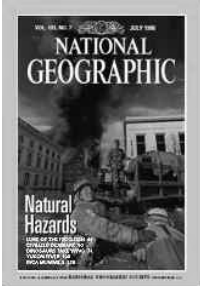


Natural Hazards



David J. Brenner

- djb3@columbia.edu
- You can download this lecture from www.columbia.edu/~djb3
- Note, no radon today ... much more later!

2002 USA Skin Cancer Statistics

➤ Over 1,000,000 new cases of primary skin cancer projected

- 800,000: Basal cell carcinomas
- 160,000: Squamous cell carcinomas
- 53,600: Malignant melanomas

of deaths due to skin cancer – 9,600
7,400 – Malignant melanomas

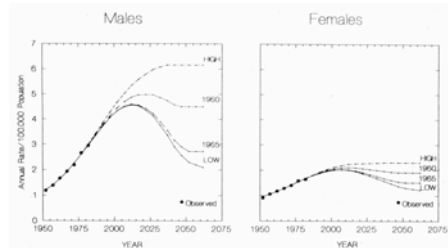
Malignant Melanoma

Yearly increase in melanoma rate: 3% per year

Lifetime risks for malignant melanoma:

- 1935: 1 in 1,500
- 1980: 1 in 250
- 1991: 1 in 100
- 2002: 1 in 70

Malignant Melanoma

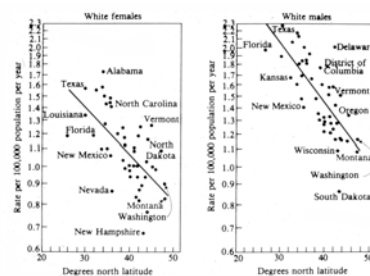


Malignant Melanoma

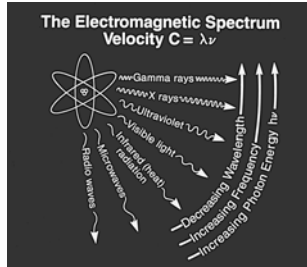
➤ Melanoma is more common than any non-skin cancer among women between 25 and 29 years old.

➤ Every hour one person dies from melanoma.

