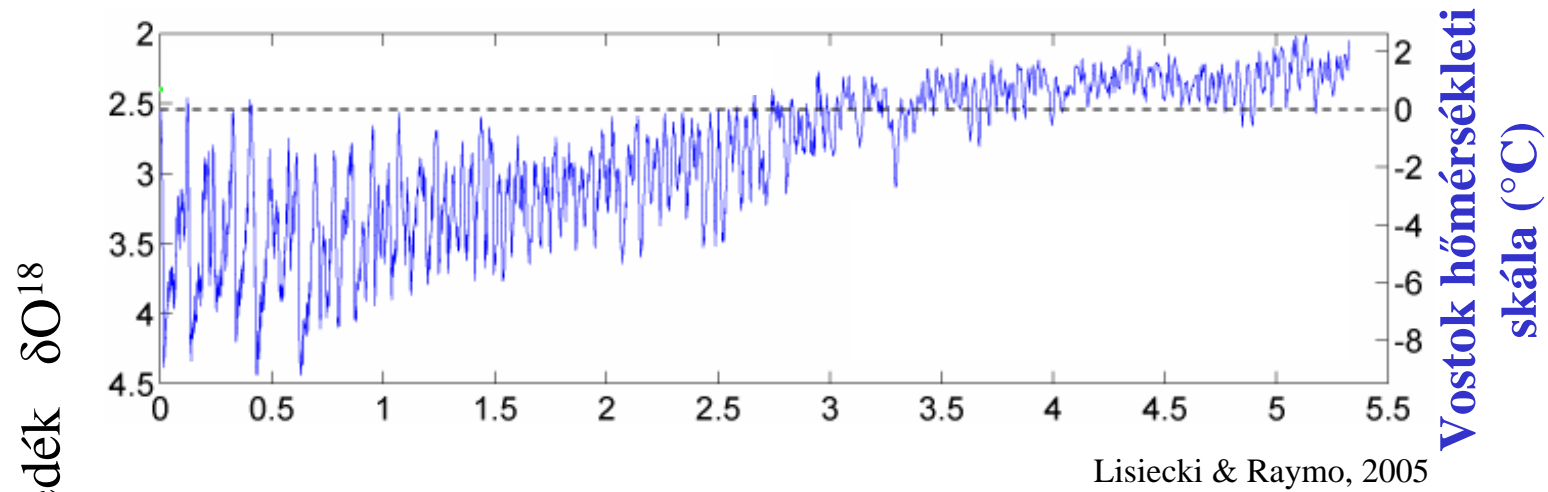
Az utolsó 450 ezer év



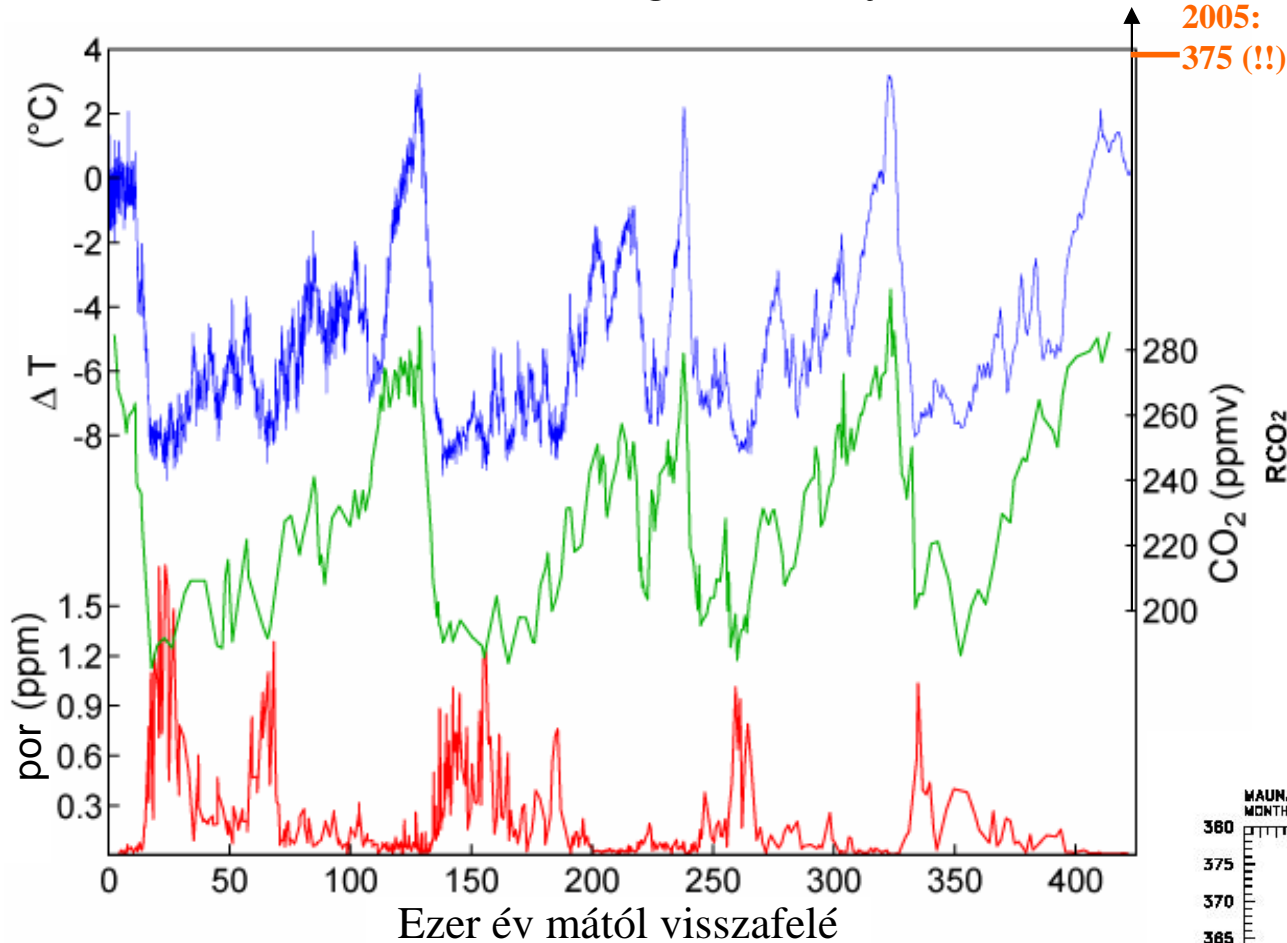
Éghajlatváltozás millió éves időskálán



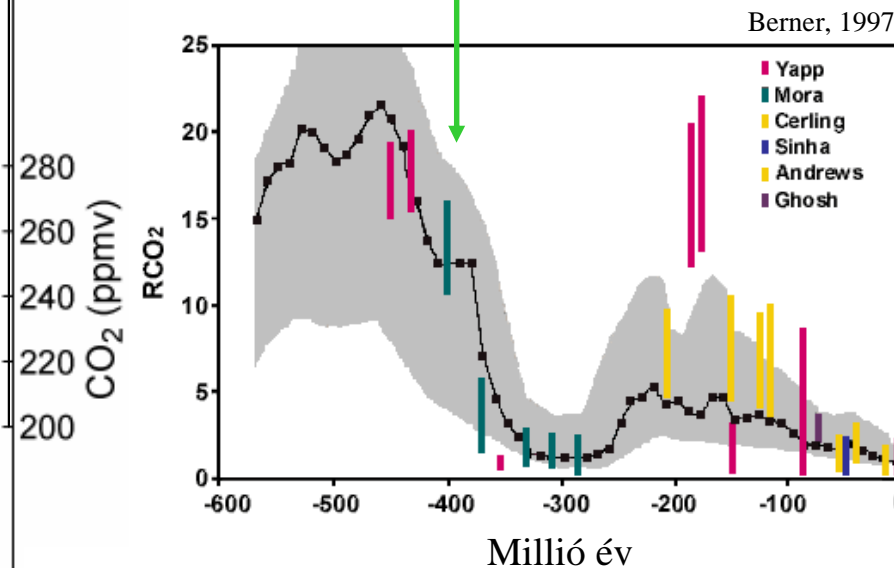
Éghajlatváltozás millió éves időskálán



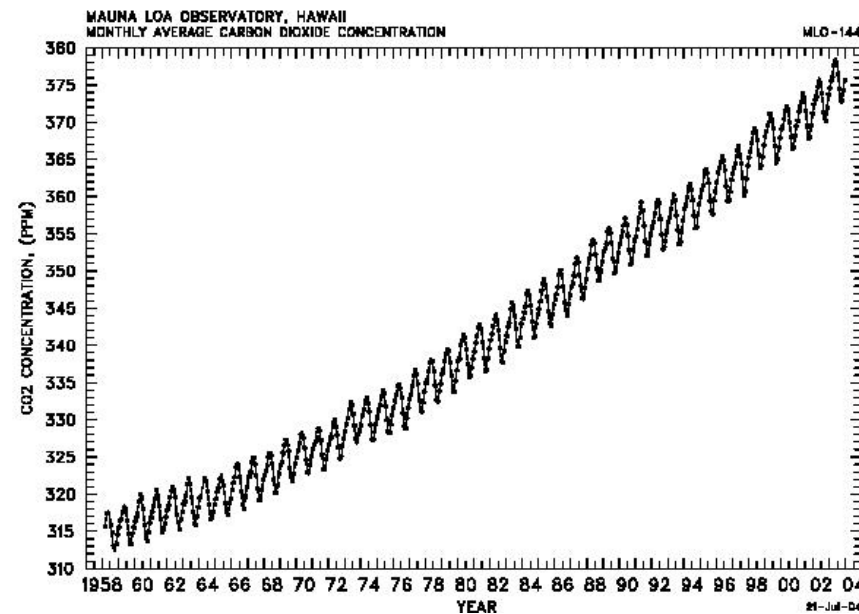
Klímváltozás és levegőszennyezés



Szárazföldi növényzet



CO₂



Globális CO₂ mérleg (gigatonnaC/év)

