

Nuclear Disarmament, Climate Change and Scientific Responsibility



Jürgen Scheffran, University of Illinois

**Conference "Conferència Catalana per un Futur Sense Nuclears I
Energeticament Sostenible"**

Barcelona, April 25, 2009

Obama, In Prague, Calls For Elimination Of Nuclear Weapons

Today, the Cold War has disappeared but thousands of those weapons have not. In a strange turn of history, the threat of global nuclear war has gone down, but the risk of a nuclear attack has gone up. More nations have acquired these weapons. Testing has continued. Black markets trade in nuclear secrets and materials. The technology to build a bomb has spread. Terrorists are determined to buy, build or steal one.

As the only nuclear power to have used a nuclear weapon, the United States has a moral responsibility to act. We cannot succeed in this endeavor alone, but we can lead it; we can start it.

So today, I state clearly and with conviction America's commitment to seek the peace and security of a world without nuclear weapons. This goal will not be reached quickly -- perhaps not in my lifetime. It will take patience and persistence.

A close-up photograph of Barack Obama speaking into a microphone. He is wearing a suit and tie, and his mouth is open as if in the middle of a speech. The background is dark and out of focus.

Barack Obama on Climate Change:

“My presidency will mark a new chapter in America’s leadership on climate change that will strengthen our security and create millions of new jobs in the process”

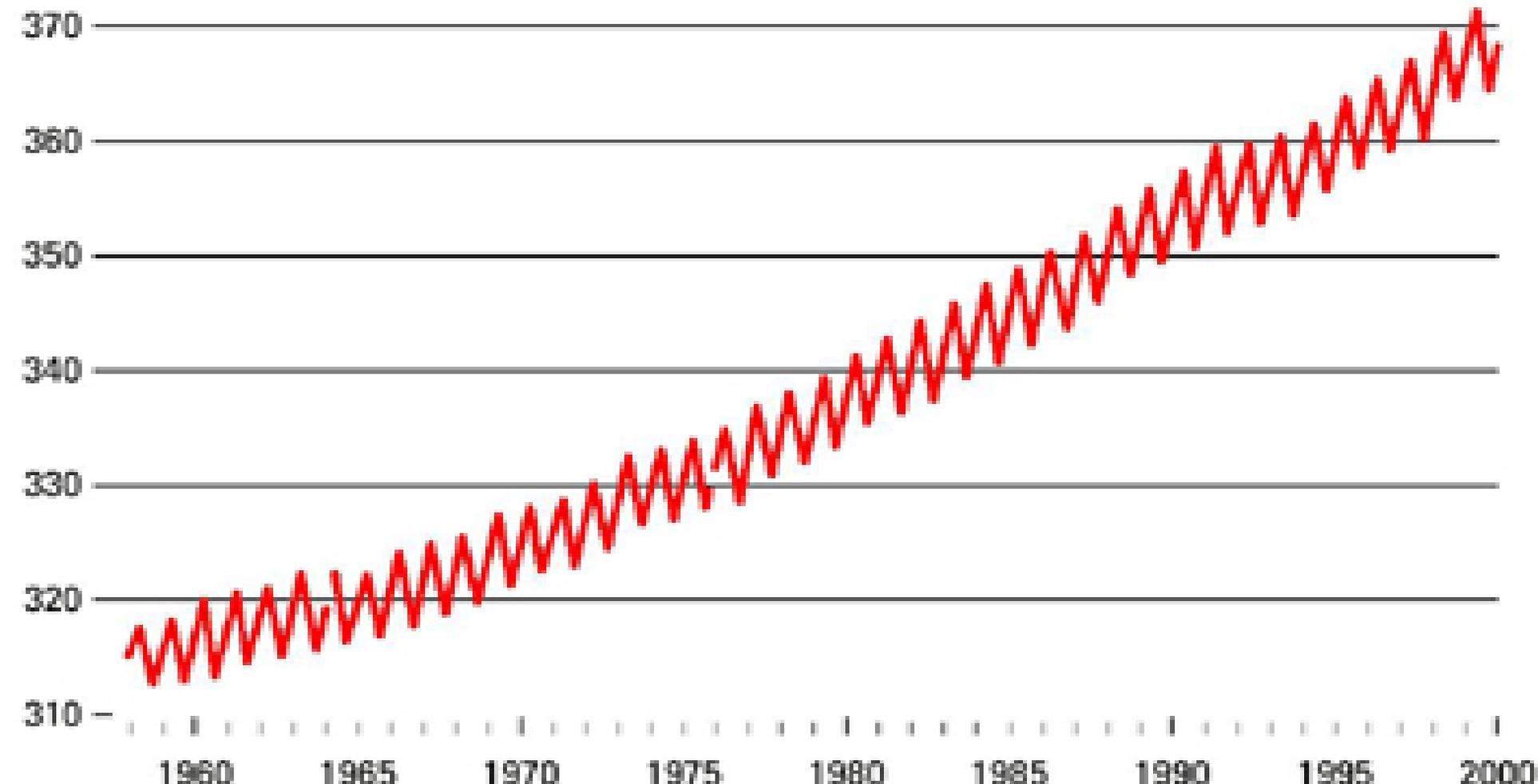
Reduce climate-altering carbon dioxide emissions by 80 percent by 2050, and invest \$150 billion in new energy-saving technologies.

“Now is the time to confront this challenge once and for all, ... Delay is no longer an option. Denial is no longer an acceptable response.”

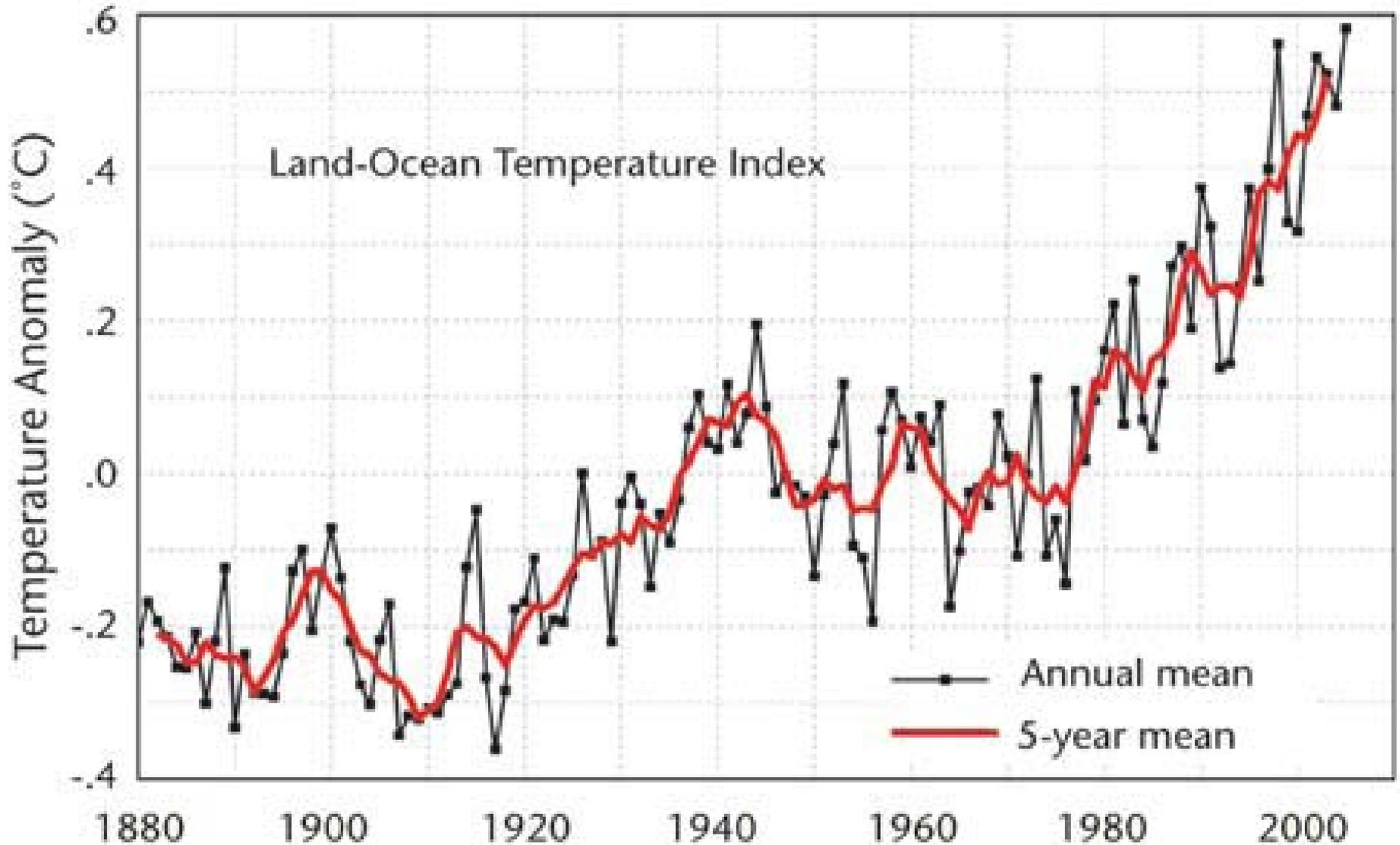
Changes in CO₂ composition of greenhouse gases

