

水、空氣變遷

柳中明

- 死水
- 臭氧洞
- 空氣污染

討論題綱：

- (a) 你覺得台灣的空氣品質、自來水如何？是可以更好還是已經很滿意了？
- (b) 台灣西北部外海油船擱淺，重油漏出。在東北季風強盛下，那些生態會受到衝擊？該怎麼辦？

全變通識-4 (liucm)

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1. 死水

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Ocean

Oceans cover roughly 70 per cent of the Earth's surface and make up some 90 per cent of space habitable by living things. They contain a vast, and largely unexplored, diversity of life, from the smallest of microorganisms to blue whales, the largest mammals on the Earth. Oceans are essential for the ecological functions and resources they provide, including food, medicines, and energy for millions of people worldwide (UNEP-WCMC 2003).

海洋佔全球70%的面積
約有90%的物種居住其中
海洋的健康對地球生態與人類非常重要

全變通識-

就全球而言，主要的**海洋污染**來源是由徑流和陸地的排放（44 %），陸地的排放也有經由大氣層排放（33 %）、海上運輸活動（12 %）和近海石油和天然氣生產（1 %）。至於**廢棄物丟棄**，其相對於海洋污染的貢獻，估計在10 %以上。

http://www.oceansatlas.com/unatlas/uses/ocean_dumpingwastes/dumping/dumping_at_sea.htm

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廢棄物丟棄(dumping)

1. 疏浚材料；
2. 污水處理廠污泥；
3. 魚類廢物，或材料所造成的工業魚類加工業務；
4. 船隻和平台或其他在海上的人為結構；
5. 惰性與無機的地質材料；
6. 天然的有機物質來源；
7. 大件物品包含鋼鐵、混凝土和類似的無害材料，因在如小島嶼與孤立的社區等，除了丟棄而無其他方式處理。

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Radioactive Waste 輻射廢棄物

Radioactive waste is dumped in the oceans and usually comes from the nuclear power process, medical use of radioisotopes, research use of radioisotopes and industrial uses. The difference between industrial waste and nuclear waste is that nuclear waste usually **remains radioactive for decades**. The protocol for disposing of nuclear waste involves special treatment by **keeping it in concrete drums** so that it doesn't spread when it hits the ocean floor. The dumping of radioactive material has reached a **total of about 84,000 terabecquerels (TBq)**, a unit of radioactivity equal to 10^{12} atomic disintegrations per second or **27,027 curies**.

One curie (Ci) is a unit of radioactivity, which represent exactly 3.7×10^{10} atomic disintegrations per second, or 37 gigabecquerels (GBq), this being the best estimate of the activity of a gram of radium.

The **high point of nuclear waste dumping** was in **1954 and 1962**, but this **nuclear waste** only accounts for **1% of the total TBq** that has been dumped in the ocean.

The concentration of radioactive waste in the concrete drums varies as does the danger to marine life and humans.

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Between 1964 and 1991 the former Soviet Union dumped the total of 4,900 containers of solid nuclear waste in Arctic seas, and 6,868 containers in the Pacific. Furthermore, the Russian navy simply sank 57 vessels filled with nuclear waste. Sixteen decommissioned reactors were also sent to the deep, including six with unloaded fuel.

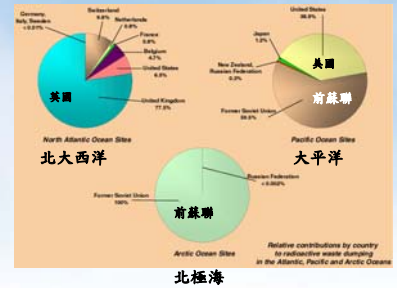
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USA in 1946 in the North-East Pacific Ocean and the latest was carried out by the Russian Federation in 1993 in the Japan Sea/East.

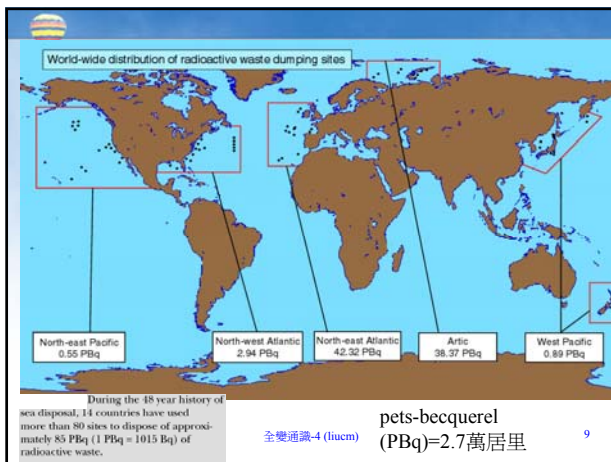
During the 48 year history of sea disposal, 14 countries have used more than 80 sites to dispose of approximately 85 PBq (1 PBq = 10^{15} Bq) of radioactive waste.