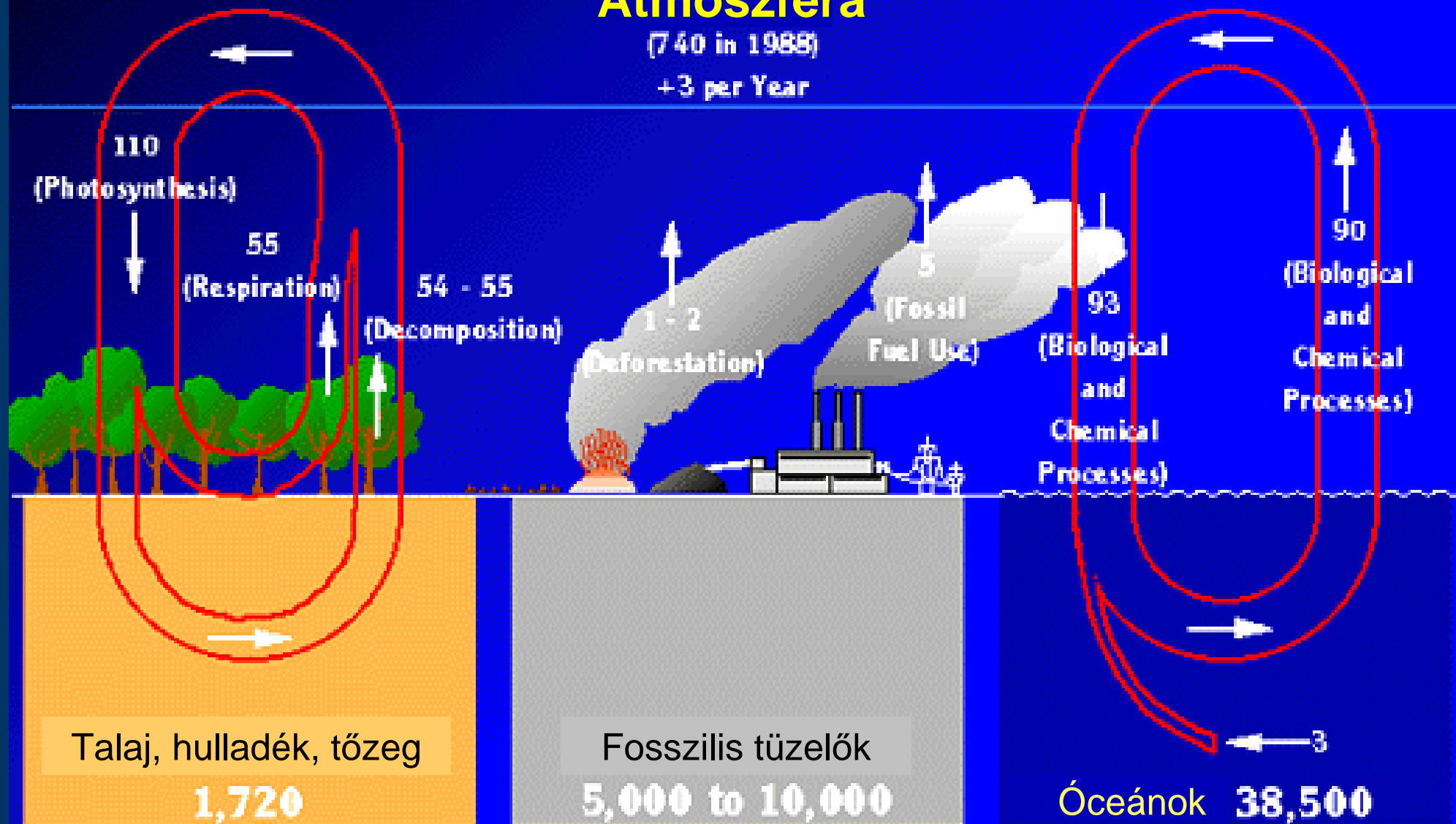


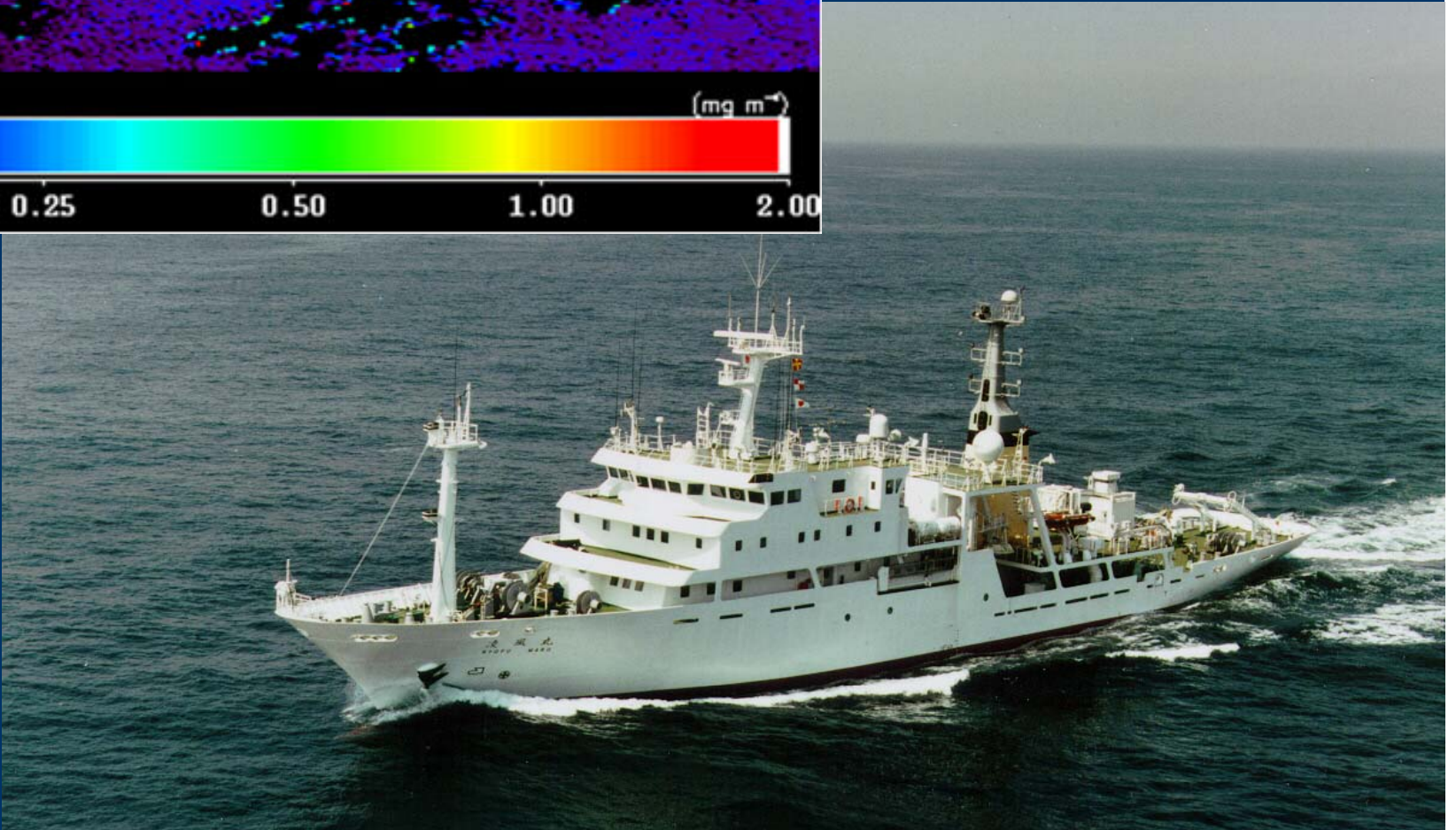
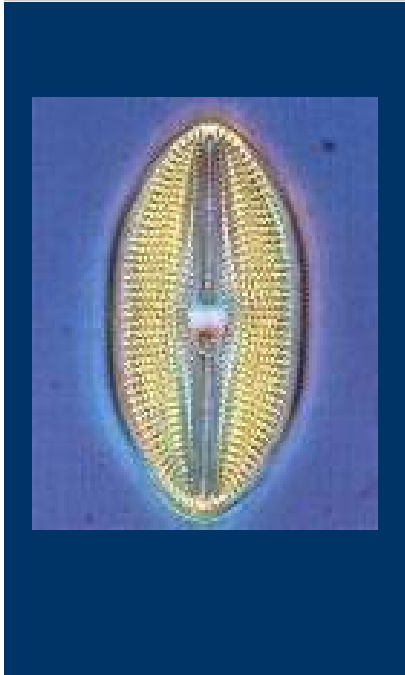
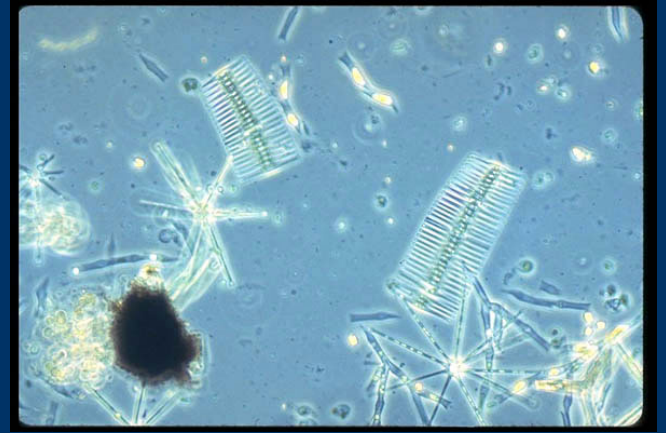
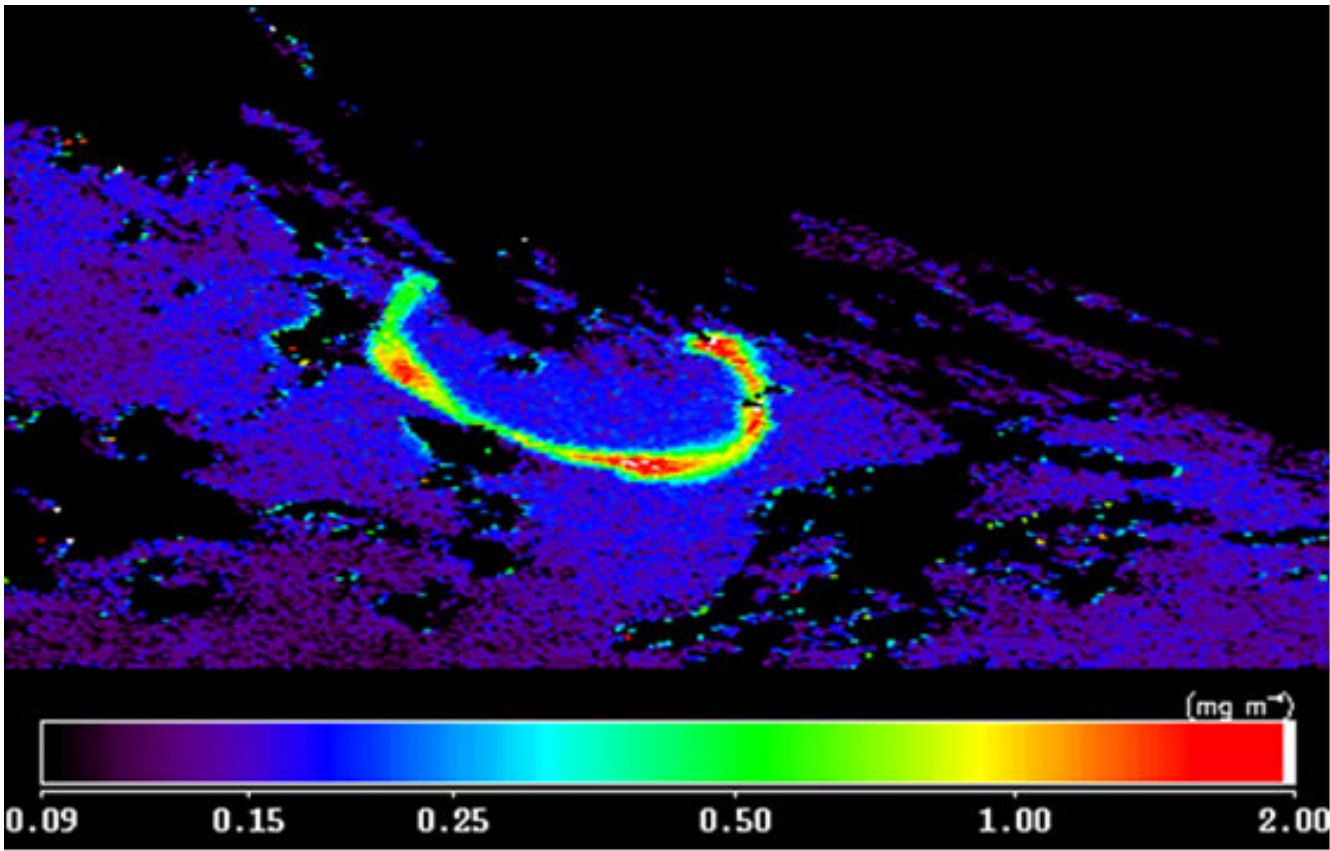
- emberi tevékenység ~3%, növekmény ~0.4%