Mauna Loa CO₂ increases

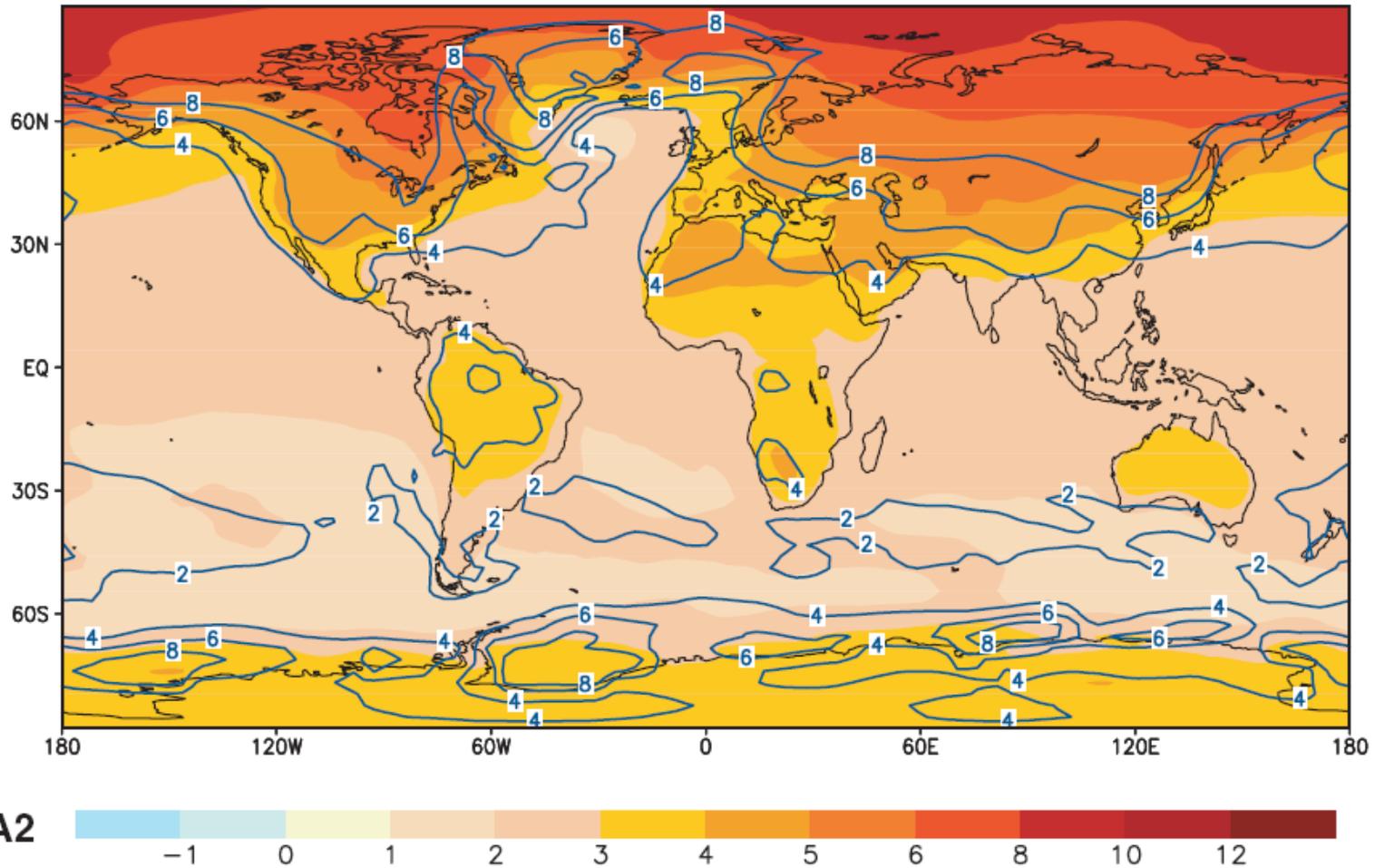
CO₂ concentration in ppmv



Global mean surface temperature measurements

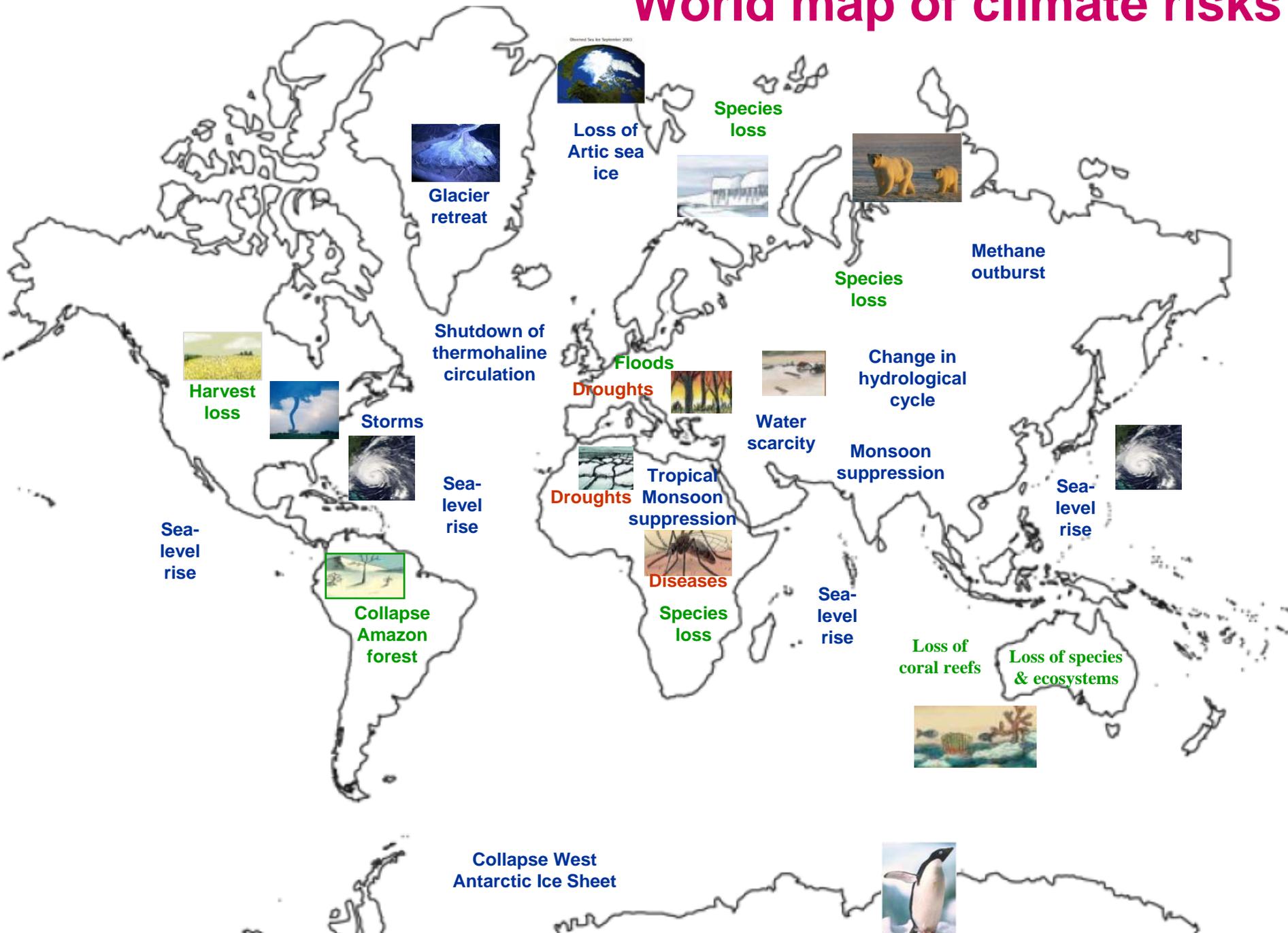


Projected regional temperature change



Annual mean change of temperature and its range (unit: °C) for SRES scenario A2 for period 2071 to 2100 relative to the period 1961 to 1990 (IPCC 2001, WG1).

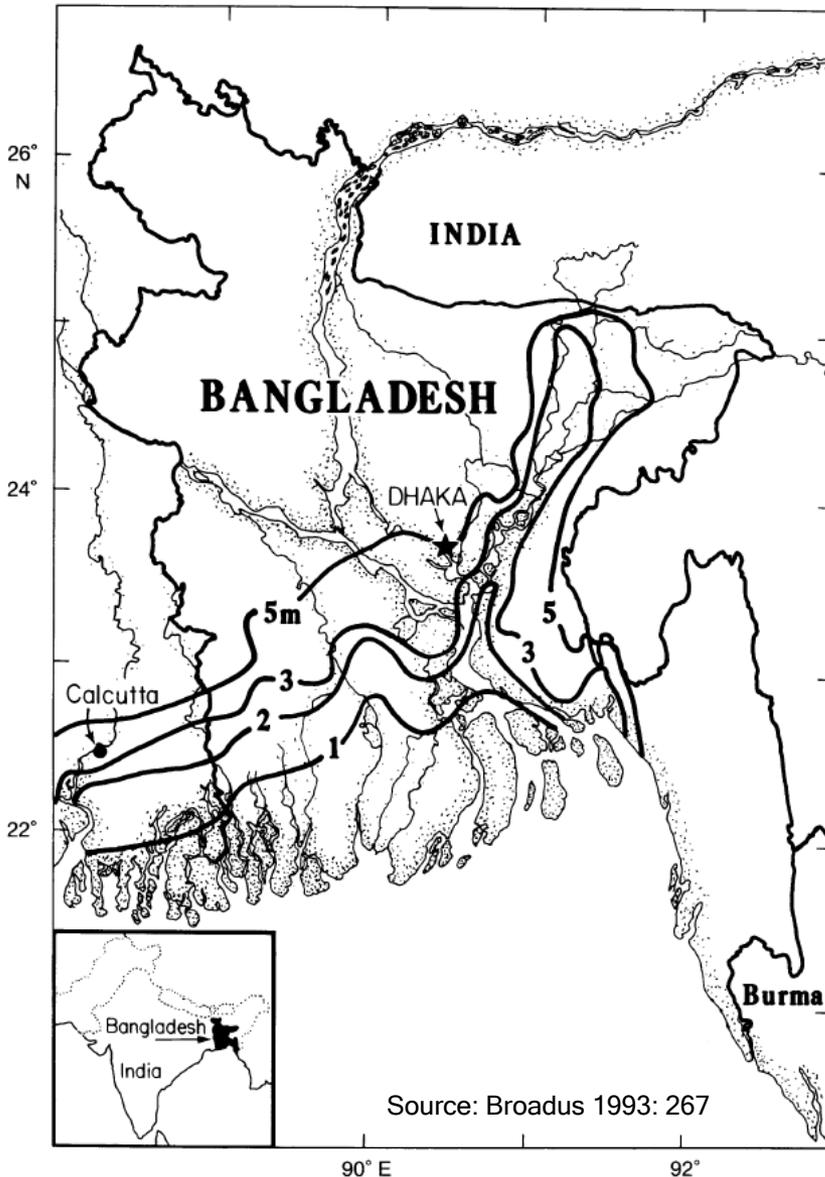
World map of climate risks



Vulnerability of coastal delta populations



Sea level transgression scenarios for Bangladesh



Since 1960, about 600,000 persons died due to cyclones, storm surges and floods. November 2007 cyclone SIDR raked Bangladesh's southwest coast with maximum sustained winds of 241 km/h (150 mph), leaving thousands dead and hundreds of thousands homeless.

Climate change would significantly aggravate human insecurity in Bangladesh, one of the poorest and most densely populated countries of the world. During the monsoon about one quarter of Bangladesh is flooded

Water crisis in the Middle East

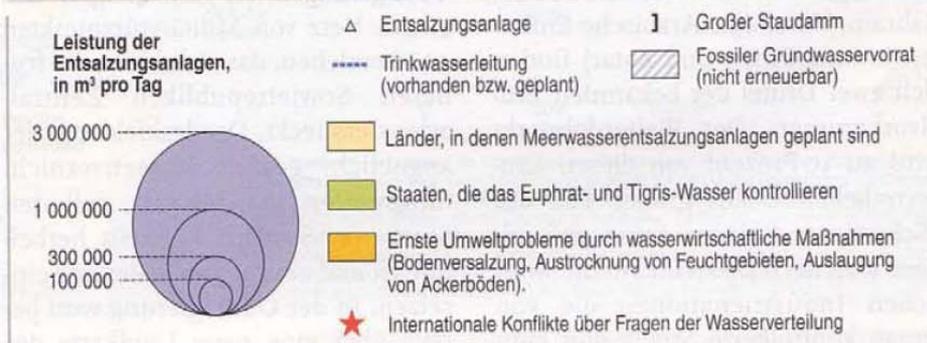
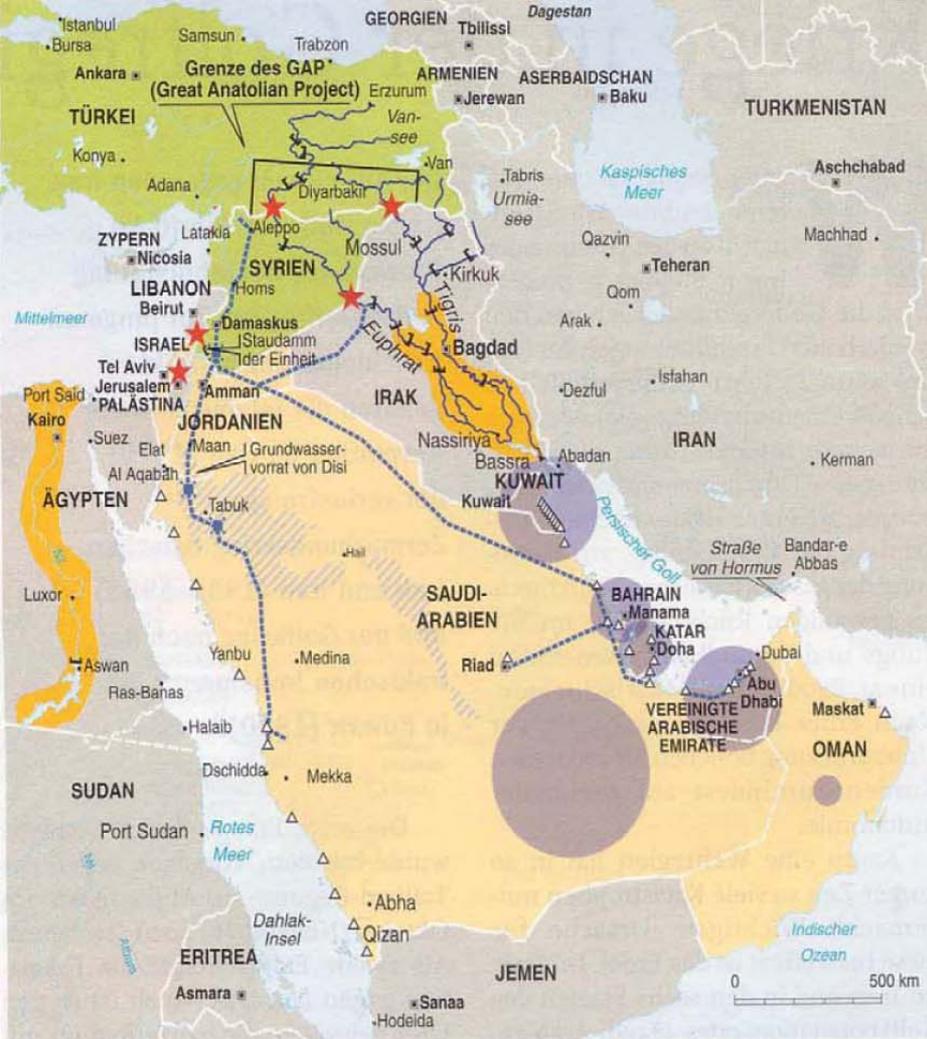
Water strategic issue and conflict factor in the Middle East

- Arid climate
- Imbalance between water demand and supply
- Confrontation between key political actors
- Transboundary water resources
- Water disputes coincide with land disputes.

Competition over shared water resources

- Nile
- Euphrate
- Jordan

➔ Water wars or water cooperation?



Quellen: Masahiro Musakami, Managing Water for Peace in the Middle East: Alternative Strategies. New York (United Nations University Press / UNUPI) 1995.

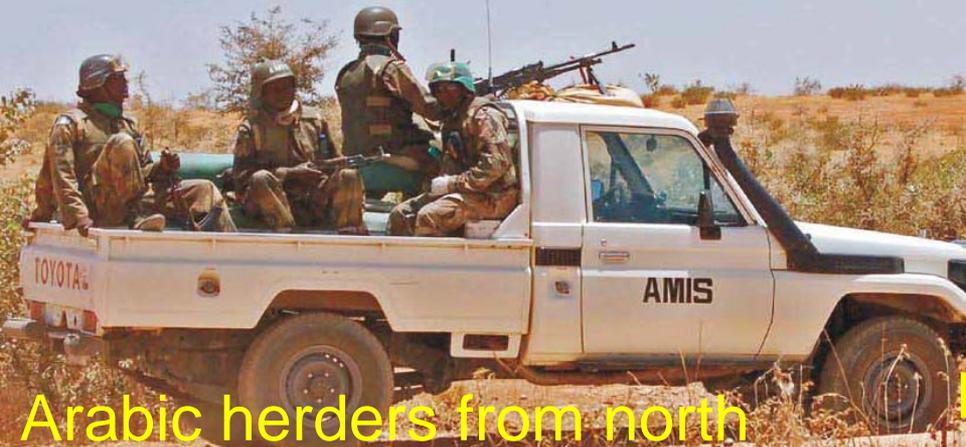
Darfur Sudan



Boundary semi-desert to desert moved southward by 50 to 200 km since 1930s. Significant drop in food production (20%)



Drought & desertification in Sahara increased migration of nomadic groups into more fertile areas of Darfur.



Arabic herders from north migrated south and cattles trampled fields of African farmers.



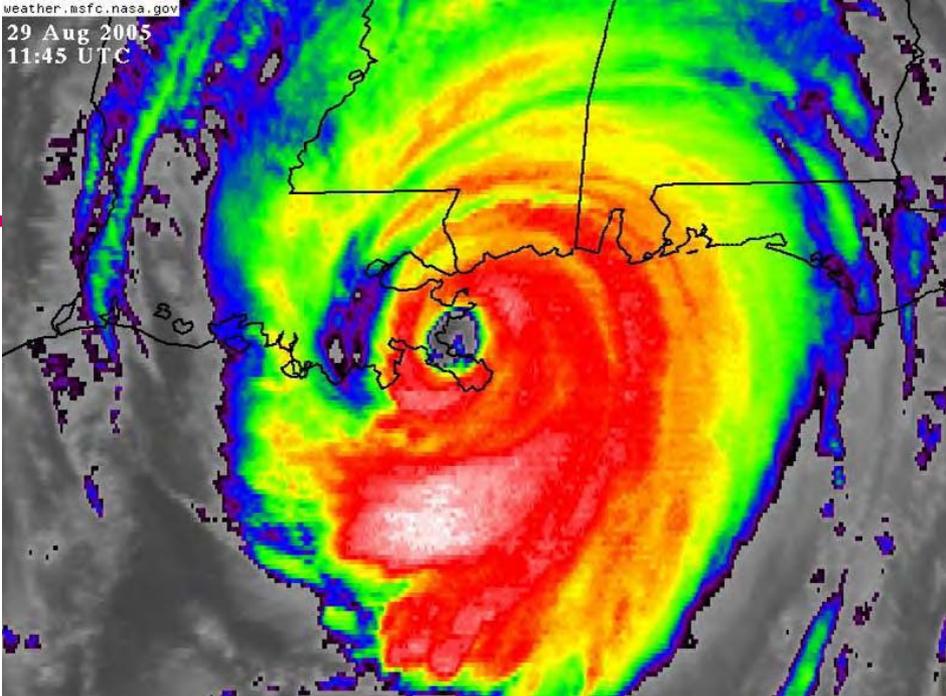
Darfur is considered a "tragic example of the social breakdown that can result from ecological collapse" (LINEP 2007)

A large, intense wildfire with bright orange and yellow flames consuming a structure. The fire is very bright and appears to be spreading rapidly. The background is dark, suggesting a night or low-light environment. The fire is the central focus of the image.