Skin Cancer



Electromagnetic Spectrum



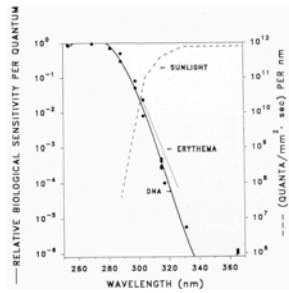
Ultraviolet (UV) Radiation

UVC: Wavelength 200 - 280 nm

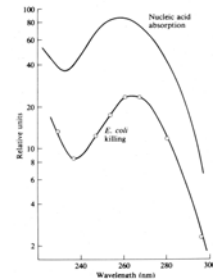
UVB: Wavelength 280 - 320 nm

UVA: Wavelength 320 - 400 nm

Absorption of UV Radiation

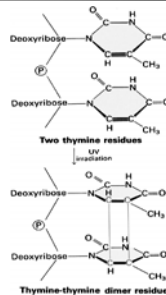


Biological Effects of UV Radiation



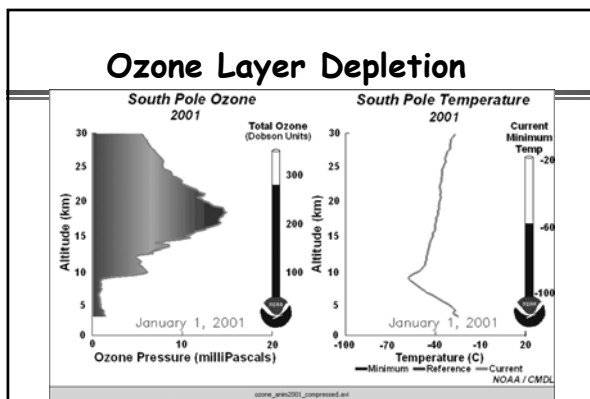
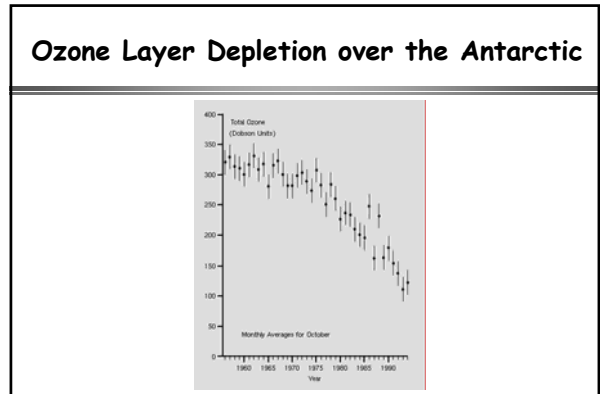
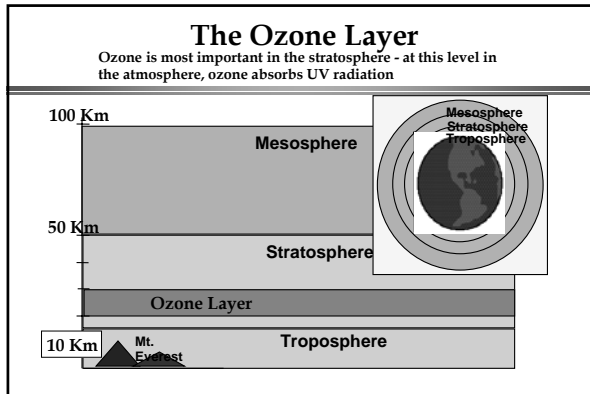
UVB Irradiation and Thymine-Thymine Dimers

UVB irradiation induces formation of thymine-thymine dimers which alter the local DNA structure



How do thymine dimers get repaired?





Chlorofluorocarbons (CFC's)

- Chemically inert
- Highly volatile
- Used in refrigeration, insulation fire extinguishers, air conditioners, aerosols

Molina and Rowland, Nature 1974

In the stratosphere...

CFCs : $\text{CCl}_2\text{F}_2 \rightarrow \text{CClF}_2\cdot + \text{Cl}\cdot$
 $\text{Cl}\cdot + \text{O}_3 \rightarrow \text{ClO}\cdot + \text{O}_2$
 $\text{ClO}\cdot + \text{O} \rightarrow \text{Cl}\cdot + \text{O}_2$

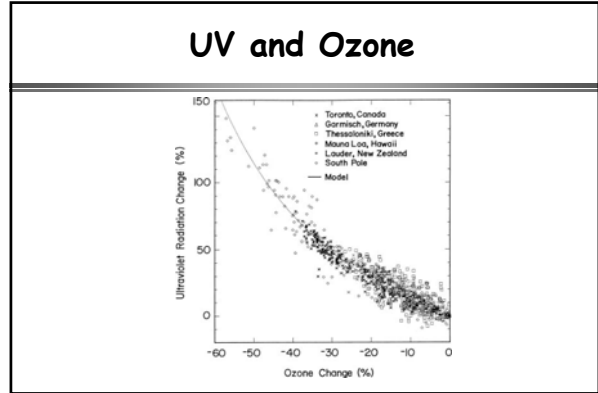
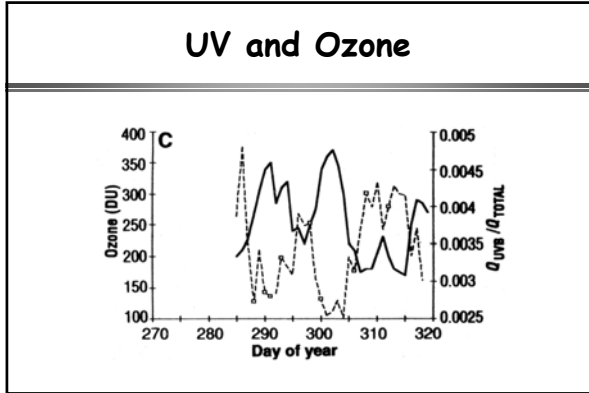
Net: $\text{O} + \text{O}_3 \rightarrow 2\text{O}_2$

The Cl acts basically as a catalyst:
 ~10,000 O_3 will break down to O_2 for every Cl.