Atmoszféra

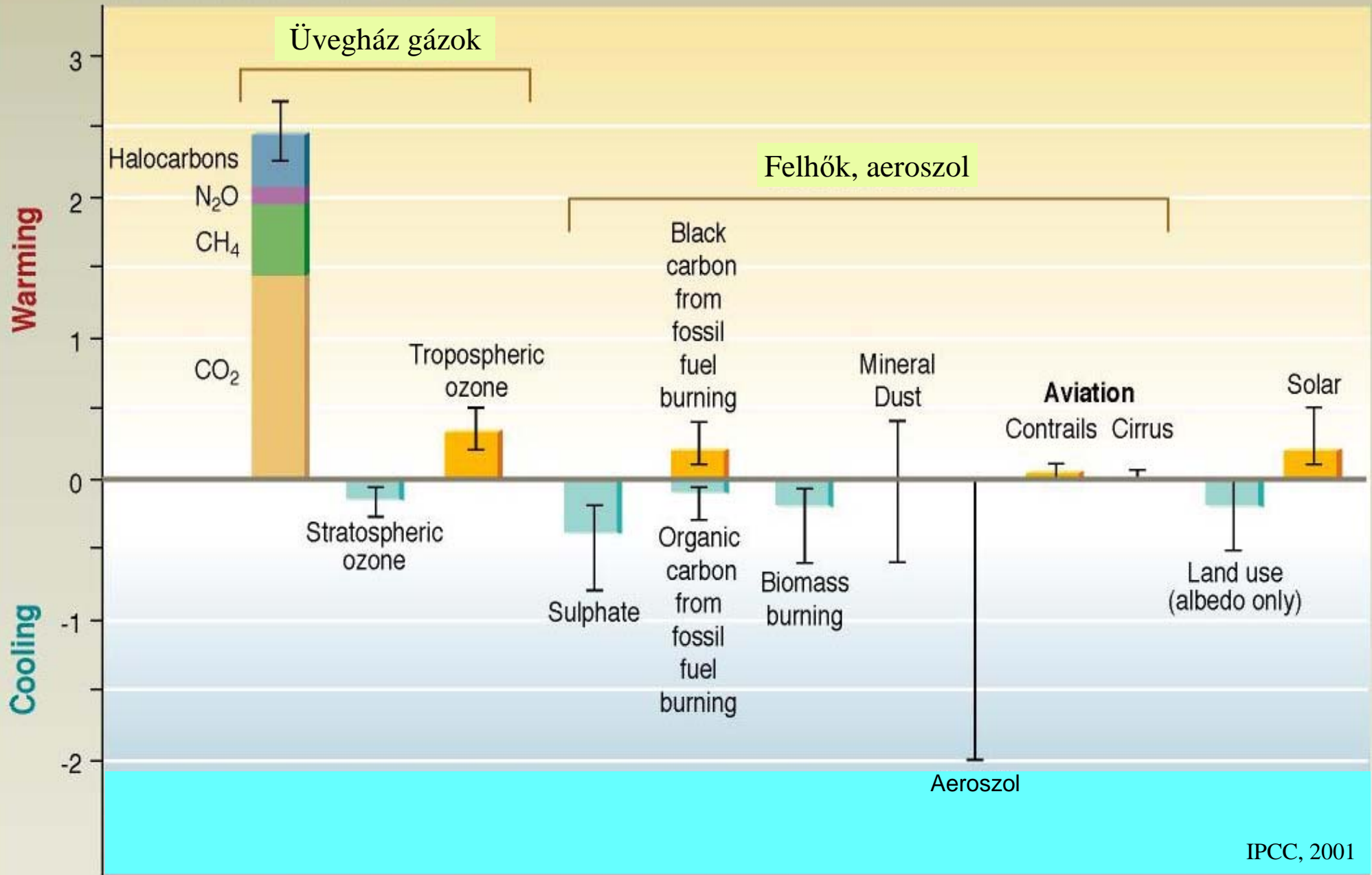
(740 in 1988)

+3 per Year





Ekvivalens sugárzási kényszer (Wm^{-2})



IPCC, 2001

Tudományos megértés szintje (!!!)

High Medium Medium Low Very low Very low Very low Very low Very low Very low Very low

Felszíni jég olvad.....

© Jungle Photos Africa 2004

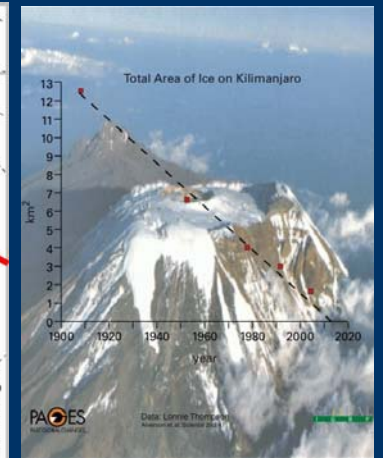
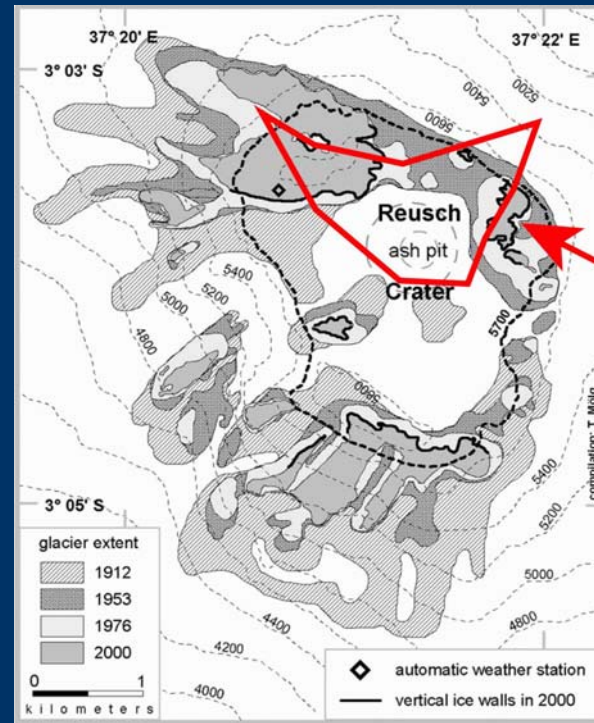