2003 heatwave in Europe: 35,000 people died and agricultural losses reached \$15 billion.

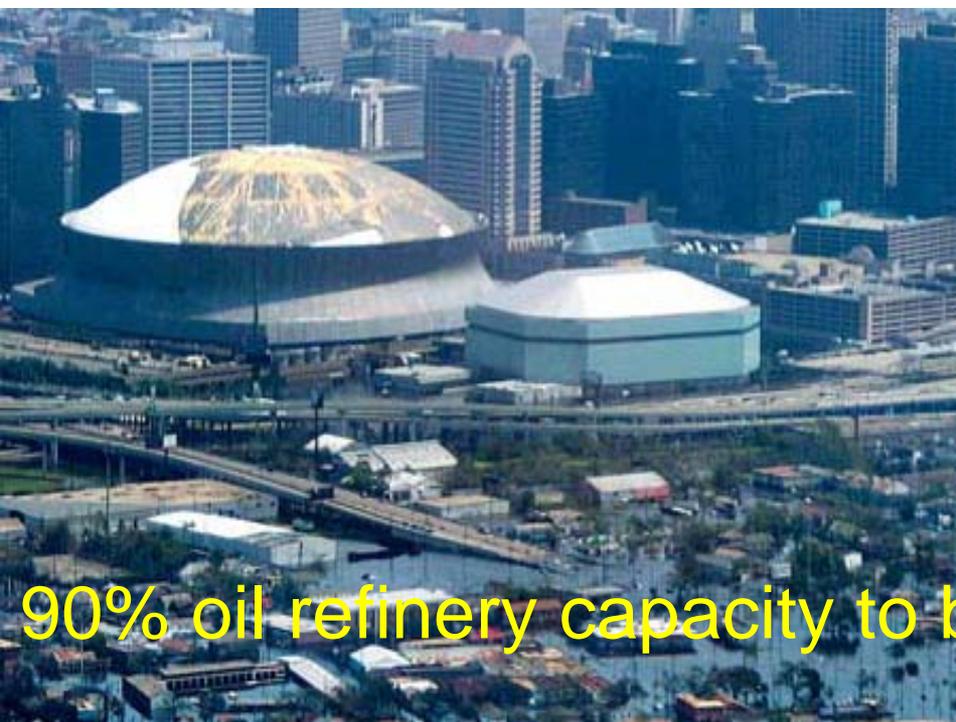
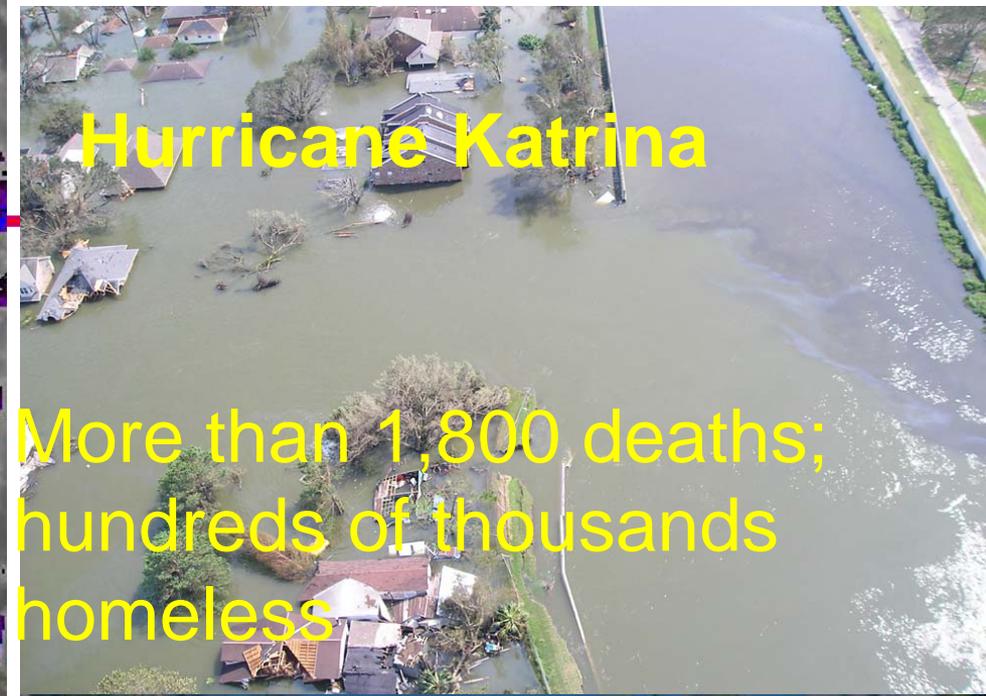
A juvenile playing with matches started a Southern California wildfire that scorched more than 38,000 acres and destroyed 63 structures.

weather.msfc.nasa.gov
29 Aug 2005
11:45 UTC



Hurricane Katrina

More than 1,800 deaths;
hundreds of thousands
homeless



90% oil refinery capacity to be shut down.



Climate refugees?

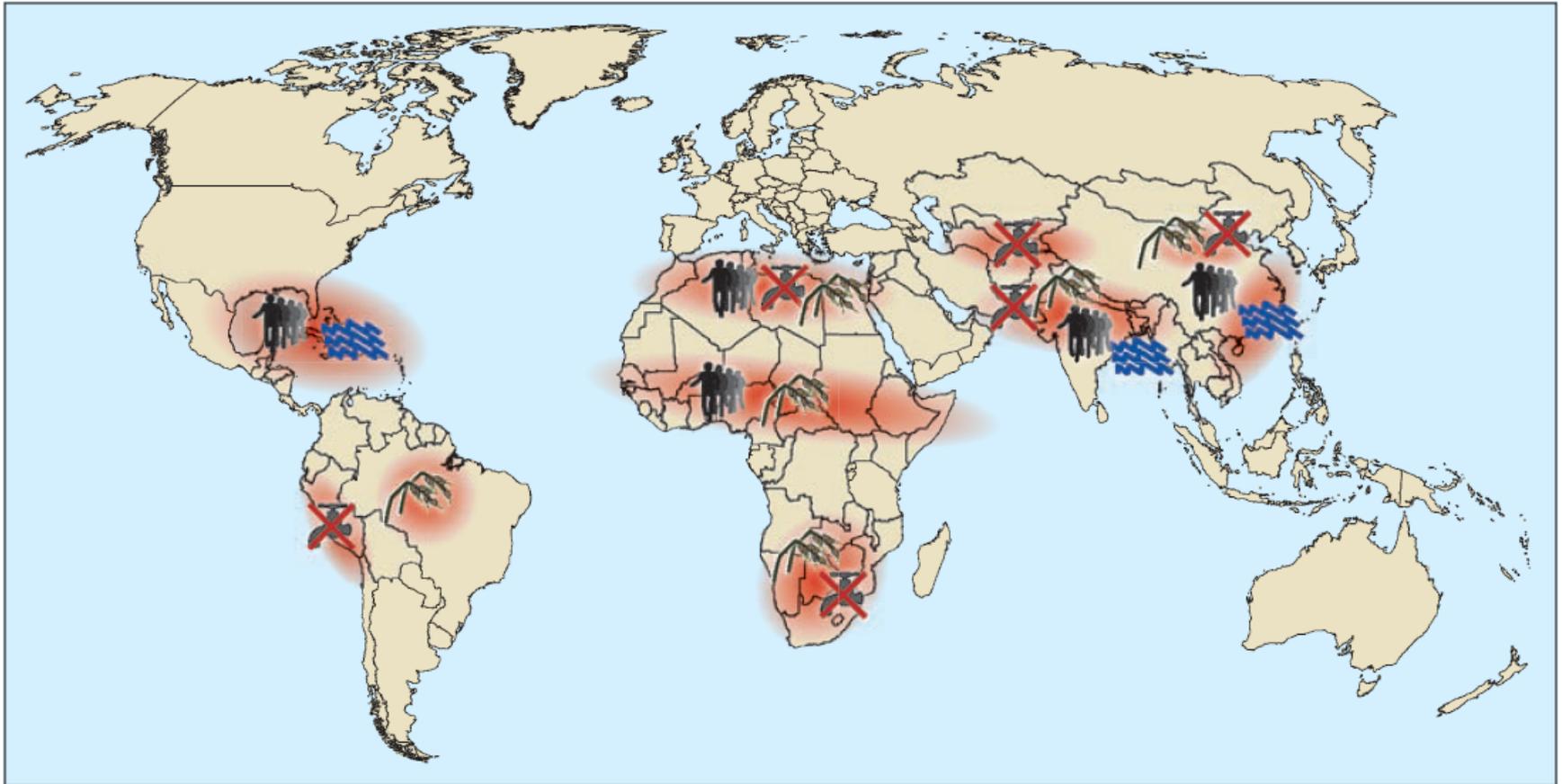
8.4 million registered refugees and 23.7 million of Internally Displaced Persons (2006).

At least 25 million environmental migrants mid-1990s and expected 50 million by 2010 and up to 150 million by 2050

Number of environmental migrants likely substantially rise in the future due to the impacts of climate change.



Security risks associated with climate change: Selected hotspots



Conflict constellations in selected hotspots



Climate-induced degradation of freshwater resources



Climate-induced decline in food production



Hotspot



Climate-induced increase in storm and flood disasters



Environmentally-induced migration

Source: WBGU 2007

Intergovernmental Panel on Climate Change (IPCC)

2007 Fourth Assessment Report WG2

Human society will face **new risks and pressures** as a result of climate change, and people and ecosystems will need to adapt to these pressures.

Vulnerable systems include water resources, agriculture, forestry, human health, human settlements, energy systems, the economy.

Impacts are specific for each region whereas regions highly dependent on ecosystems services and agricultural output are more sensitive.

“Vulnerable regions face multiple stresses that affect their exposure and sensitivity as well as their capacity to adapt. These stresses arise from, for example, current climate hazards, poverty and unequal access to resources, food insecurity, trends in economic globalisation, conflict, and incidence of disease such as HIV/AIDS.”

Poor communities can be especially vulnerable, in particular those concentrated in high-risk areas. They tend to have more limited adaptive capacities, and are more dependent on climate-sensitive resources such as local water and food supplies.

Security risks of climate change?

“Climate-related shocks have sparked **violent conflict** in the past, and conflict is a serious risk in areas such as West Africa, the Nile Basin and Central Asia.” (Stern Review 2006)

Climate change is characterized as a “**threat multiplier**” in already fragile regions of the world, exacerbating conditions that lead to failed states — the breeding grounds for extremism and terrorism. (National Security and the Threat of Climate Change, April 2007)

The effects of climate change have “long-term security implications for all countries which are far more serious, lasting and destructive than those of international **terrorism.**” (Oxford Research Group 2006)

Climate change may “pose as much of a danger to the world as **war.**” (UN Secretary General Ban Ki-Moon 2007)

PROBLEMS AND CONFLICTS OF FOSSIL- NUCLEAR ENERGY



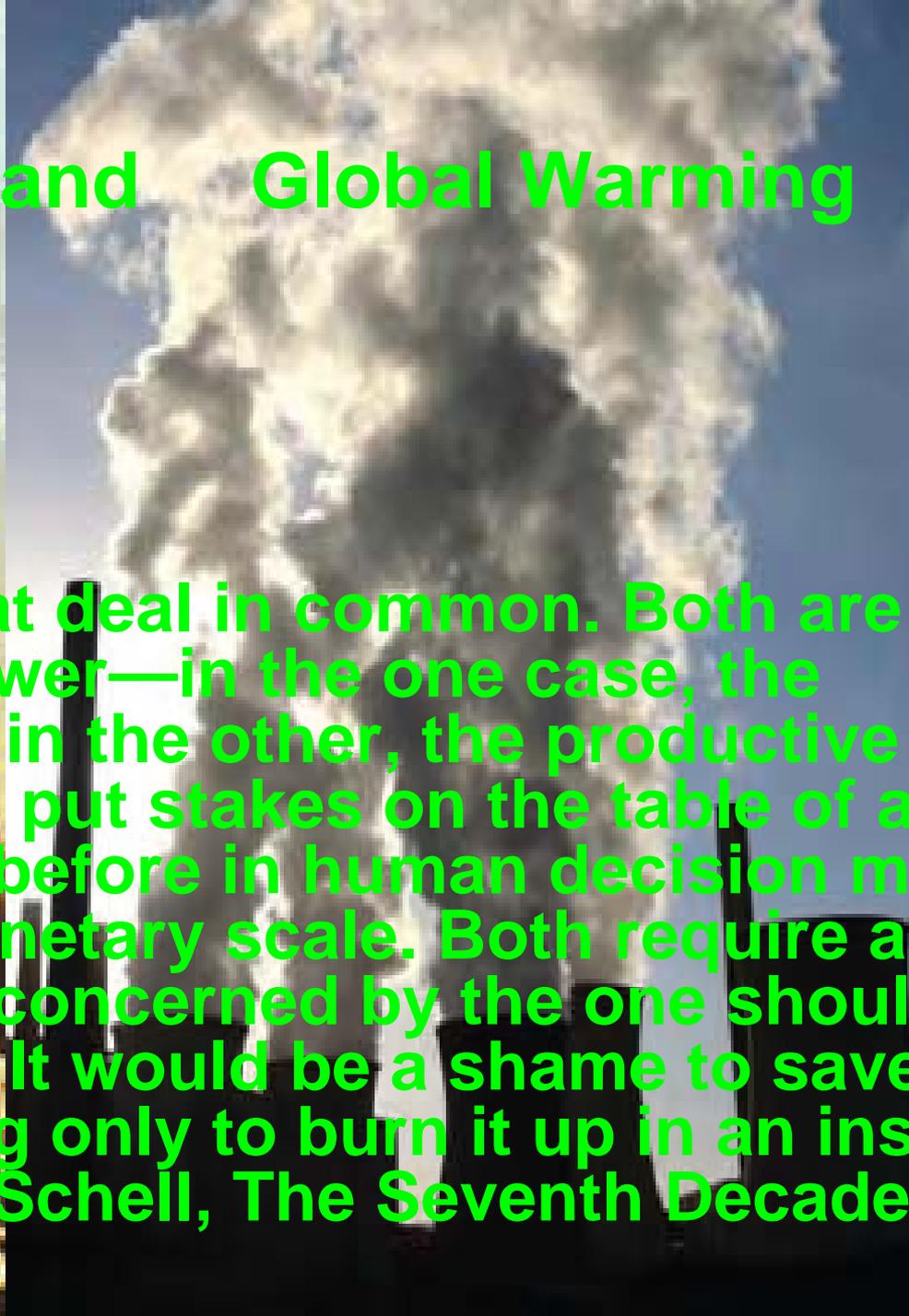
Abrupt climate change: a security risk?