Montreal Protocol on Substances that Deplete the Ozone Layer

- Signed 1987
- Ratified by over 50 countries
- Took effect 1989

Development of HCFC's and HFC's
 Less Cl, more H.



1987 EPA Estimates

1% reduction in stratospheric ozone
 ⇒ 2% increase in UVB on Earth

2-3% average global decrease in ozone,
 1968-1988

Have UVB levels increased?

Table II. UVB levels from 1974 to 1985 with Robertson-Berger meters at 297 nm

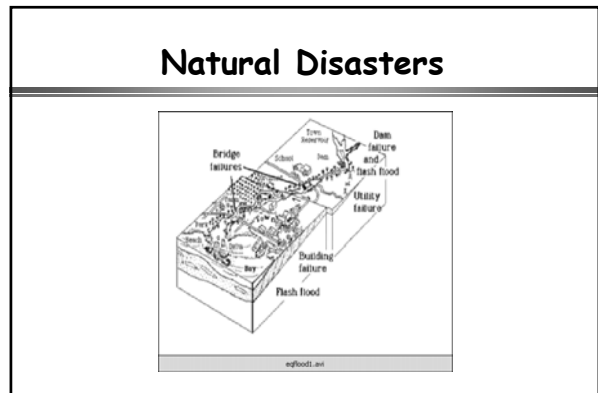
Location	Monthly average UVB level
El Paso, Tex.*	11% decrease
Florida*	Slight decrease
Albuquerque, N.M.*	Slight decrease
Oakland, Calif.*	Slight decrease
Minnesota*	Slight decrease
Fort Worth, Tex.*	No change
Philadelphia, Pa.*	No change
Bismarck, N.D.*	No change
Mauna Loa, Hawaii†	No change

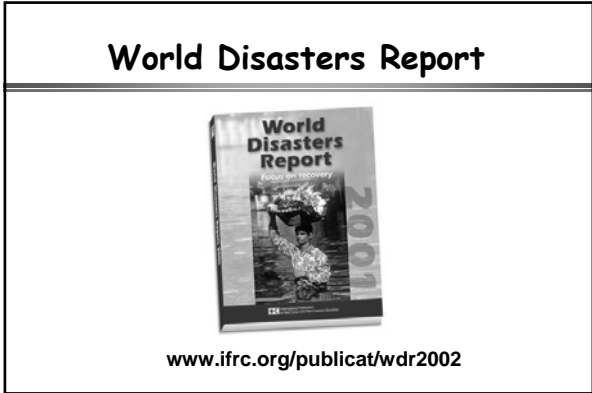
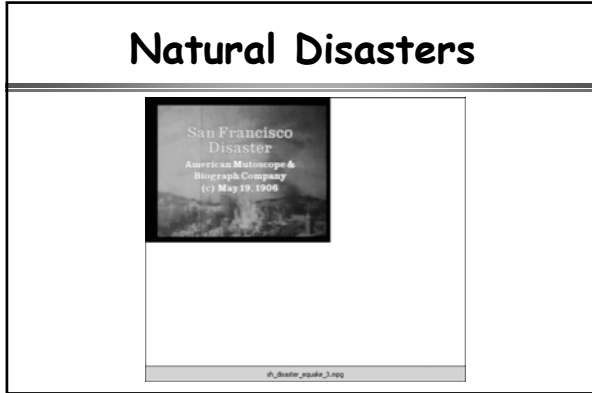
*From Scotto JG, Cotton F, Urbach F, et al. Science 1988;239:762-4.
 †From Urbach F. Photochem Photobiol 1989;50:507-13.