Photographed in 1928

South Cascade gleccser, Washington Cascade Mountains



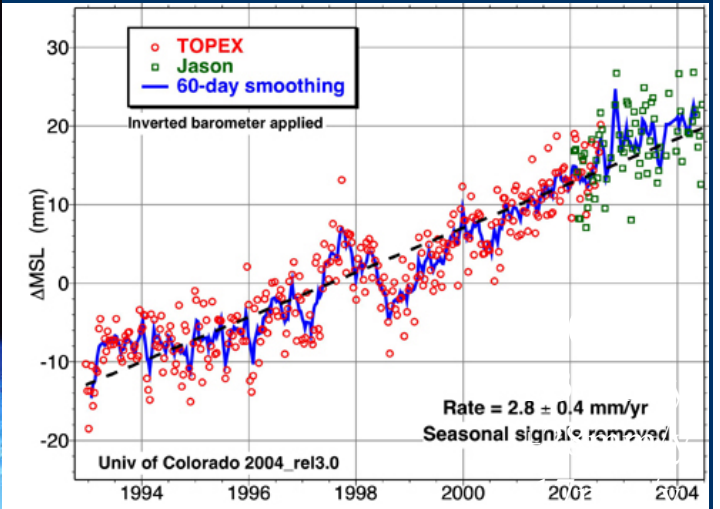
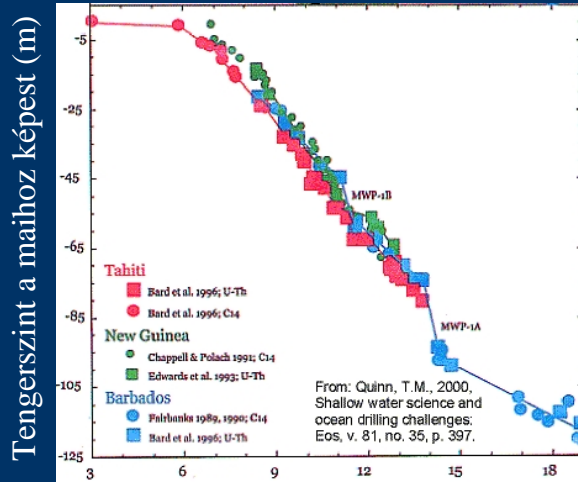
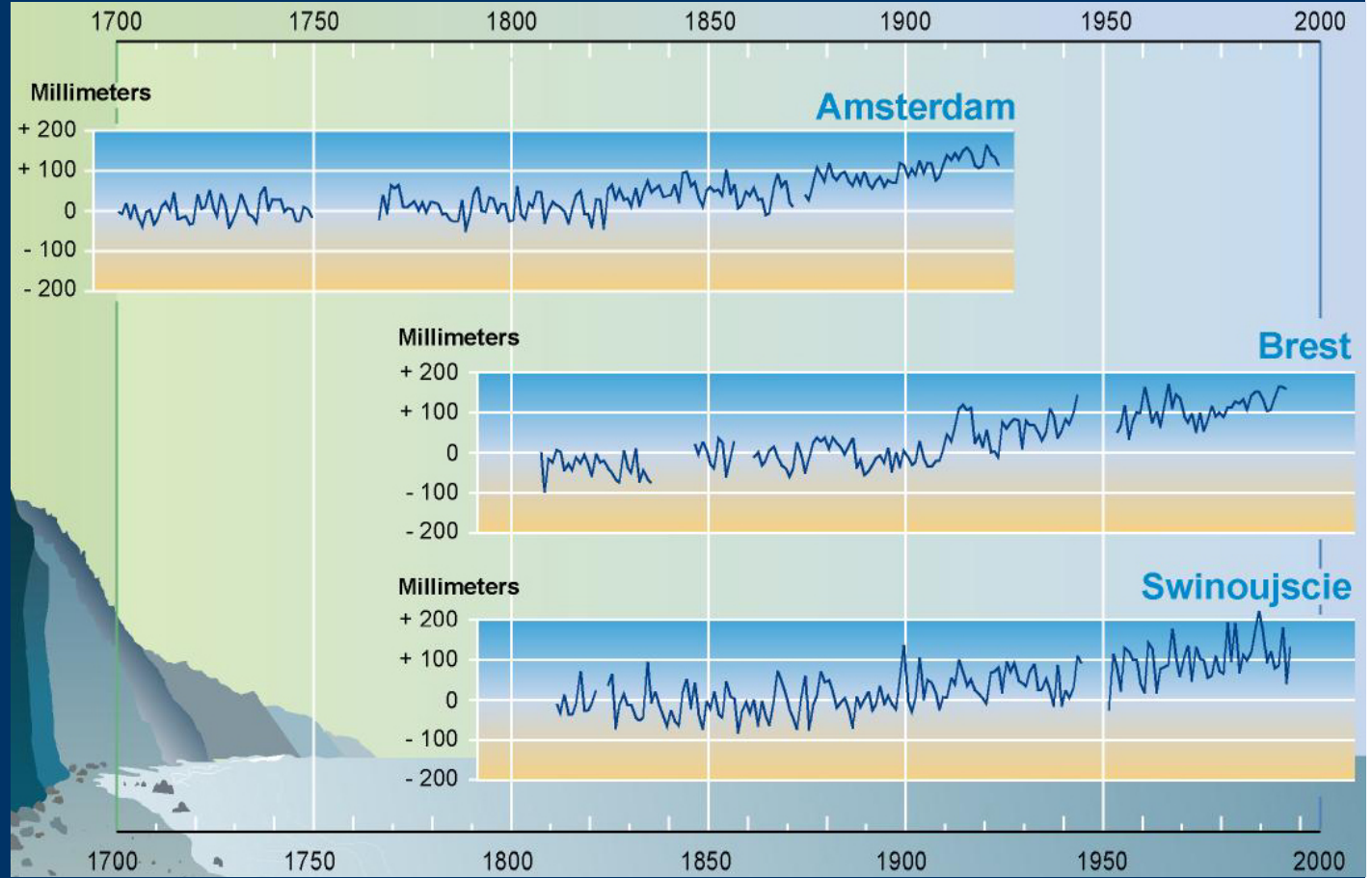
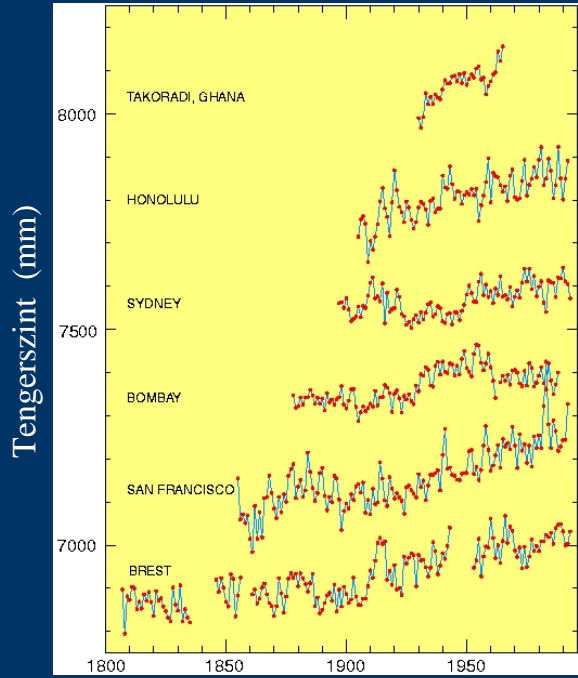
Photographed in 2000



Thompson et al., 2002

Mölg, Hardy, Kasel, 2003

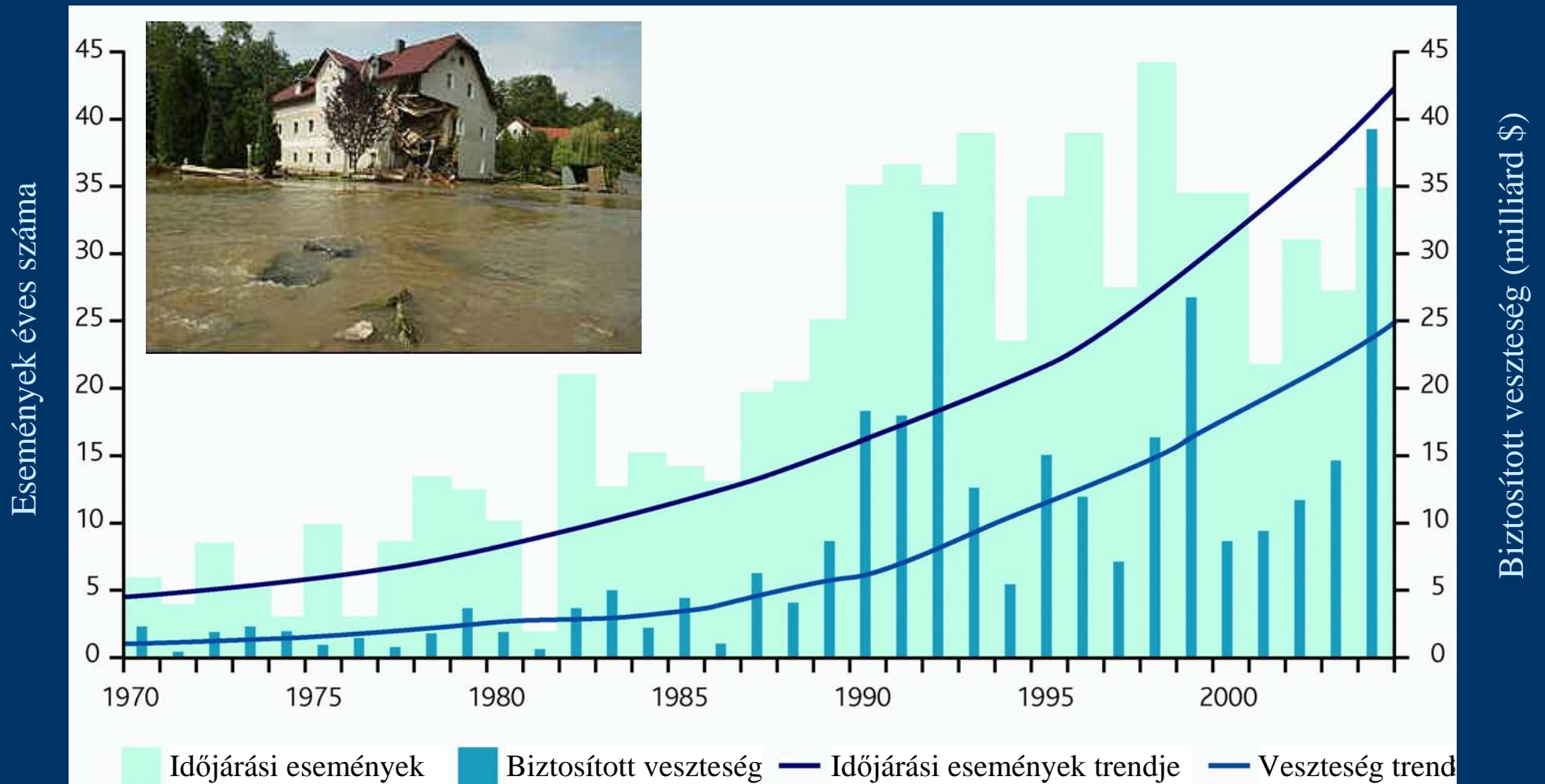
Tengervízszint emelkedik.....



Ezer év visszafelé

Extrém klimatikus események, katasztrófák

Időjárási katasztrófák száma és biztosított anyagi veszteség (2004-es dollár árfolyamon)



Source: Sigma Database, Swiss Re.

Hurrikánok



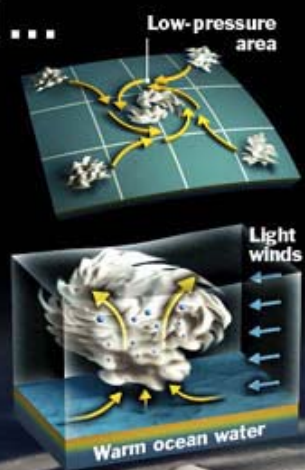
Elena, 1985 szept. 1.



Isabelle, 2003 szept. 16.

HOW HURRICANES FORM ...

- 1 A cluster of thunderstorms gather to form a **low-pressure area**, which draws in air and generates **spin** in a counterclockwise direction
- 2 **Warm ocean water** fuels the transfer of heat and moisture to generate thunderstorms that **rise upward**. If there are no strong winds to break the storm up, it intensifies
- 3 When wind speeds reach **74 m.p.h. (120 km/h)** or higher and a distinct eye has formed in the center, the storm is called a **hurricane**. When the hurricane moves over cool water or land, it loses energy and weakens