„As global and local carrying capacities are reduced, **tensions** could mount around the world, leading to two fundamental strategies: defensive and offensive. Nations with the resources to do so may **build virtual fortresses** around their countries, **preserving resources** for themselves. Less fortunate nations especially those with ancient enmities with their neighbors, may initiate in **struggles for access to food, clean water, or energy**. Unlikely alliances could be formed as defense priorities shift and the goal is **resources for survival** rather than religion, ideology, or national honor.“

„With a scarcity of energy supply – and a growing need for access -- **nuclear energy will become a critical source of power**, and this will **accelerate nuclear proliferation** as countries develop enrichment and reprocessing capabilities to ensure their national security. China, India, Pakistan, Japan, South Korea, Great Britain, France, and Germany will all have nuclear weapons capability, as will Israel, Iran, Egypt, and North Korea.“ (Schwartz/Randall 2003)

A large, orange and yellow mushroom cloud from a nuclear explosion, with a bright fireball at its base. The cloud is set against a clear blue sky.

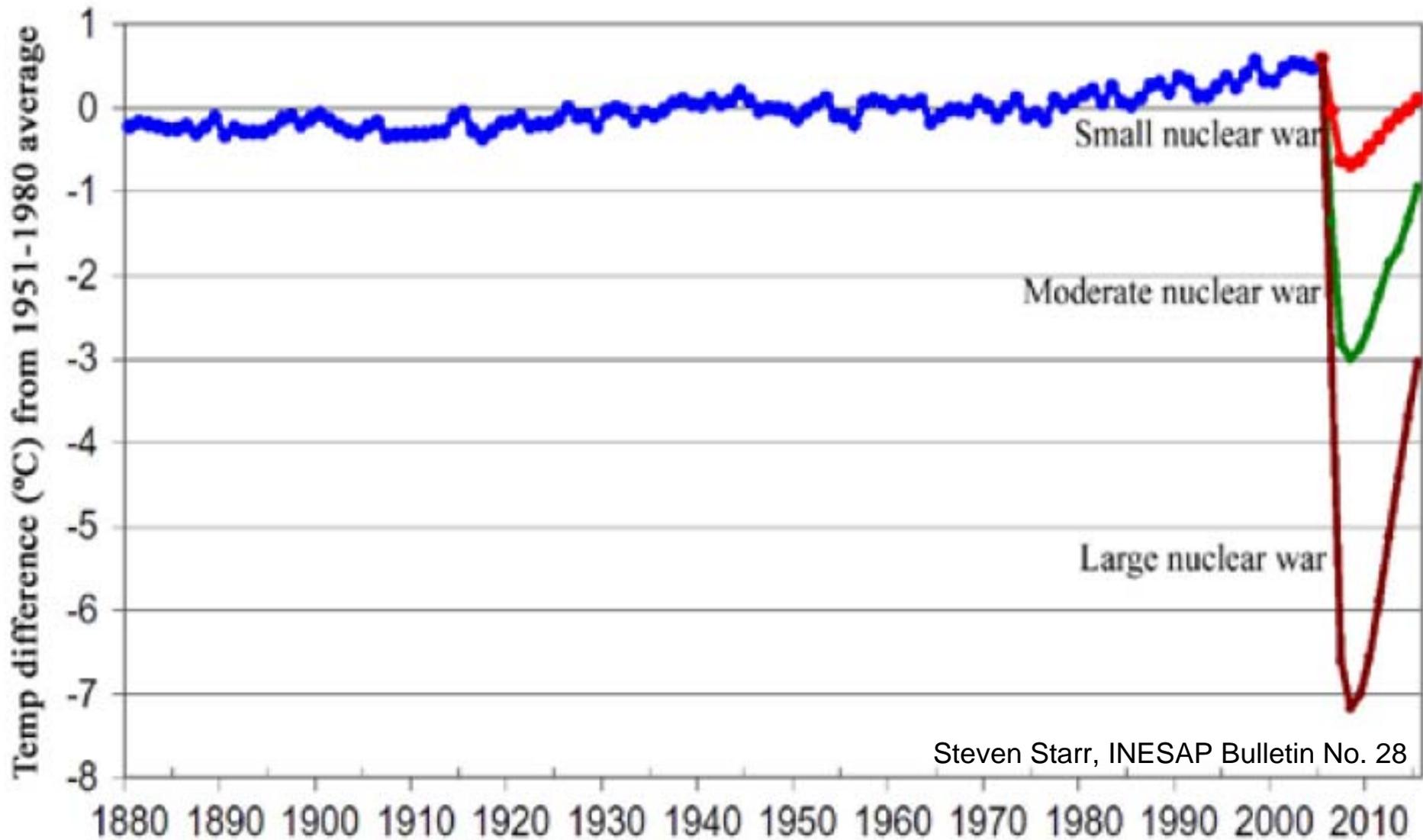
Nuclear Winter

A massive, billowing plume of white smoke or steam rising into a clear blue sky. The plume has a textured, cauliflower-like appearance.

and Global Warming

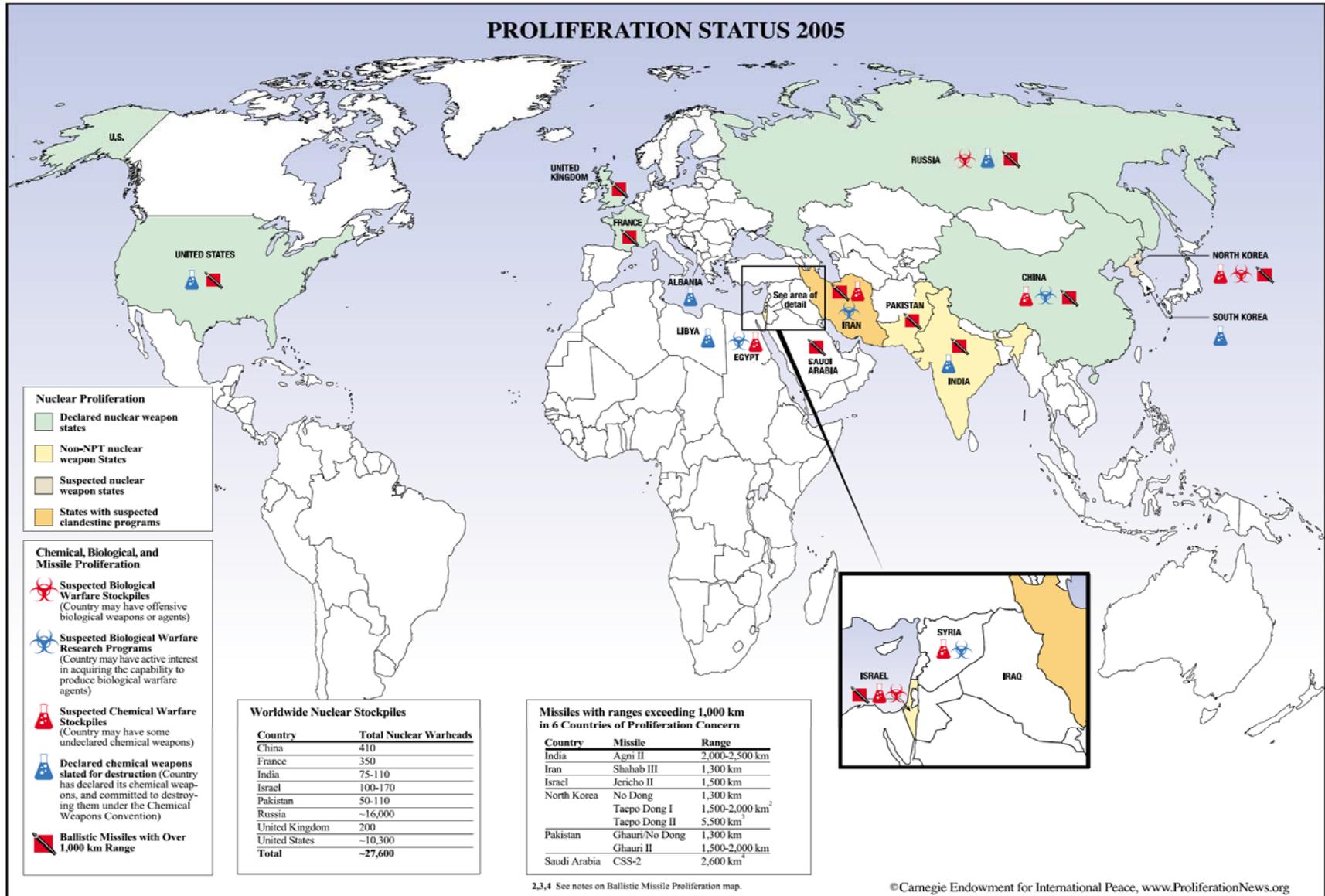
The two perils have a great deal in common. Both are fruit of swollen human power—in the one case, the destructive power of war; in the other, the productive of fossil-fuel energy. Both put stakes on the table of a magnitude never present before in human decision making. Both threaten life on a planetary scale. Both require a global response. Anyone concerned by the one should be concerned with the other. It would be a shame to save Earth from slowly warming only to burn it up in an instant in a nuclear war.” Jonathan Schell, *The Seventh Decade*

Global average surface air temperature changes from small, moderate, and large nuclear conflicts in the context of the climate change of the past 125 years



Steven Starr, INESAP Bulletin No. 28

Nuclear weapons and proliferation



2.3.4 See notes on Ballistic Missile Proliferation map.

Overview of Programs and Arsenals

Status of Nuclear Weapon Programs

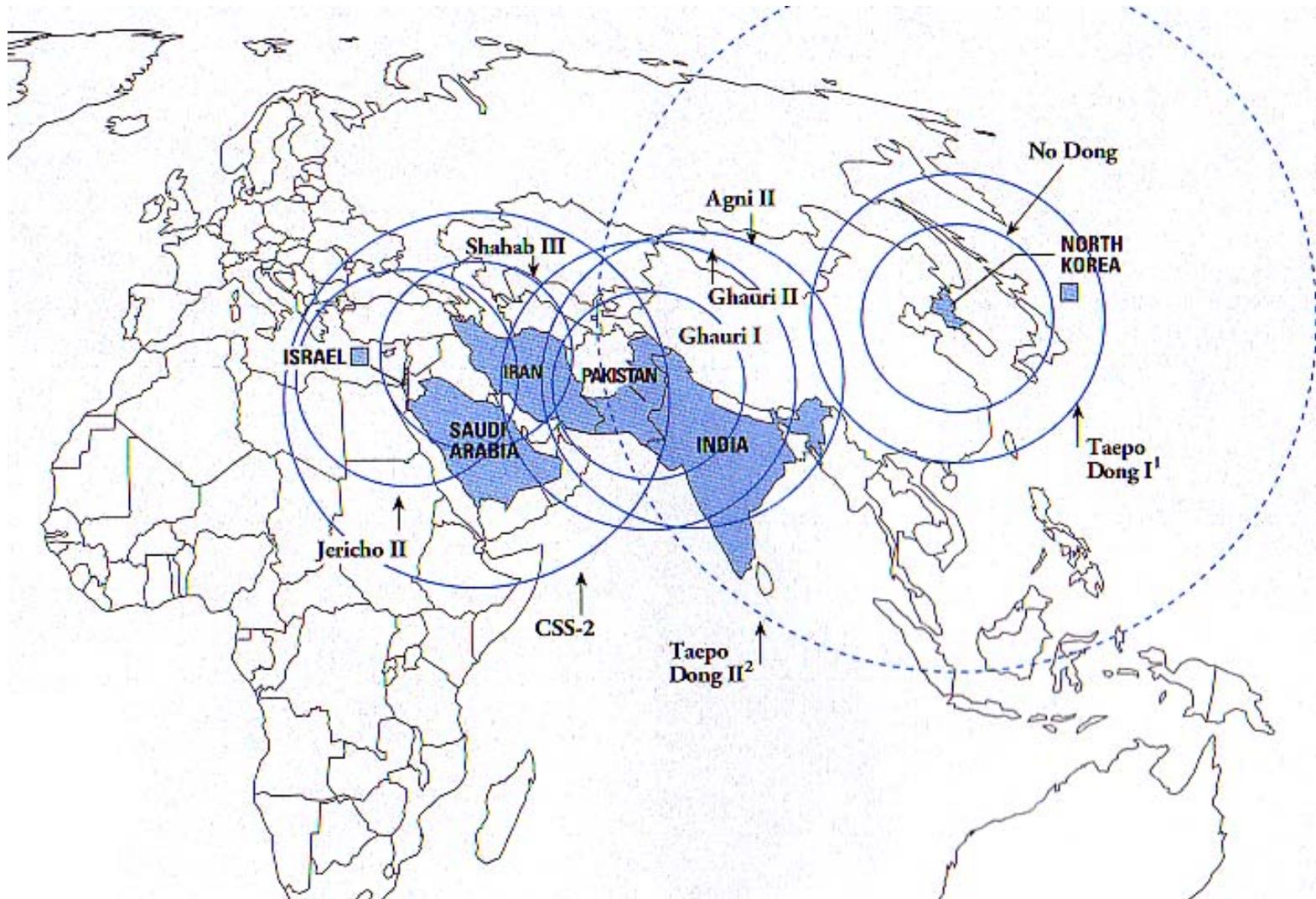


Countries with Nuclear, Biological, or Chemical Weapons or Offensive Research

Country	Nuclear	Biological	Chemical
Russia	W	W	W*
China	W	W	W
Israel	W	W?	W
United States	W		W*
France	W		
United Kingdom	W		
India	W	R?	W*
Pakistan	W	R?	R?
North Korea	W?	W	W
Iran	R	R?	W?
Egypt		R?	W
Syria		R?	W
South Korea			W*
Libya			W*
Albania			W*