Sunbathing

Exposure Situation	Risk of NMSC at age 70 (%)
Indoor worker, no sunbathing	2-3
Indoor worker, sunbathing 2 wks / year	10-15
Indoor worker, sunbathing 4 wks / year	20-60

Diffey et al: Photoderm 1987, 4, 118-26





Natural Disasters

10 Deadliest Natural Disasters of the 20th Century

	Country	Year	Disaster	Killed
1	China, P Rep	1931	Flood	3,700,000
2	China, P Rep	1928	Drought	3,000,000
3	China, P Rep	1959	Flood	2,000,000
4	India	1942	Drought	1,500,000
5	India	1900	Drought	1,250,000
6	Soviet Union	1921	Drought	1,200,000
7	China, P Rep	1920	Drought	500,000
8	China, P Rep	1938	Flood	500,000
9	China, P Rep	1939	Flood	500,000
10	India	1965	Drought	500,000

Lima vs Japan

Why do earthquakes in Lima kill, on average, 50 times as many people, as comparably-sized earthquakes in Japan?

Note: the two countries have comparable population densities.

Risk of Disaster

Risk of Disaster = Hazard x Vulnerability

Hazard = Probability of a potentially damaging natural phenomenon

Vulnerability = Probability of a structure subject to a given hazard being damaged / destroyed

Japan vs Lima

Different vulnerability...

Parts of Lima have:

- overcrowded conditions
- unsuitable buildings
- dilapidated buildings
- limited movement options for inhabitants

Disaster Prevention

Two Conceptual Approaches

Dominant: Concentrates on hazard prevention / prediction

Political: Concentrates on vulnerability seen as the consequences of socio-economic processes


Disaster Mitigation

“Top down” mitigation


- before or after a disaster
- flood defenses
- disaster relief
- large scale
- high tech

Top-Down Approach

An Example: Peru, 1970, Huaraz earthquake



Before



After

Top-Down Approach


An Example: Peru, 1970, Huaraz earthquake

Government reconstruction plan:

- Seismo-geological zoning
- Construction of new housing
- Reconstruction of infrastructure
- New-housing credits
- ✓ Three years spent on zoning
- ✓ No reconstruction allowed during this time
- ✓ Housing built in marginally vulnerable areas
- ✓ Housing credits to middle class only

Top-Down Approach

Bolivia, 1983 Drought



Top-Down Approach

Bolivia, 1983 Drought

Bolivian Government National Emergency Plan:

- Creating new farms in non-drought regions
- Digging wells
- Providing new potato seed
- Distribution of emergency food
- ✓ 23% of planned new farms built
- ✓ No wells dug
- ✓ No potato seed distributed
- ✓ Food distribution successful

Critiques of "Top down" Mitigation

- Failure to address vulnerability
- Failure to involve people
- Susceptibility to manipulation

Successful Mitigation

An important aspect of successful mitigation seems to be involvement of community-based organizations

Example: Ecuador, 1982-83, Rural Areas Flooding



Example: Ecuador, 1982-83, Rural Areas Flooding

Program organized by UNOCAVB
(Union de Organizaciones Campesina de Vinces-Baba)
Confederation of 30 peasants' organizations

- Distribution of food supplies by local distribution committees
- Set up of local health committees
- Assistance from government technical staff

Are we doing better?

Natural disasters now kill an average of 100,000 people / yr, compared with 3 million / yr between 1900 and 1920

But the number affected by natural disasters has increased from 50 million / yr in 1950 to 200 million / yr now

Compound Disasters are Increasing

Compound disasters: Disasters involving both natural and technological hazards

Flooding along the Mekong river (2000/2001)

- * Partly bad luck - long monsoon season
- * Partly man made - illegal logging

**Vietnam government recommended flood relief support
for consideration by the UN disaster management team**

September, 2001

- Life-vests for children (Must keep head out of water)
- Assist local people to setup kindergartens in potential deeply flooded areas, and in remote areas (Salaries for child-care, and food for children).
- Communication equipment
- Rescue boats and canoes
- Boats, canoes, and fishing nets for poor households
- Temporary houses for evacuated households.
- Water treatment equipment and water treatment chemicals for residents in deeply flooded areas and in remote areas.
- Food, especially processed foods for people that have been moved to safe havens.

Compound Disasters

**The “developed” countries
are certainly not immune
from compound disasters!**