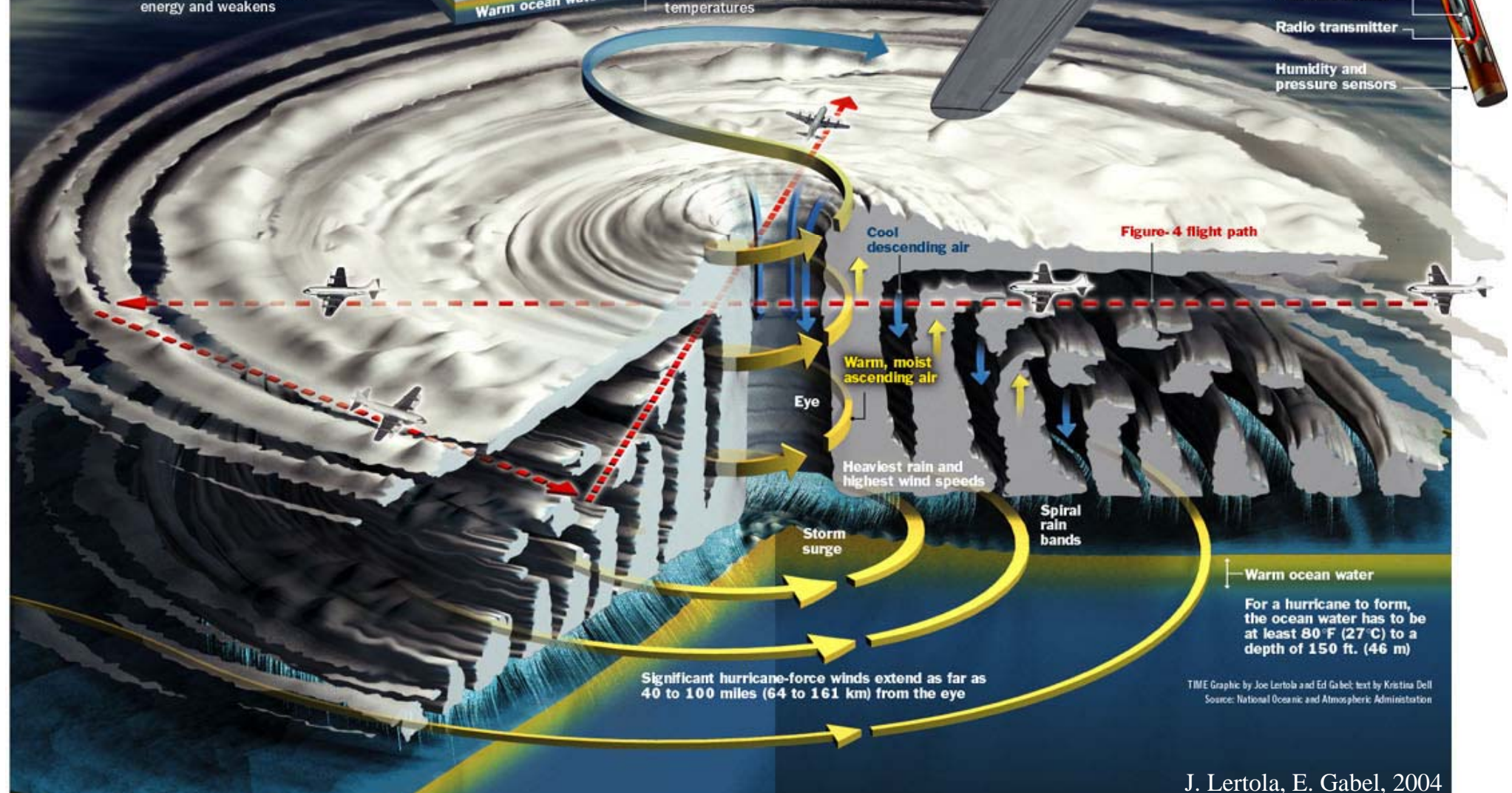


... AND HOW THEY ARE TRACKED

The **WP-3D Orion** aircraft flies at 1,500 to 10,000 ft. (400 to 3,000 m) through the hurricane, using a **figure-4 flight path** that allows observation of all four quadrants of the storm

The WP-3D has **radar systems** on its nose and under its belly that measure rainfall density to determine the level of turbulence. Doppler radar on the tail records wind speeds

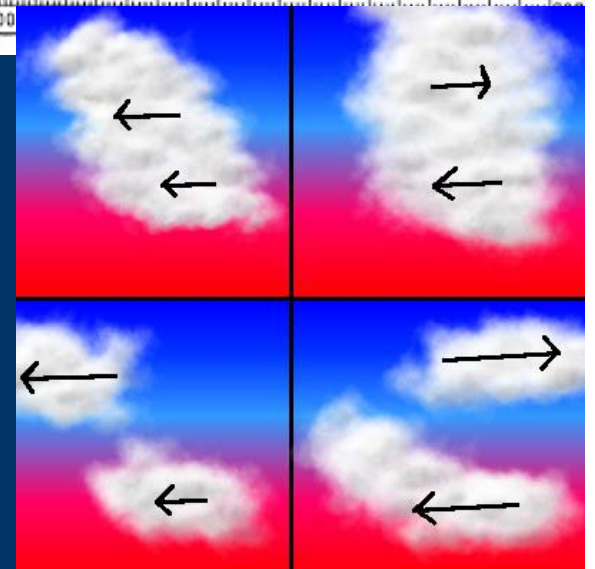
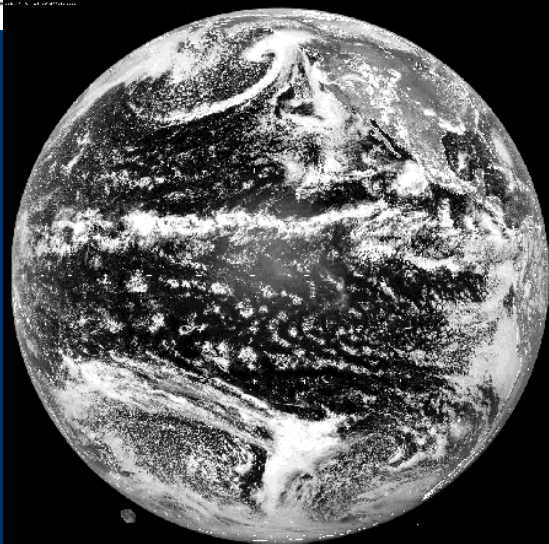
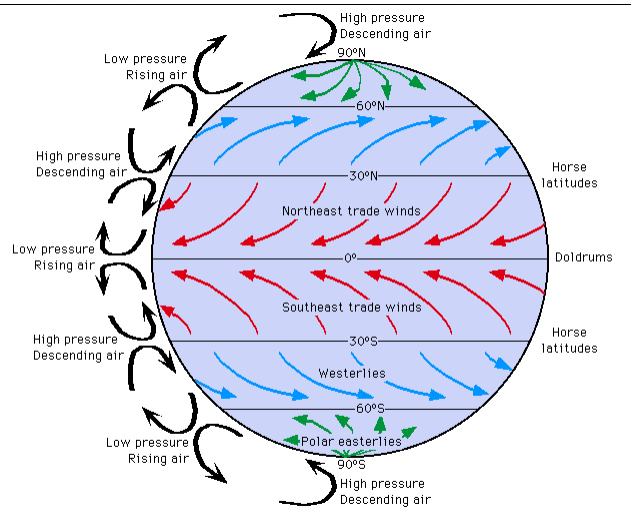
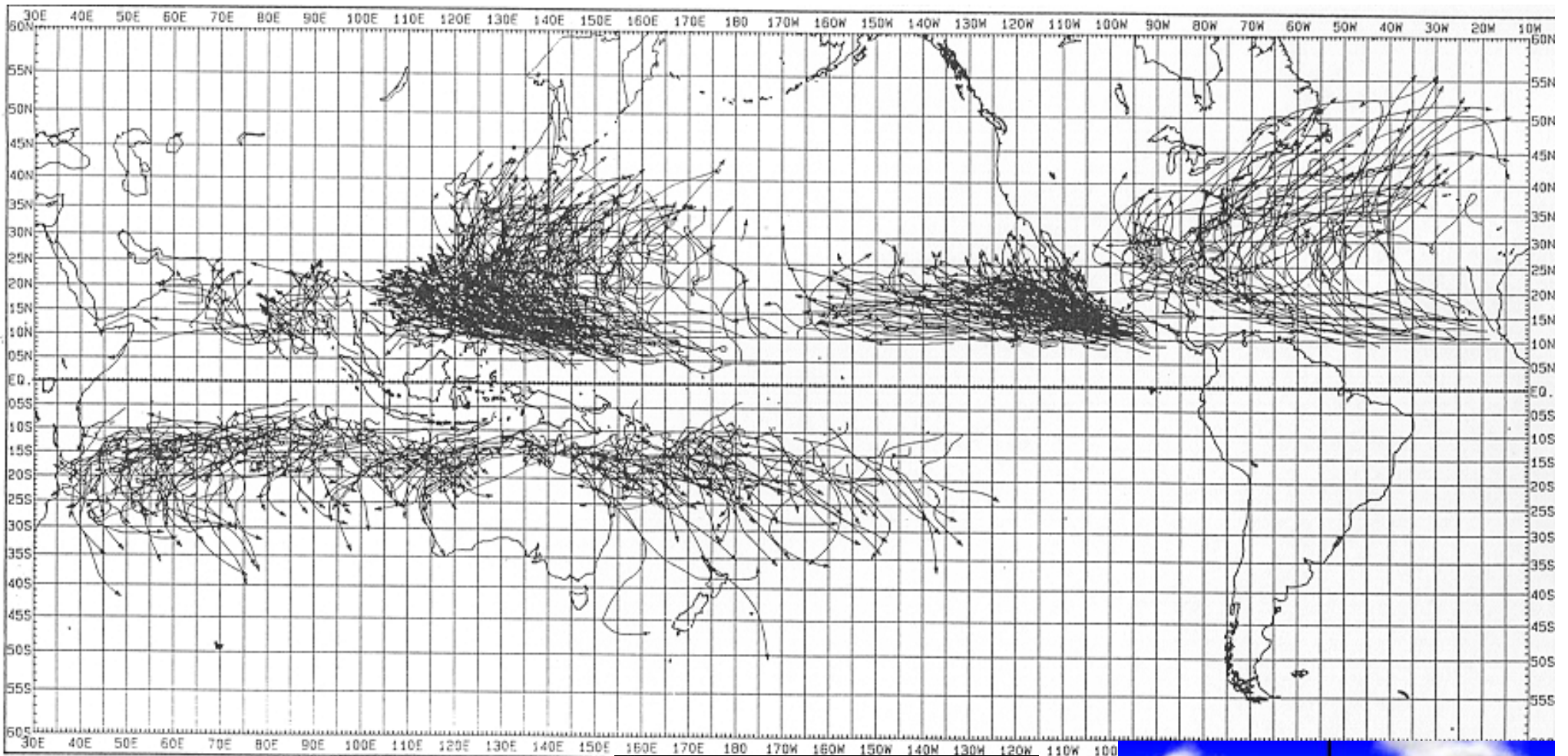
Two types of probes are released: the **dropwindsonde** measures air conditions, and the **AXBT** plunges into the ocean to record water temperatures