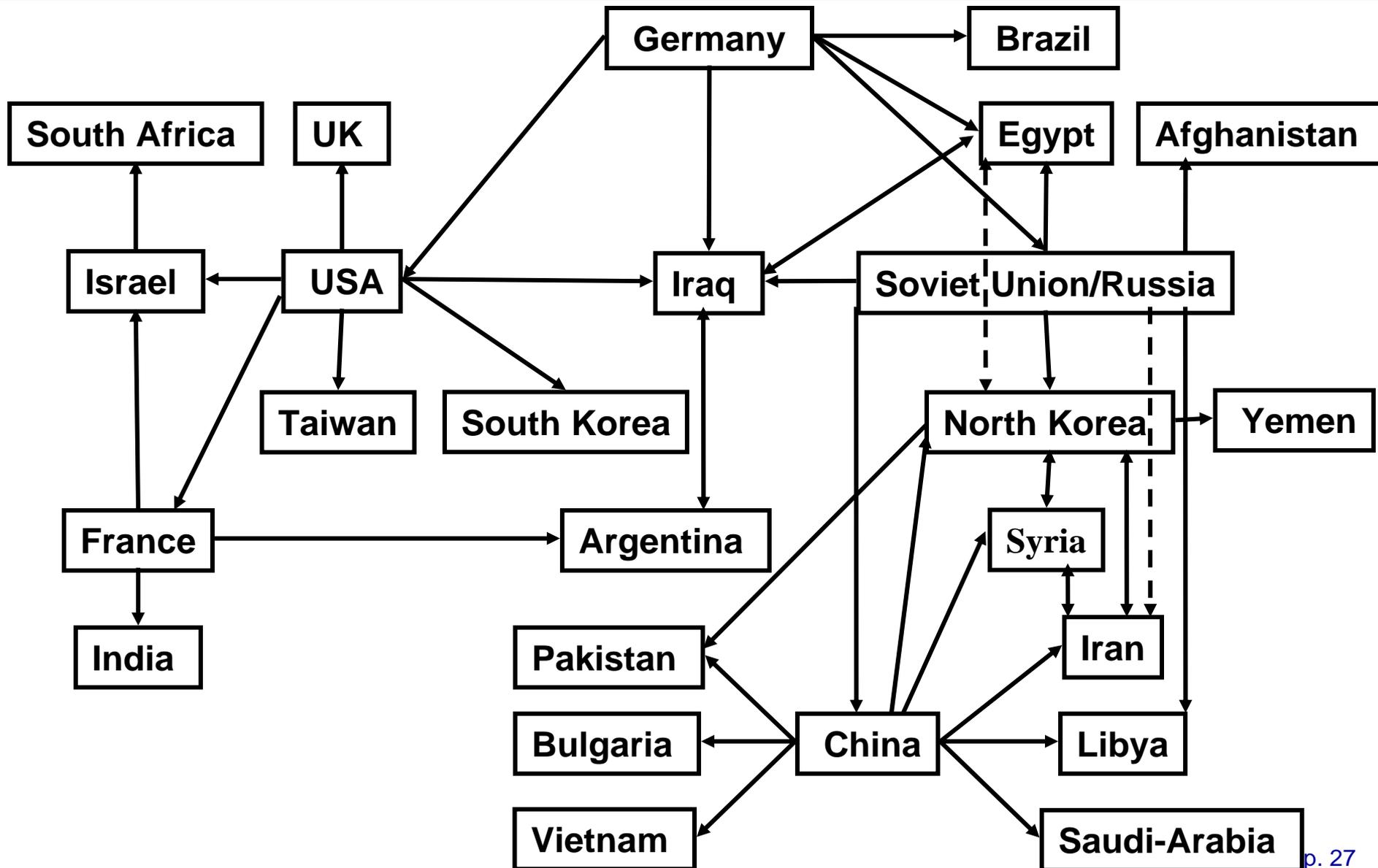
Key: W = has known weapons or agents; R = has known research program; ? = is suspected of having weapons or programs; and W* = possesses chemical weapons but has declared them under the Chemical Weapons Convention and is in the process of eliminating them.

Ballistic Missile Ranges



Cirincione, Deadly Arsenal, 2002.

Proliferation network of ballistic missiles



Three classes of the missile threat

Scud barrier

Afghanistan
 Armenia
 Bahrein
 Belarus
 Egypt
 Greece
 Iraq
 Kazakhstan
 Libya
 Rep. Korea
 Slovakia
 Syria
 Taiwan
 Turkey
 Turkmenistan
 Ukraine
 U. Arab Emirates
 Viet Nam
 Yemen

1,000km

INF barrier

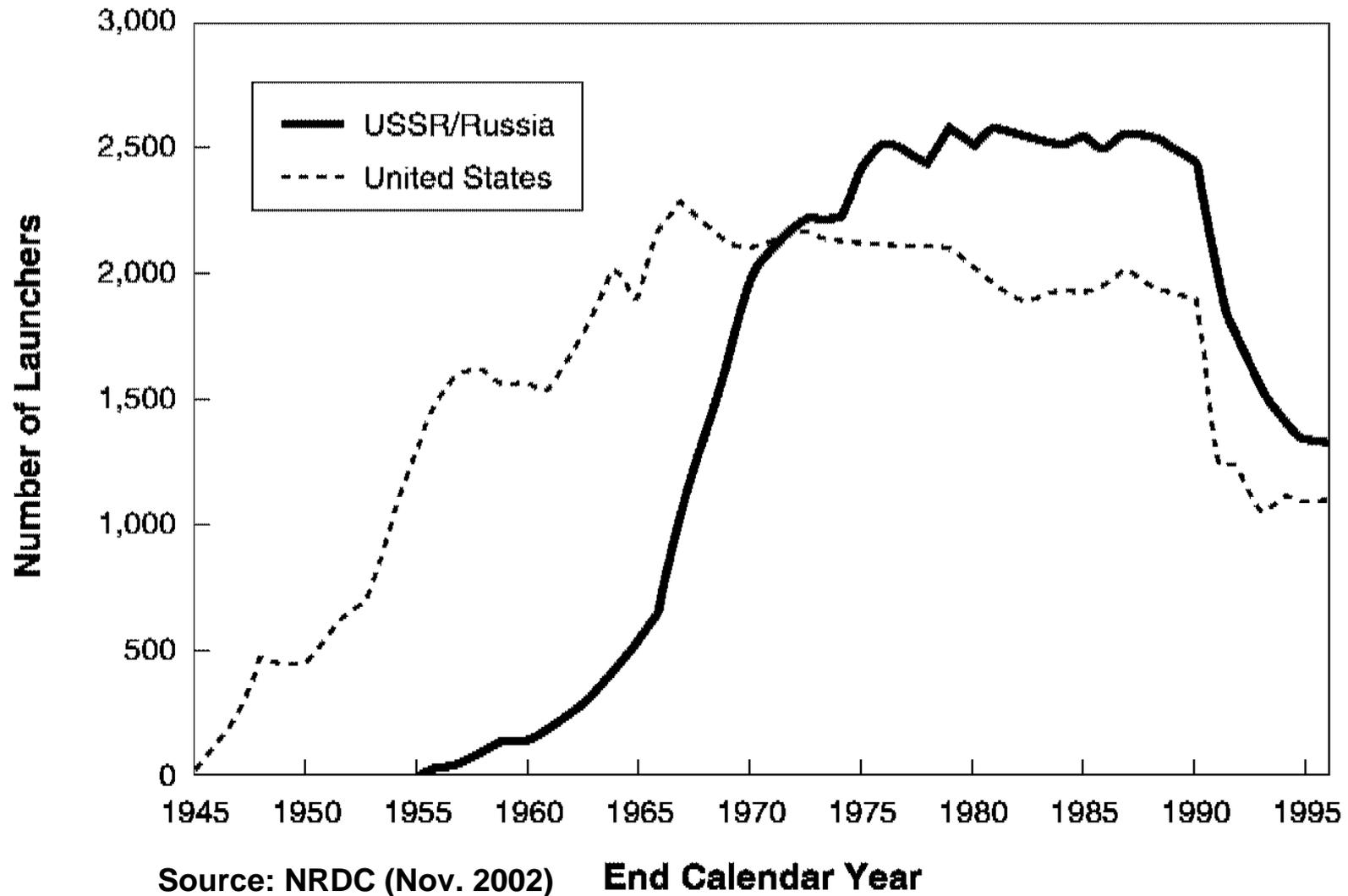
<i>Country</i>	<i>Missile</i>	<i>Range (km)</i>
DPRK	Nodong	1,300
	Taepodong-1	2,000
	Taepodong-2	5,500
India	Agni-2	2,000
Iran	Shahab-3	1,300
	Shahab-4	2,000
Israel	Jericho-3	1,300
Pakistan	Hatf-5	1,300
	Hatf-6	2,300
Saudi Arabia	DF-3 (CSS-2)	2,600

5,500km

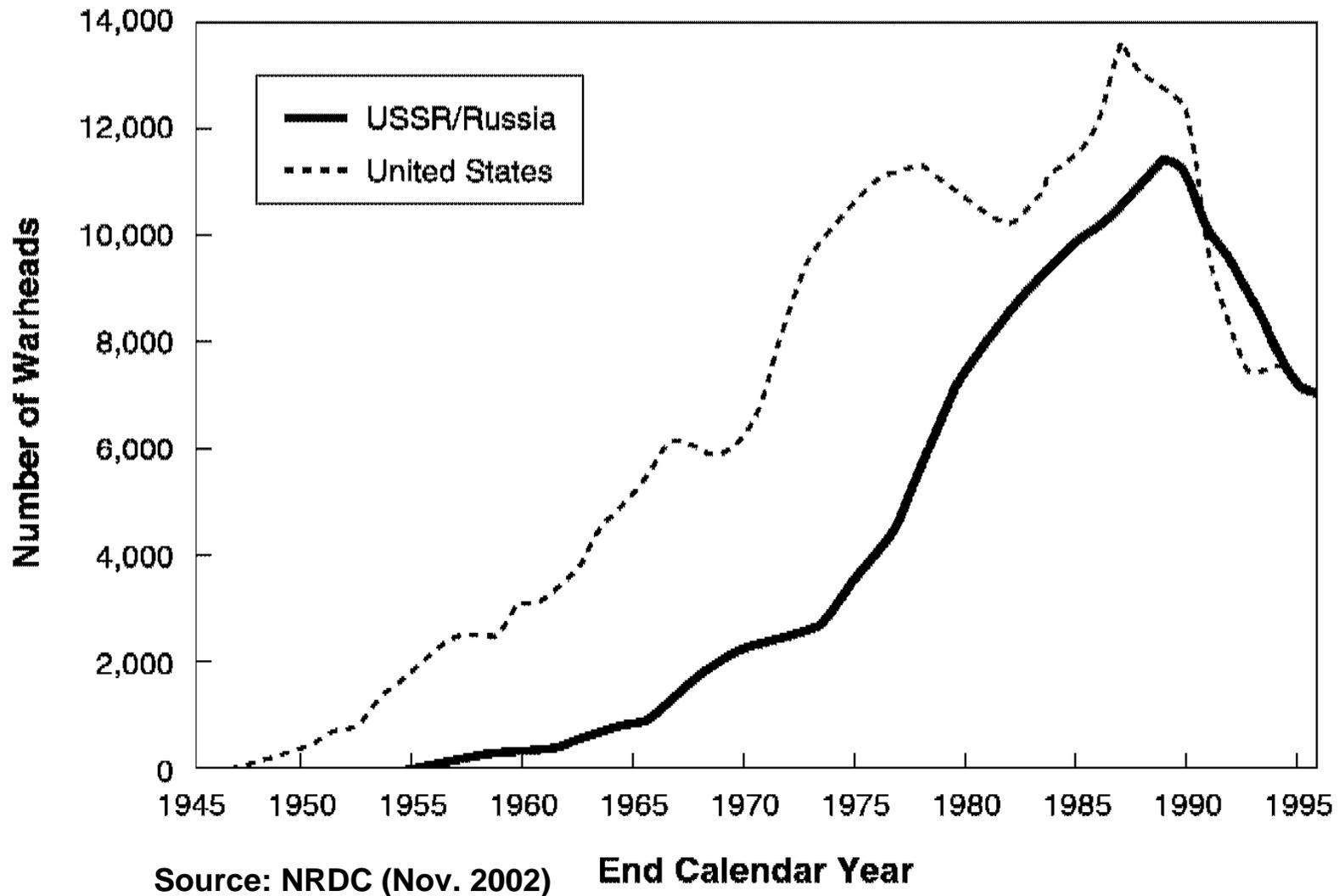
<i>Country</i>	<i>Missile</i>	<i>Range (km)</i>
China	DF-31 (CSS-X-9)	8,000
	DF-31A	12,000
	DF-5 (CSS-4)	13,000
France	M-45	6,000
	M-51	8,000
Russian Federation	SS-18	11,000
	SS-19	10,000
	SS-24	10,000
	SS-25	10,500
	SS-27	10,500
	SS-N-18	8,000
	SS-N-20	8,300
	SS-N-23	8,300
United Kingdom	Trident D-5	7,400
United States	Minuteman II	9,650
	Peacekeeper	9,650
	Trident C-4	7,400
	Trident D-5	7,400

Range

US and SU-Russian Nuclear Launchers



US and SU-Russian Nuclear Warheads



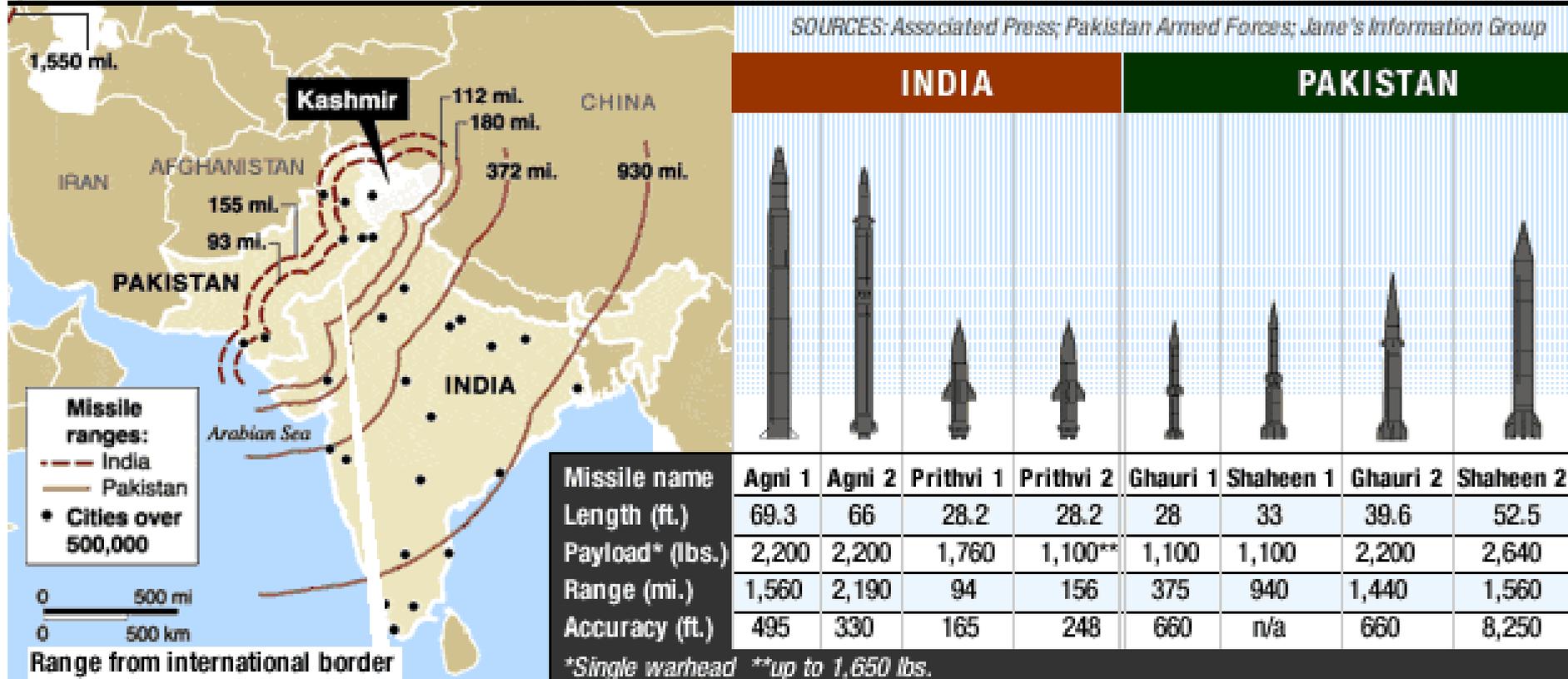
Comparison of Nuclear-Weapon-States

	United States	U.S.S.R./Russia	Britain	France	China
Warheads					
Warheads in stockpile (2003)	7,650 active, ~3,000 reserve or awaiting disassembly	8,200 active, ~10,000 reserve or awaiting disassembly	200	350	400
Peak number of warheads/year	32,500/1967	45,000/1986	410/1969	540/1993	450/1993
Total number of warheads built, years	70,000 1945–1992	55,000 1949–2003	1,200 1952–2001	1,260 1960–2003	750 1964–2003

NRDC, Sept./Oct. 2003.

Summary of India's and Pakistan's Ballistic Missile Systems

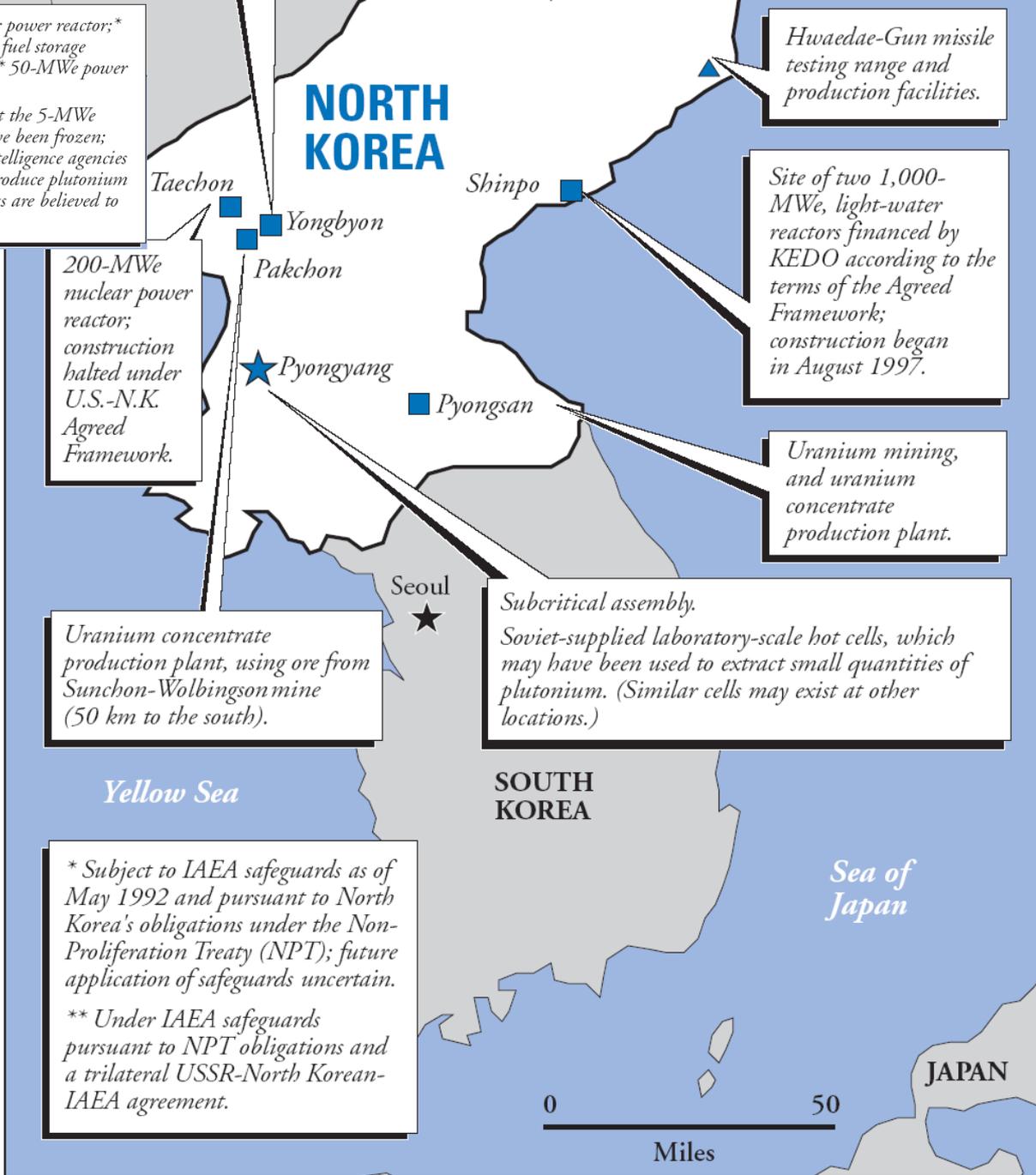
With India and Pakistan both possessing nuclear weapons and the means to deliver them great distances, a possible war could result in millions of deaths in both countries. The following illustrates the range of missiles:



Source: CNN (May 2003)

Yongbyon Nuclear Research Center Site of a 5-MWe experimental nuclear power reactor;* a partially completed plutonium extraction facility;* a fuel fabrication plant;* fuel storage facilities;* and a Soviet-supplied IRT research reactor** and critical assembly.** 50-MWe power reactor previously under construction.

Under the Oct. 21, 1994, U.S.-North Korean Agreed Framework, activities at the 5-MWe gas-graphite reactor, the fuel fabrication facility, and the reprocessing plant have been frozen; construction also has been halted on the 50-MWe gas-graphite reactor. U.S. intelligence agencies believe that North Korea has used the 5-MWe reactor and extraction plant to produce plutonium (possibly enough for 1 or 2 nuclear weapons). Wastes from the extraction process are believed to be stored at two undeclared sites near the center.



200-MWe nuclear power reactor; construction halted under U.S.-N.K. Agreed Framework.

Uranium concentrate production plant, using ore from Sunchon-Wolbingson mine (50 km to the south).

Subcritical assembly. Soviet-supplied laboratory-scale hot cells, which may have been used to extract small quantities of plutonium. (Similar cells may exist at other locations.)

Site of two 1,000-MWe, light-water reactors financed by KEDO according to the terms of the Agreed Framework; construction began in August 1997.

Uranium mining, and uranium concentrate production plant.

Hwaedae-Gun missile testing range and production facilities.

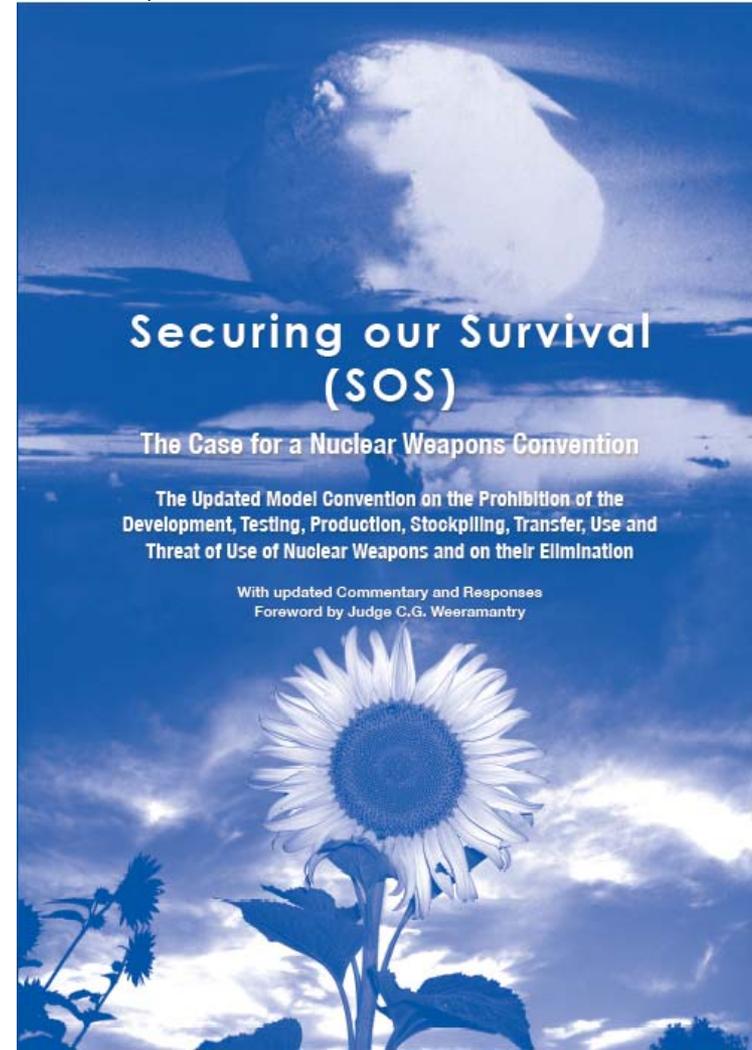
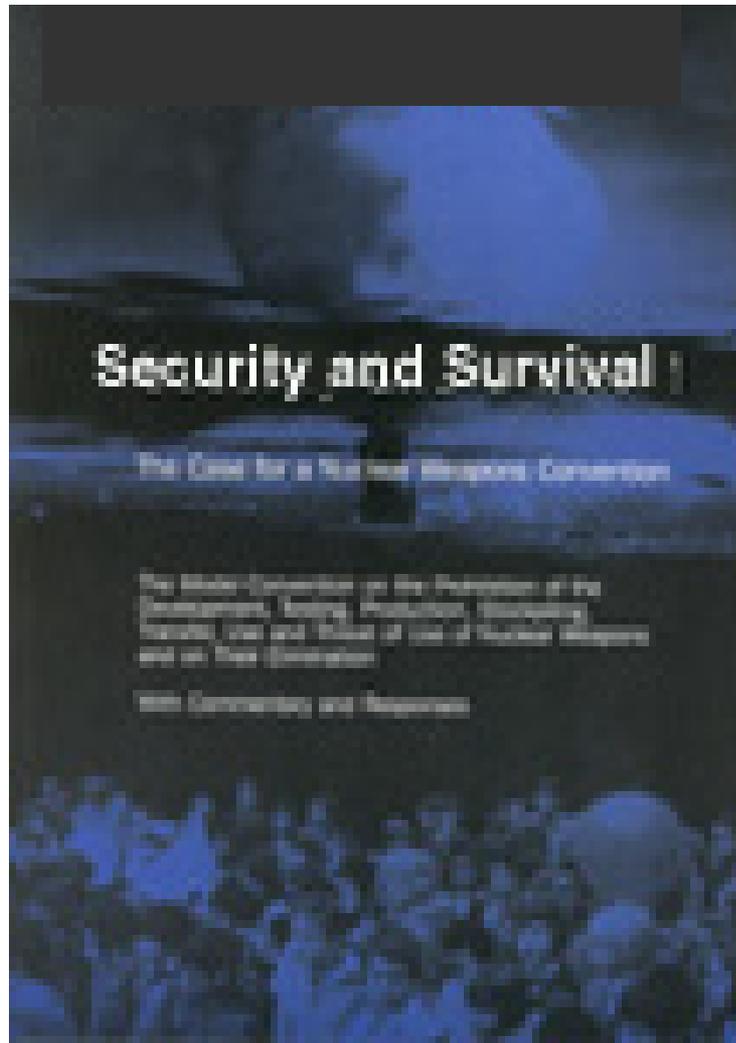
* Subject to IAEA safeguards as of May 1992 and pursuant to North Korea's obligations under the Non-Proliferation Treaty (NPT); future application of safeguards uncertain.
 ** Under IAEA safeguards pursuant to NPT obligations and a trilateral USSR-North Korean-IAEA agreement.