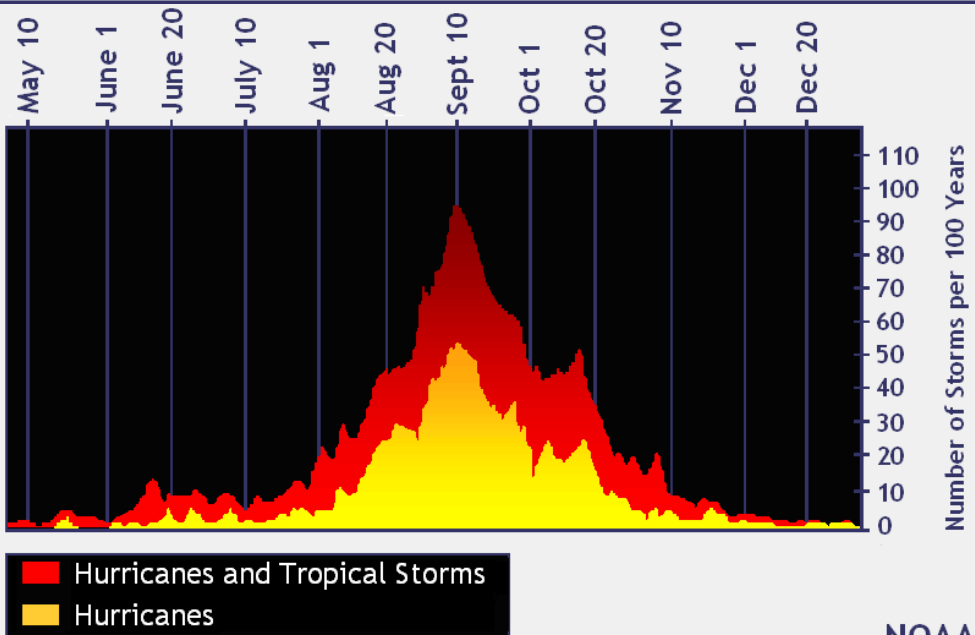
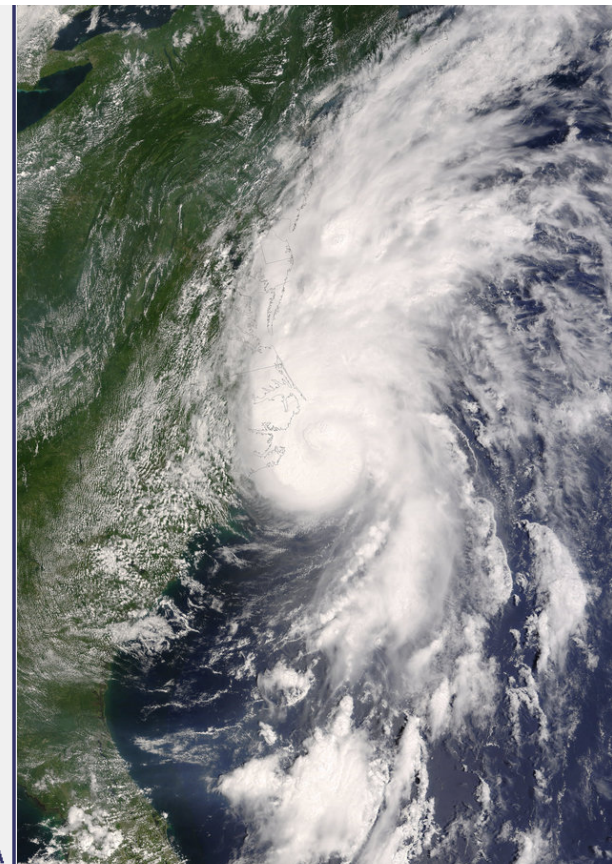
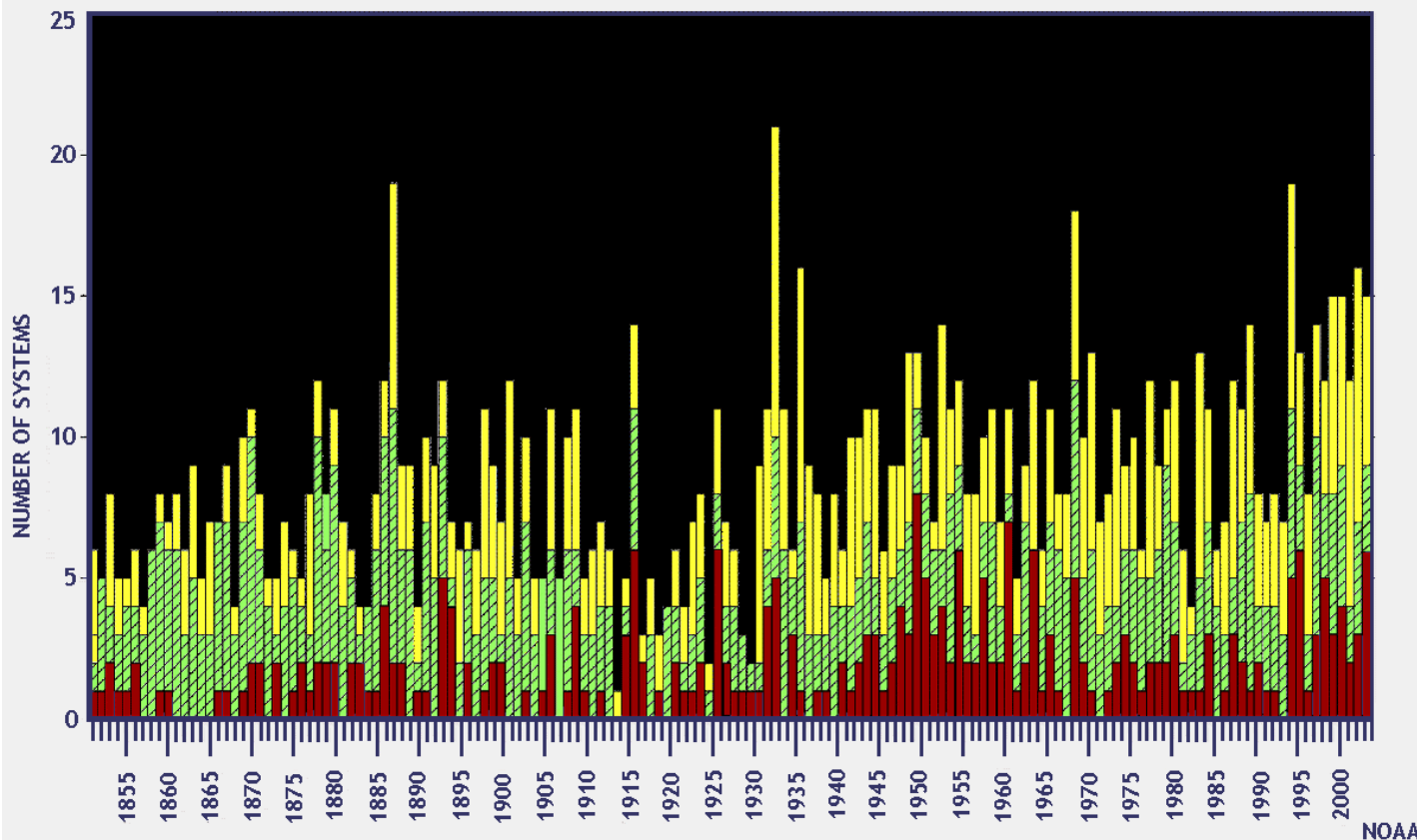
Significant hurricane-force winds extend as far as 40 to 100 miles (64 to 161 km) from the eye

For a hurricane to form, the ocean water has to be at least 80°F (27°C) to a depth of 150 ft. (46 m)

TIME Graphic by Joe Lertola and Ed Gabel; text by Kristina Dell
Source: National Oceanic and Atmospheric Administration

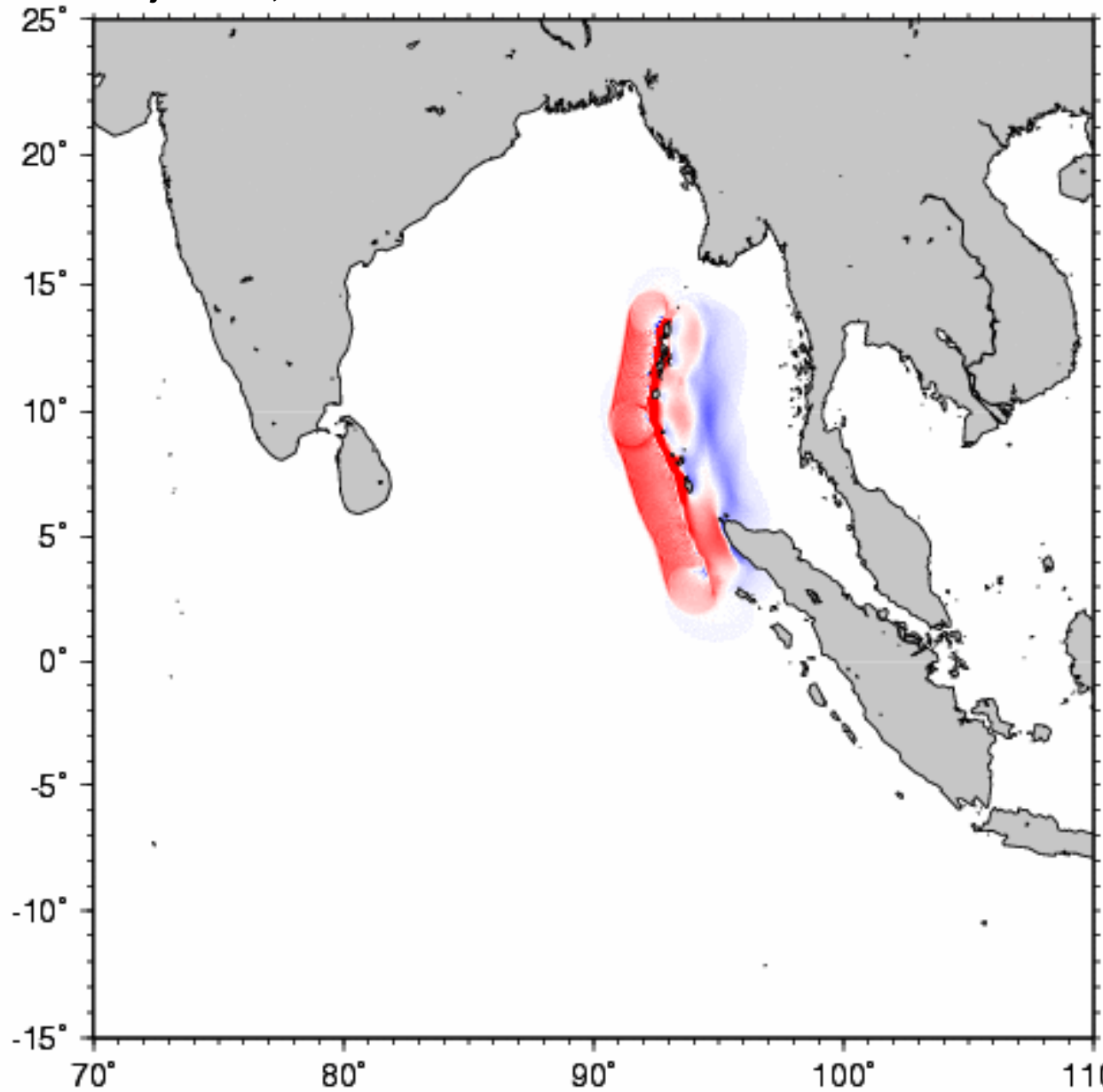


Adapted from Duxbury, Alun C. and Alison B. Duxbury. *An Introduction to the World's Oceans*, 4/e. Copyright © 1994 Wm. C. Brown Publishers, Dubuque, Iowa.