Iran's Nuclear Complex



The Nuclear Weapons Convention A Path to the Nuclear-Weapon-Free World

Article VI Forum, Berlin, January 29-30, 2009
Jürgen Scheffran, ACDIS, INESAP



Model Nuclear Weapons Convention

Model Nuclear Weapons Convention

Convention on the Prohibition of the
Development, Testing, Production,
Stockpiling, Transfer, Use and
Threat of Use of Nuclear Weapons
and on Their Elimination

PROJET DE CONVENTION RELATIVE AUX ARMES NUCLÉAIRES

Projet de convention sur l'interdiction de la mise au point, de l'essai, de la fabrication,
du stockage, du transfert, de l'emploi ou de la menace d'emploi d'armes nucléaires,
et sur leur élimination

CONVENCIÓN TIPO SOBRE ARMAS NUCLEARES

Convención sobre la prohibición del desarrollo, los ensayos, la
producción, el almacenamiento, la transferencia, el empleo o la
amenaza del empleo de armas nucleares y sobre su eliminación

Конвенция о запрещении разработки, испытания, производства,
накопления запасов, передачи, применения и угрозы применения

核武器示范公约

关于禁止发展、试验、生产、储存、转让、
使用和威胁使用核武器及消除此种武器的公约

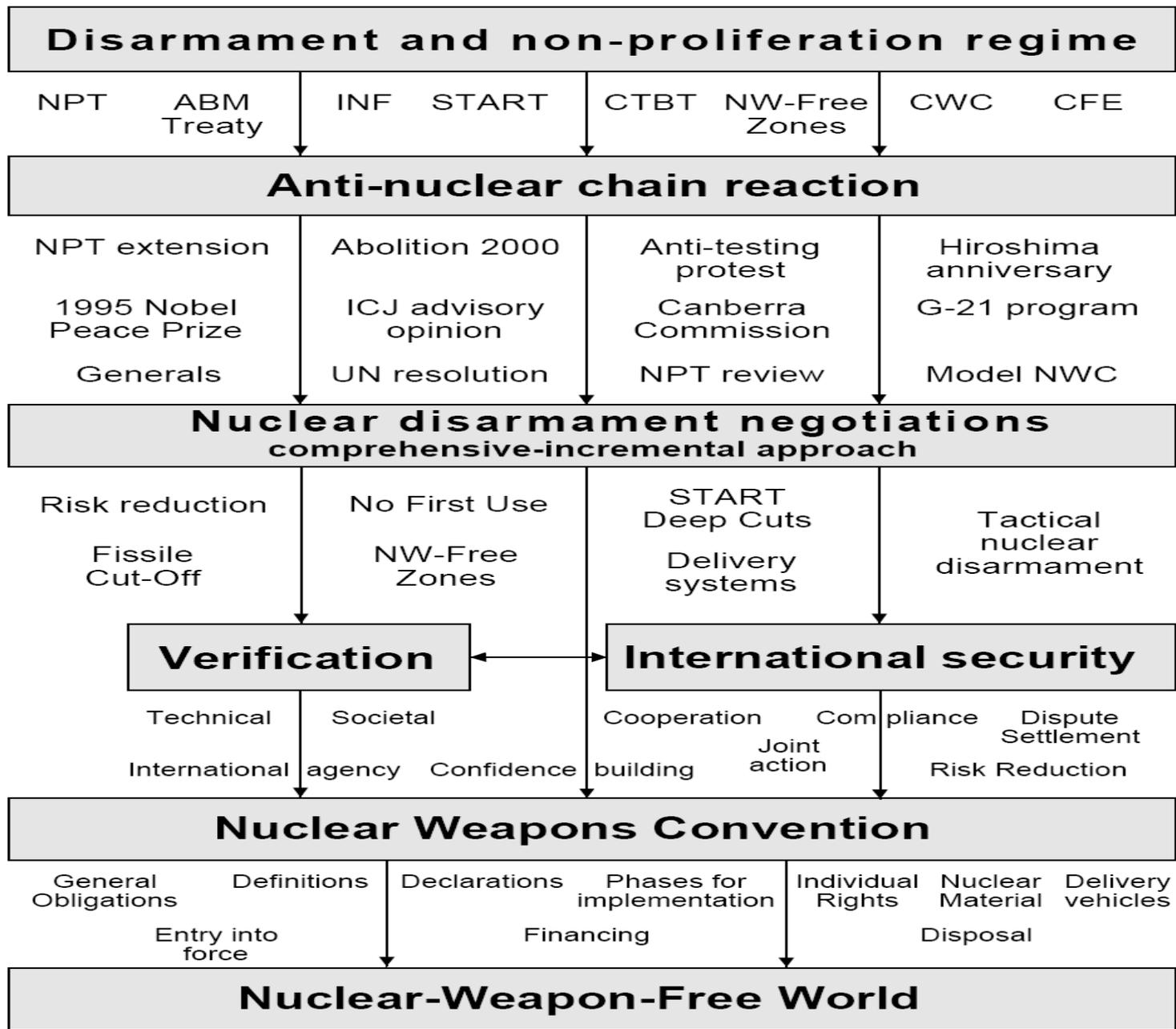
草 案

PROYECTO

الاتفاقية النموذجية للأسلحة النووية

اتفاقية حظر استحداث الأسلحة النووية
وتجريبها وإنتاجها وتخزينها ونقلها واستعمالها
والتهديد باستعمالها وإزالة تلك الأسلحة

Transformation into a Nuclear-Weapon-Free World



Model Nuclear Weapons Convention

Model Convention on the Prohibition of the Development, Testing, Production, Stockpiling, Transfer, Use and Threat of Use of Nuclear Weapons and on Their Elimination (1997/2007)

Negative Obligations

States Parties undertake never to

- use or threaten to use nuclear weapons
- engage in any military or other preparations to use nuclear weapons
- [research], develop, test, produce, otherwise acquire, deploy, stockpile, maintain, retain or transfer nuclear weapons or delivery vehicles
- produce, stockpile, retain, transfer, or use nuclear weapons grade fissionable or fusionable material (except medical, etc.)

Positive Obligations

States Parties undertake to

- Destroy nuclear weapons and destroy or convert facilities in the production, testing, and research of nuclear weapons as well as nuclear weapons delivery vehicles
- Participate in activities aimed at transparency and education for purposes of detecting and preventing prohibited activities
- Report violations of the Convention, cooperate with the implementing Agency, and enact domestic legislation for implementation.

Phases of the Model Nuclear Weapons Convention

Phase I [1 year]

- Each State Party would submit to the Agency plans for the implementation of the NWC
- All nuclear weapons and delivery vehicles would be de-alerted and disabled
- Targeting coordinates and navigational information for all nuclear weapons delivery vehicles shall be removed

Phase II [2 years]

- All warheads removed from delivery vehicles
- Weapons and delivery vehicles removed from deployment sites
- Agreements for preventive control negotiated

Phase III [5 years]

- All nuclear weapons would be dismantled
- All nuclear weapons delivery vehicles destroyed or converted
- All nuclear weapons would be destroyed except a fixed number of warheads in the stockpiles of Russia and the US, with proportional cuts by China, France and UK
- Similar provisions for other States known to possess nuclear weapons

Phase IV [10 years]

- More cuts in the number of nuclear weapons
- [All reactors using plutonium as fuel would be closed or converted]

Phase V [15 years]

- All nuclear weapons would be destroyed
- The powers and functions of the Agency would be reviewed and adjusted

UN Resolution (Dec. 12, 1996)

Paragraph 3: "Underlines the unanimous conclusion of the Court that 'There exists an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects under strict and effective international control' ".

Paragraph 4: "Calls upon all States to fulfil that obligation immediately by commencing multilateral negotiations in 1997 leading to an early conclusion of a nuclear weapons convention prohibiting the development, production, testing, deployment, stockpiling, transfer, threat or use of nuclear weapons and providing for their elimination".

Yes: 115 States

No: 22

Abstentions: 32

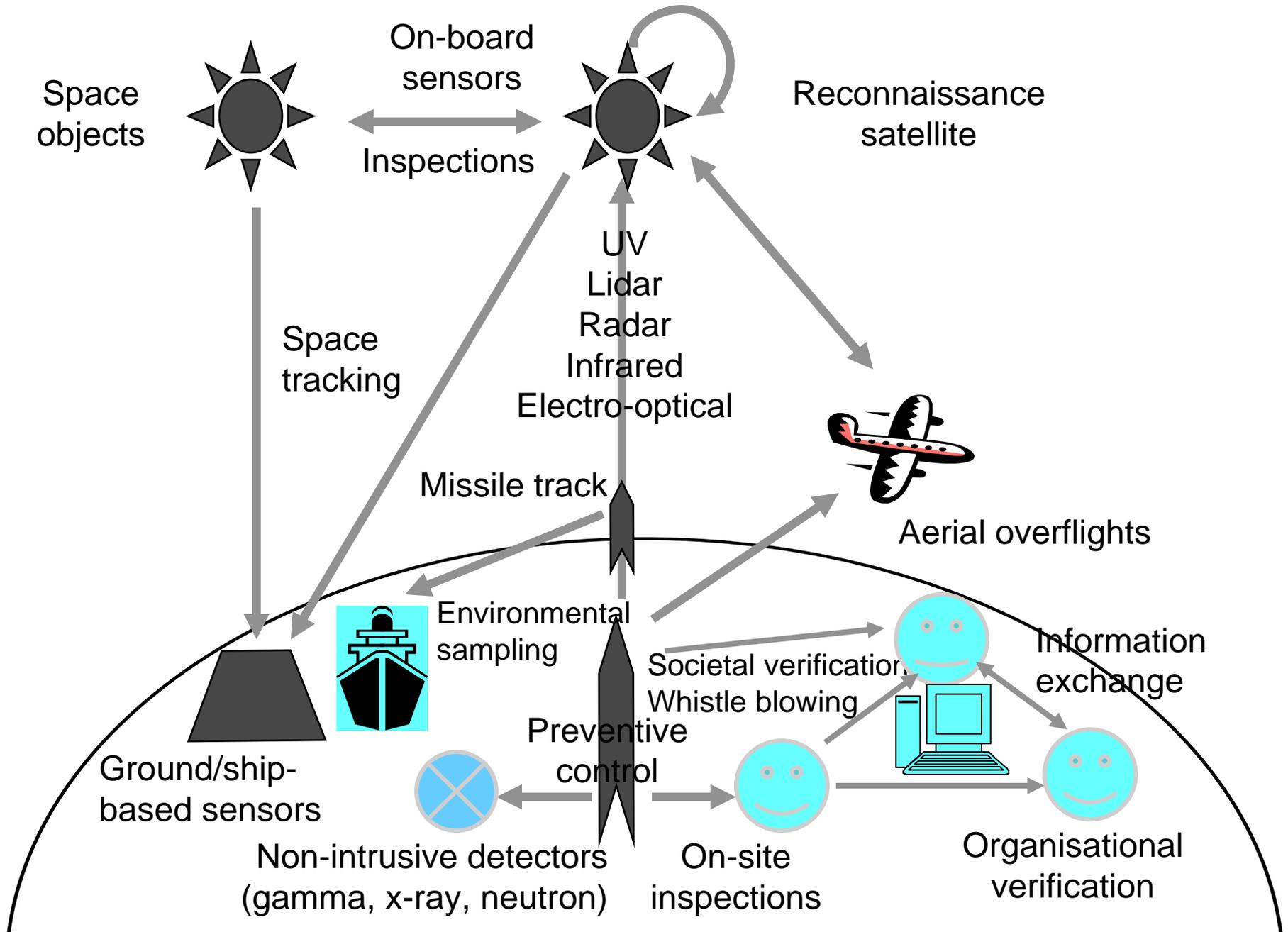
Verification guiding principles

1. No nuclear weapons or relevant nuclear materials may be held back and hidden in the current nuclear weapons states.
2. Nuclear weapons need to be “disinvented” to the degree achievable.
3. A break-out of the ban to develop or manufacture nuclear weapons needs to be prevented and detected.
4. No intention to acquire nuclear weapons should remain or have a reason to reemerge.

Integrated verification concept



Instruments for monitoring and verification



Verification of horizontal non-proliferation

Example: Natanz, Iran

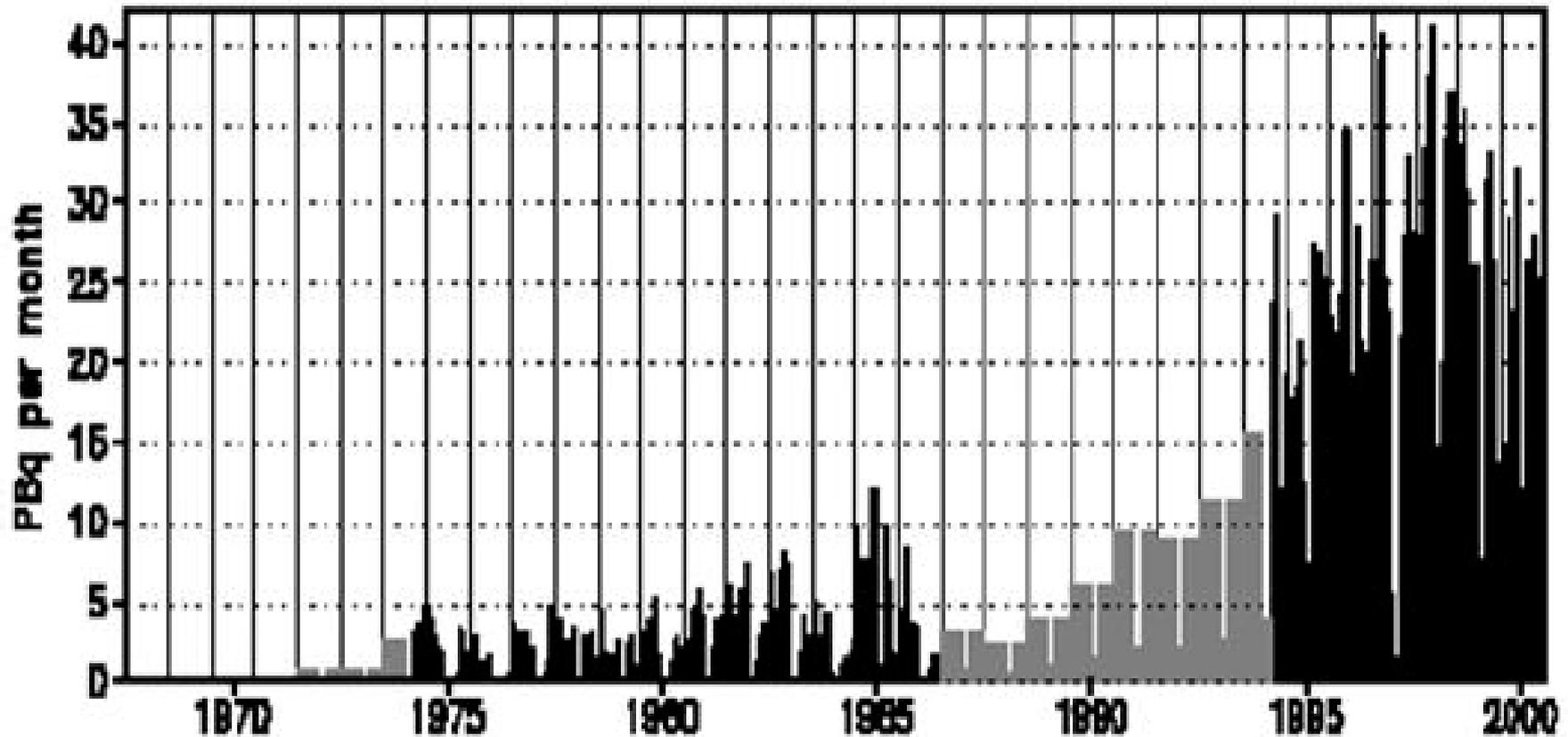
Apparent attempt to hide an underground uranium centrifuge enrichment facility