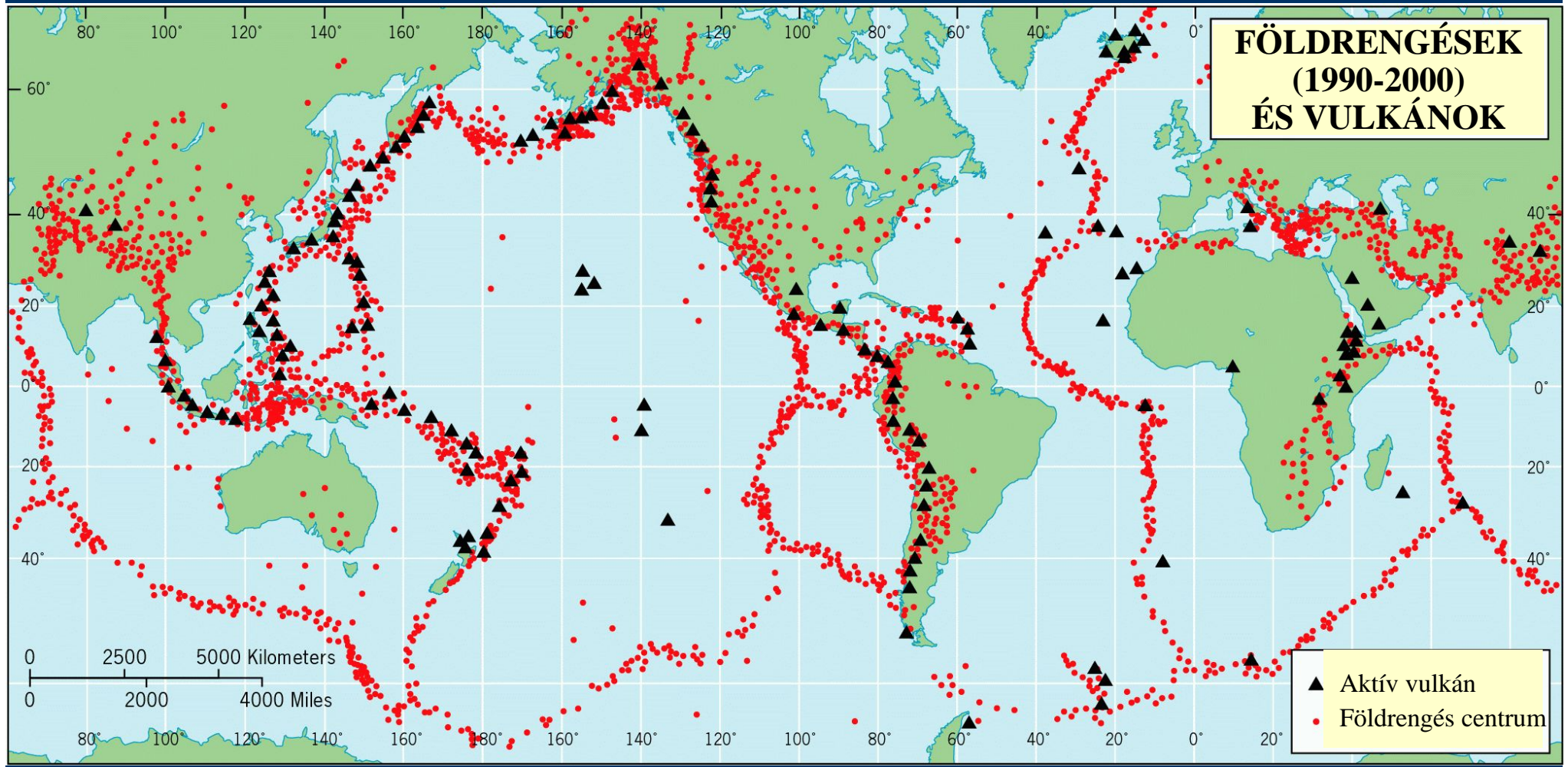
Cunami

Kenji Satake, 2005



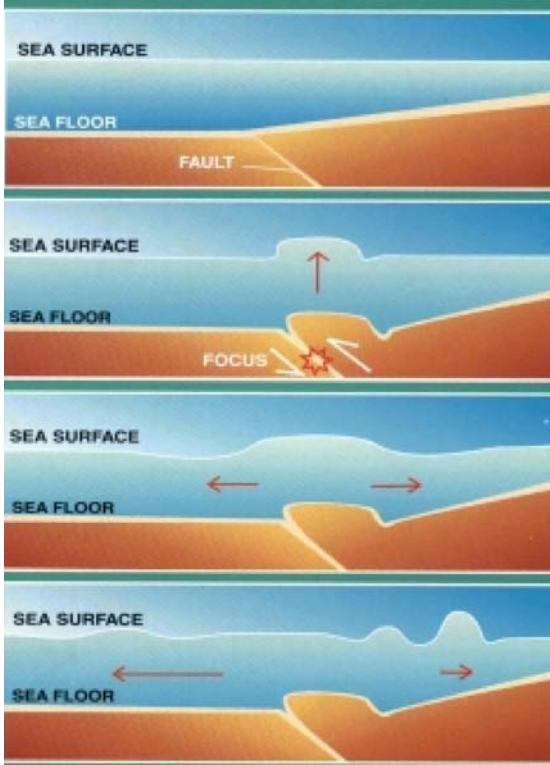
DigitalGlobe, 2005

FÖLDRENGÉSEK (1990-2000) ÉS VULKÁNOK

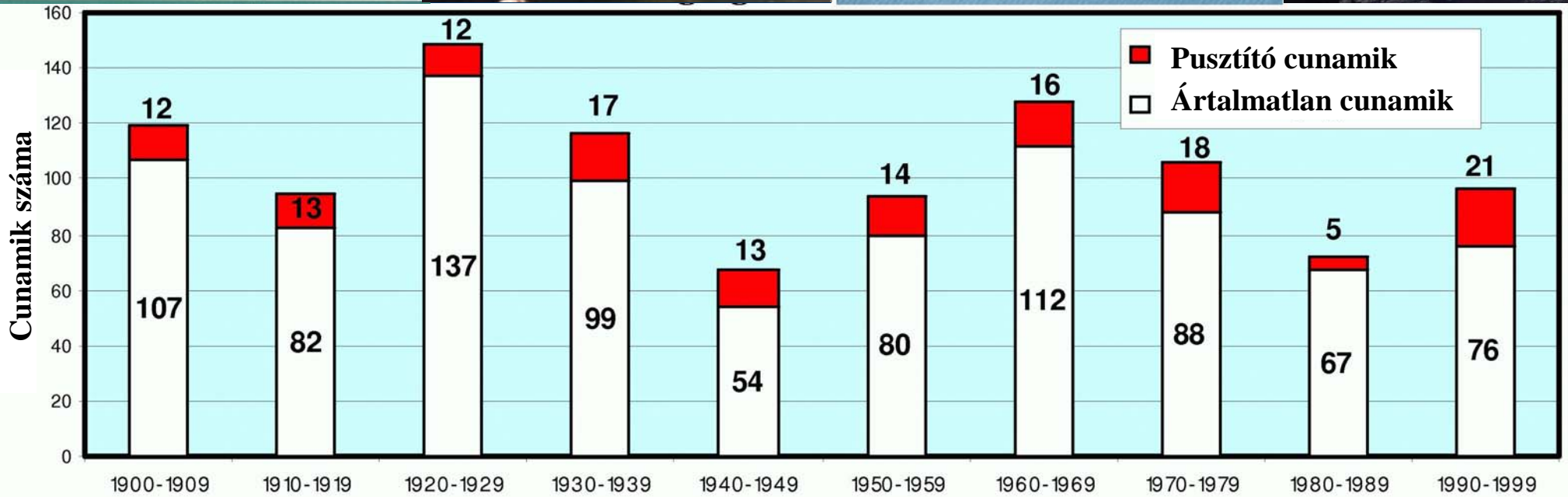
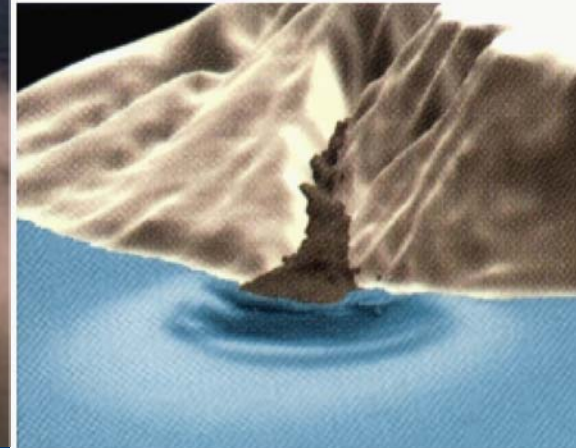


- ▲ Aktív vulkán
- Földrengés centrum

Cunami előfordulások



Tsunami generated by a landslide



0.131 s

0.196 s

0.261 s

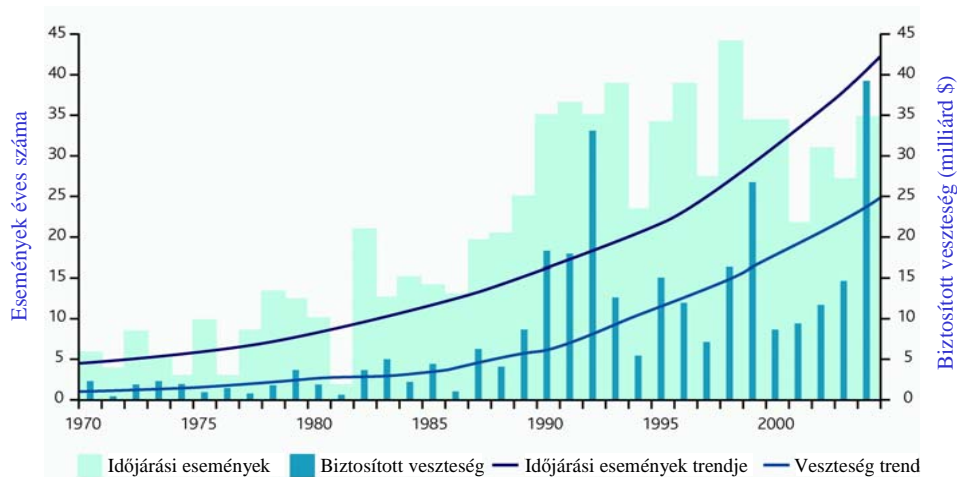
0.327 s



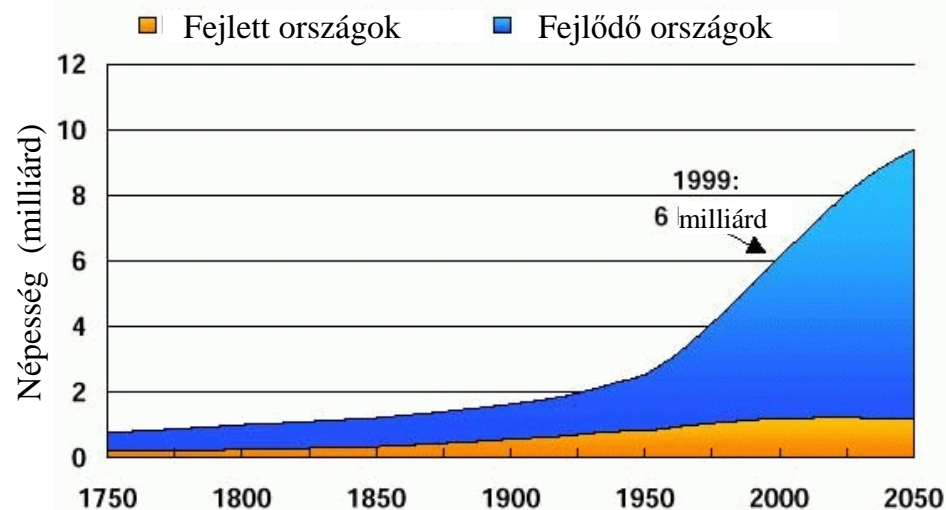


Adapted from 'Scotland on Sunday'