Portal Monitors



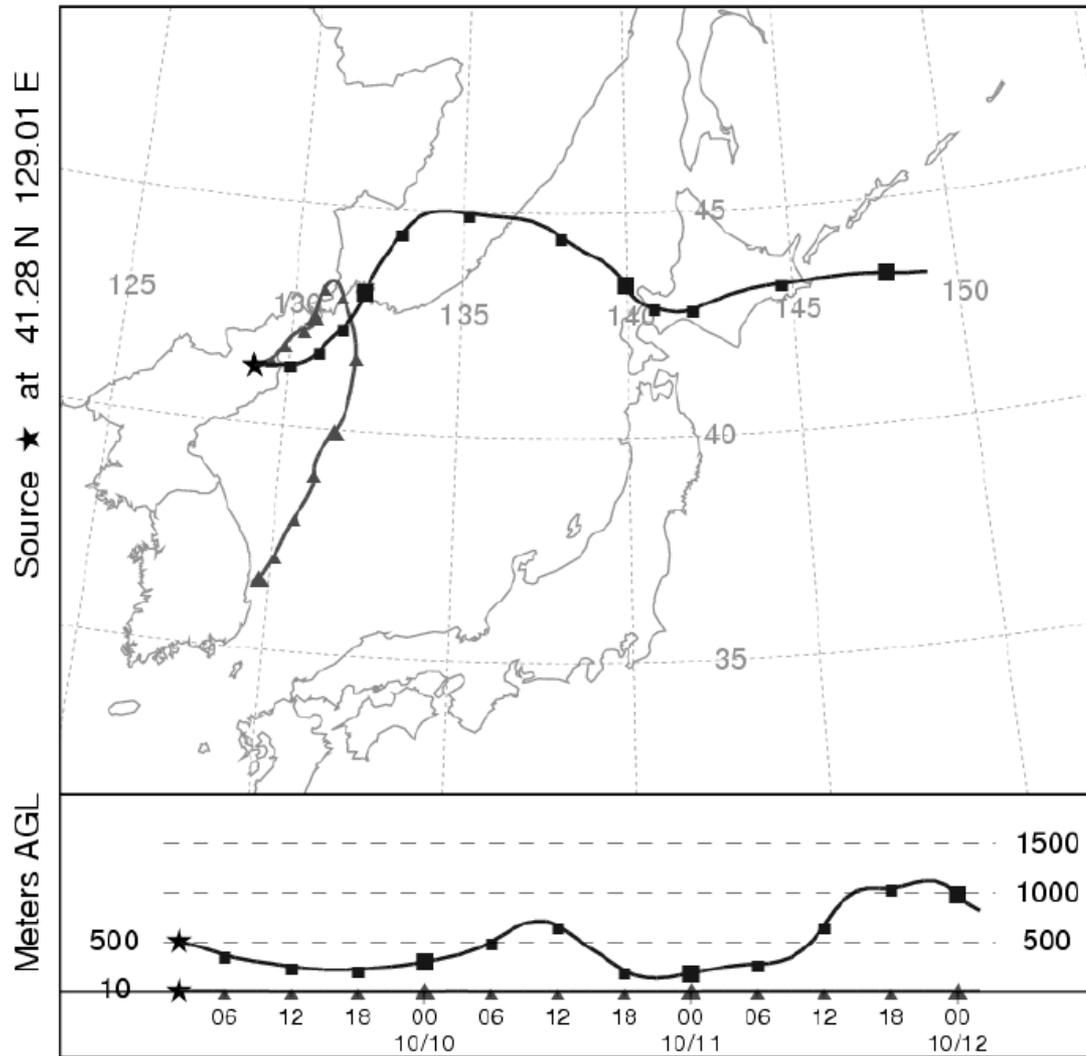
Monthly 85Kr emissions from La Hague



(real values – black columns; calculated values from yearly sum – grey columns)

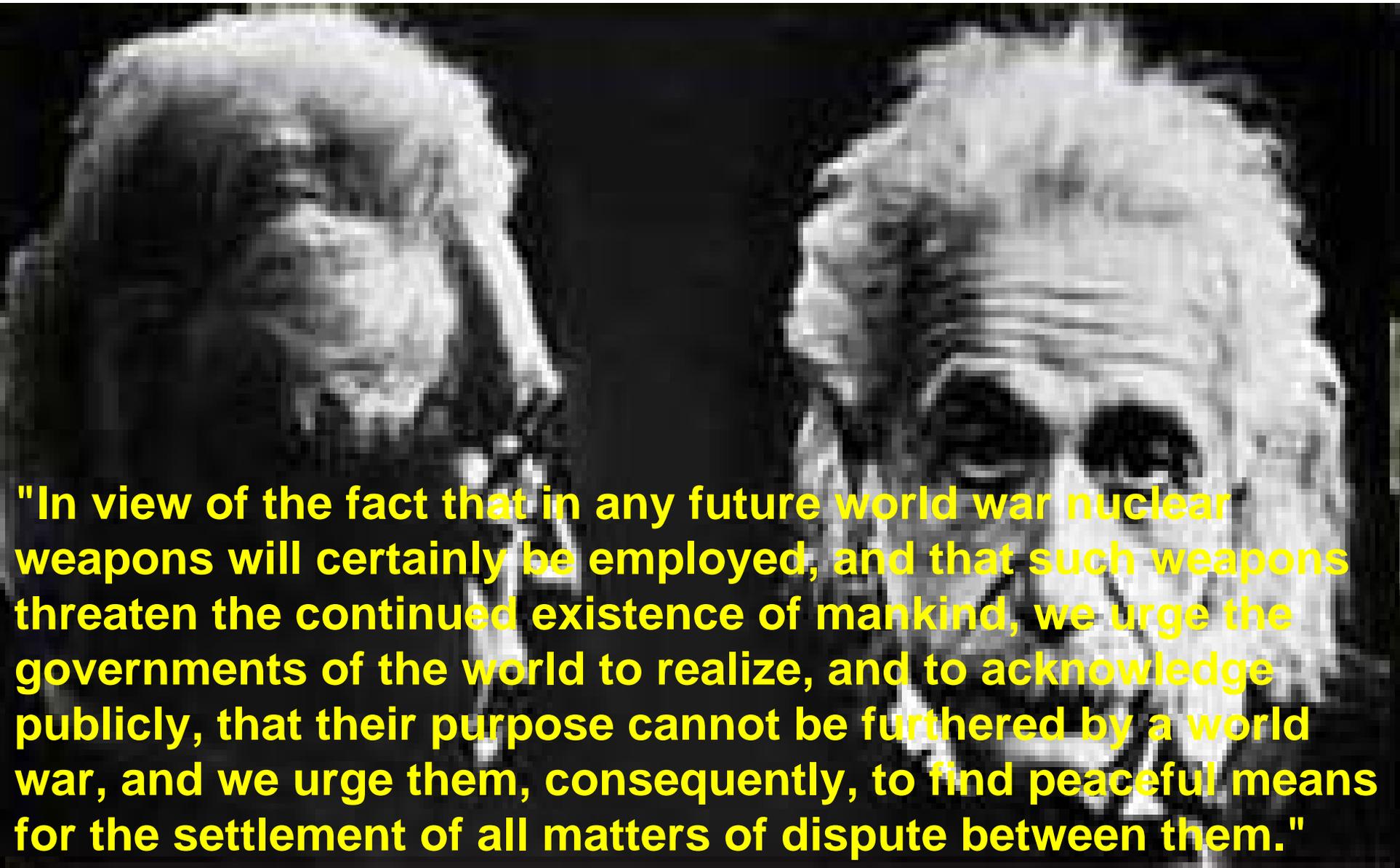
Source: Martin Kalinowski, Johann Feichter, Ole Ross, Atmospheric Krypton-85 Transport Modeling for Verification Purposes, INESAP Information Bulletin No. 27, Dec. 2006

Wind field trajectories calculated with HYSPLIT from North Korean test site for two starting heights



Source: Martin B. Kalinowski, Ole Ross, Analysis and Interpretation of the North Korean Nuclear Test, INESAP Information Bulletin No. 27, Dec. 2006

Russel-Einstein Manifesto 1955

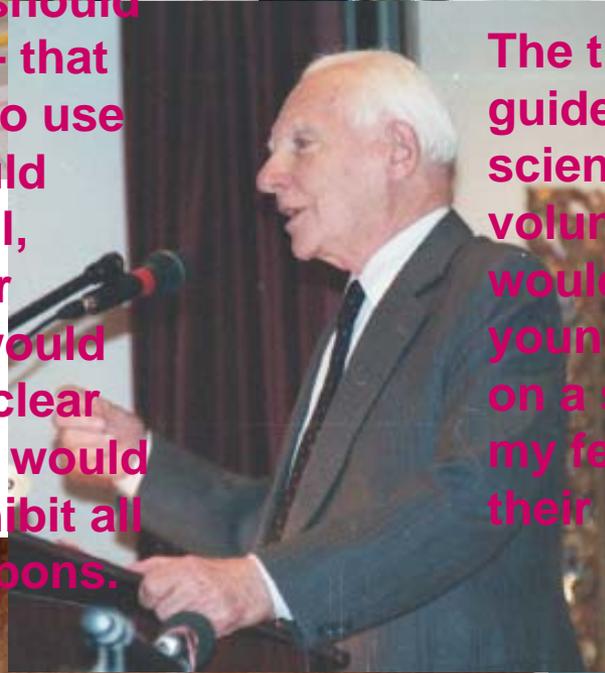


"In view of the fact that in any future world war nuclear weapons will certainly be employed, and that such weapons threaten the continued existence of mankind, we urge the governments of the world to realize, and to acknowledge publicly, that their purpose cannot be furthered by a world war, and we urge them, consequently, to find peaceful means for the settlement of all matters of dispute between them."

Joseph Rotblat, Nobel Peace Prize 1995



All nuclear weapon states should ... declare - in Treaty form - that they will never be the first to use nuclear weapons. This would open the way to the gradual, mutual reduction of nuclear arsenals, down to zero. It would also open the way for a Nuclear Weapons Convention. This would be universal - it would prohibit all possession of nuclear weapons.



The time has come to formulate guidelines for the ethical conduct of scientist, perhaps in the form of a voluntary Hippocratic Oath. This would be particularly valuable for young scientists when they embark on a scientific career.....I appeal to my fellow scientists to remember their responsibility to humanity.



Global warming may “induce large-scale migration and lead to greater competition for the earth's resources” and result in “increased danger of violent conflicts and wars, within and between states”

Nobel Peace Prize Committee 2007



International Network of Engineers and Scientists Against Proliferation (INESAP)



Santa Barbara March 2001



Shanghai December 2001



Berlin October 2002



Berlin January 2003



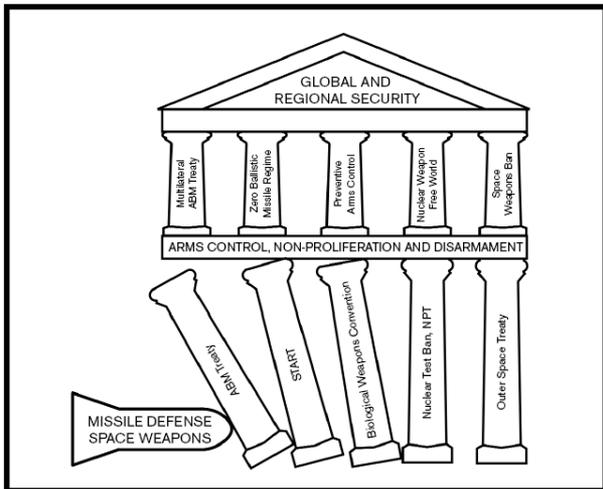
Hiroshima October 2004



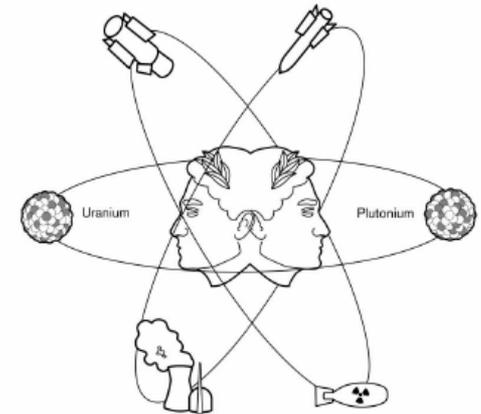
Information

International Network of Engineers
and Scientists Against Proliferation

Bulletin



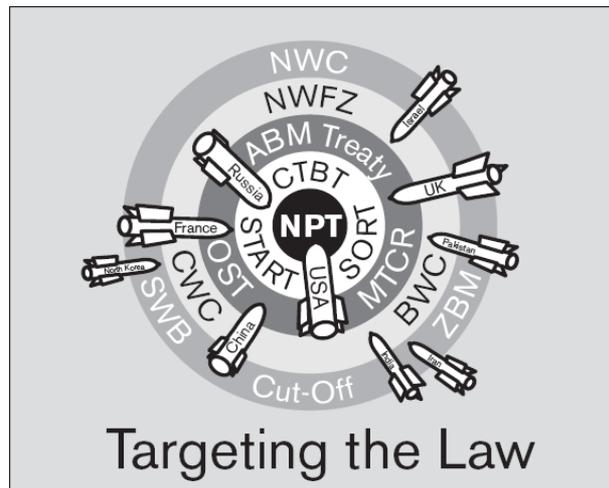
The Janus Face of Science and Technology



Catching the Bomb

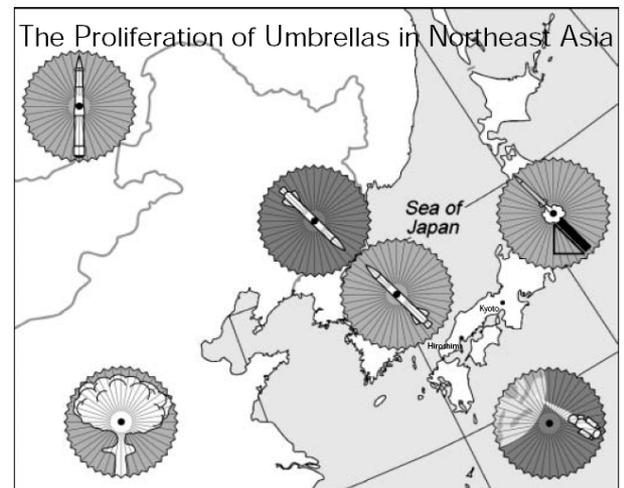


10 Years Networking in INESAP



Targeting the Law

The Proliferation of Umbrellas in Northeast Asia





Last Exit Disarmament

World at the Crossroads

Towards a peaceful and sustainable energy future