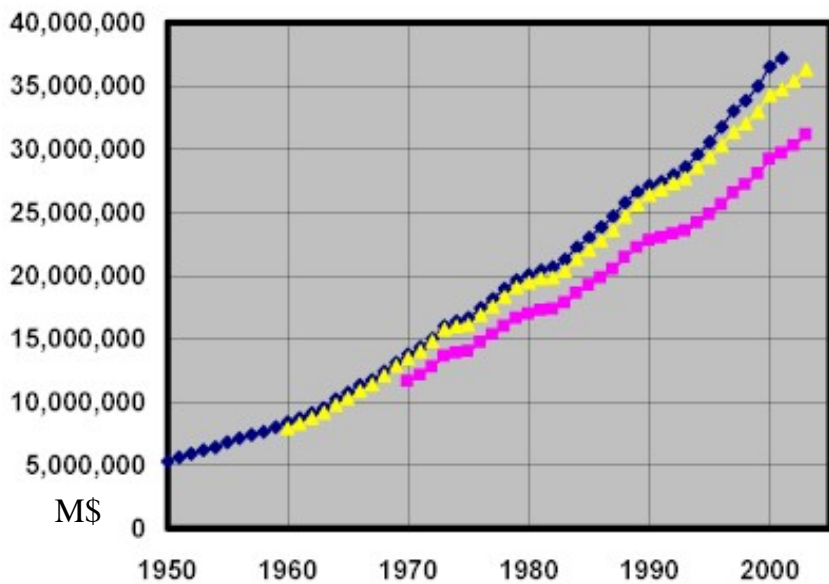
Katasztrófák?



Source: Sigma Database, Swiss Re.

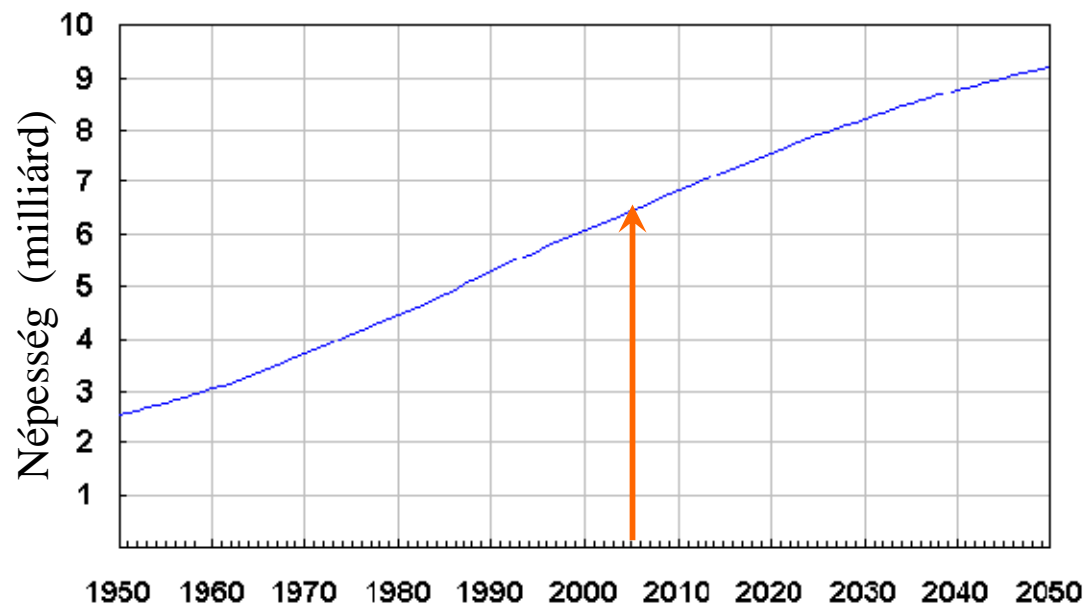


A világ GDP növekedése



Source: EWI, World Bank, UN

A világ népessége 1950-2050

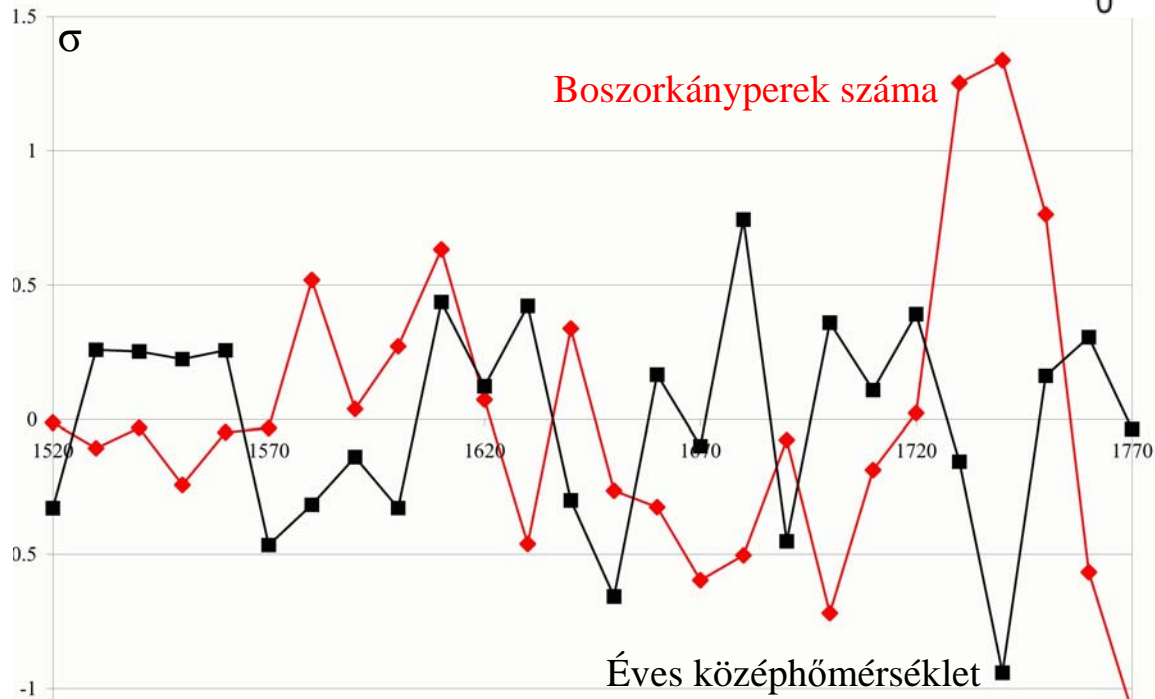
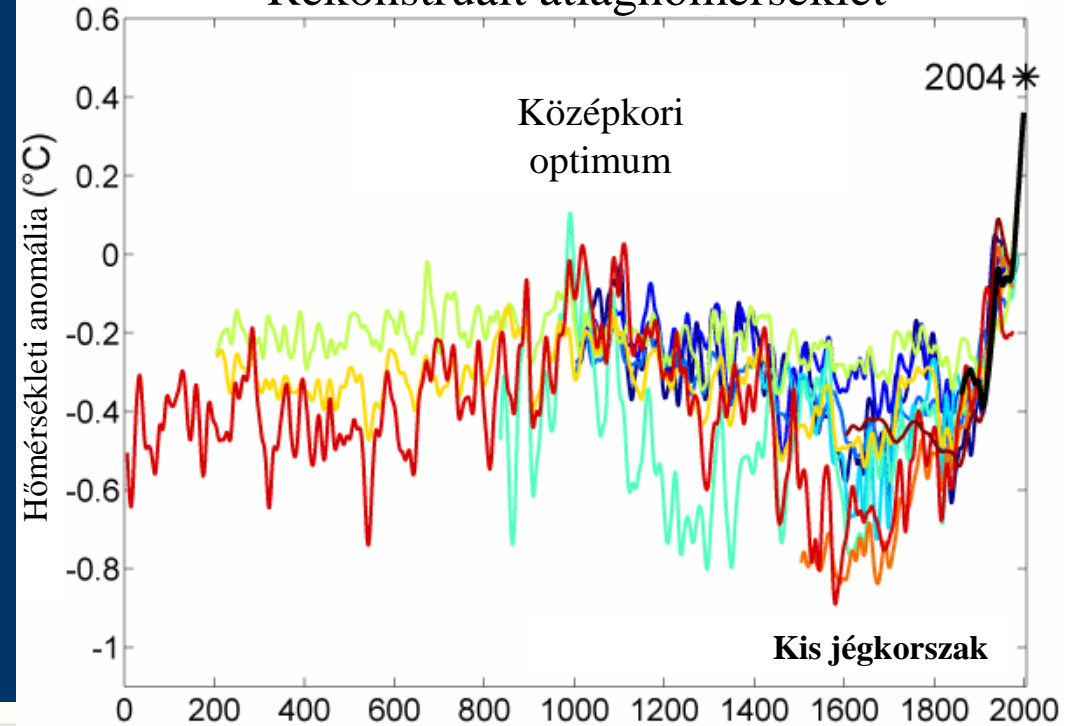


Source: U.S. Census Bureau, International Data Base, April 2005 version.

+ egy kis pszichológia...



Rekonstruált átlaghőmérséklet



E. Oster, 2004



An alleged witch is burned to death in Amsterdam.

Összegzés

- Globális felmelegedés: mérhető trend
- Példátlan? (nem)
- Környezetszennyezés: tény
- Csatolás a kettő között? (nem tudjuk)
- Katasztrófák? (nem tudjuk)