<http://www.oceansatlas.com/unatlas/about/physicalandchemicalproperties/radiosp/index.htm>



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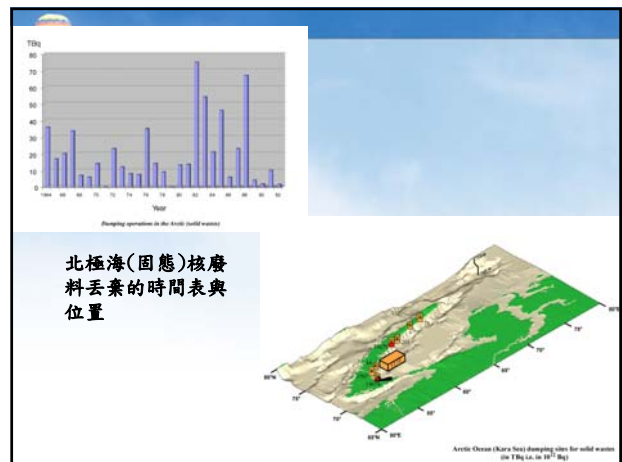
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pets-bequerel
(PBq)=2.7萬居里

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北極海(固態)核廢料丟棄的時間表與位置

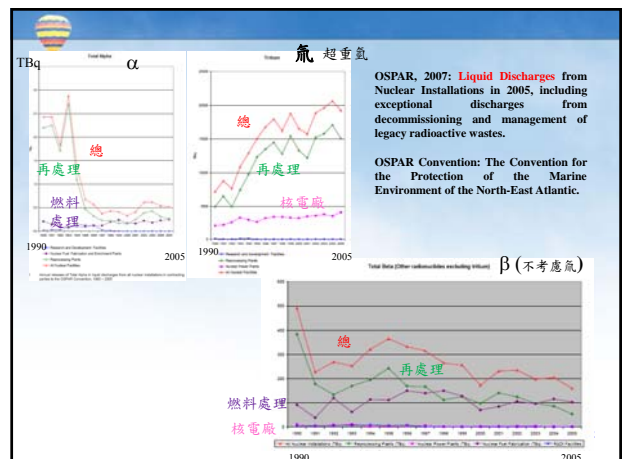
1993: the London Convention is AMENDED and PROHIBITS PERMANENTLY the dumping of radioactive and industrial wastes at sea, and ocean incineration. 倫敦公約

Every year millions of litres of radioactive waste are being routinely pumped into the sea from nuclear reprocessing plants. Each year, the total amount of radioactivity discharged into the environment from Europe's giant reprocessing plants at Sella field, in the United Kingdom, and La Hague, in France, exceeds that dumped in many of the world's 80 known ocean dump sites. (核料處理廠仍持續丟棄含輻射性廢棄物)

The OSPAR members' Environment Ministers committed to "substantial reductions or elimination" of radioactive discharges by 2000, in order to ensure close to zero concentrations of artificial radio nuclides in the environment by 2020. (2020年希望零輻射廢棄物)

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Oil spill 原油漏出






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超過10萬噸或3千萬加侖的漏油事件 (1噸原油=308加侖=7.33桶)

Spill / Tanker	Location	Date	*Tonnes of crude oil
Gulf War oil spill	Persian Gulf	January 23, 1991	136,000 - 1,500,000
Ixtoc I oil well	Gulf of Mexico	June 3, 1979- March 23, 1980	454,000 - 480,000
Atlantic Empress / Aegean Captain	Trinidad and Tobago	July 19, 1979	287,000
Fergana Valley	Uzbekistan	March 2, 1992	285,000
Nowruz oil field	Persian Gulf	February 1983	260,000
ABT Summer	700 nautical miles (1,300 km) off Angola	1991	260,000
Castillo de Bellver	Saldanha Bay, South Africa	August 6, 1983	252,000
Amoco Cadiz	Brittany, France	March 16, 1978	223,000
Amoco Haven tanker disaster	Mediterranean Sea near Genoa, Italy	1991	144,000
Odyssey	700 nautical miles (1,300 km) off Nova Scotia, Canada	1988	132,000
Sea Star	Gulf of Oman	December 19, 1972	115,000
Torrey Canyon	Scilly Isles, UK	March 18, 1967	80,000 - 119,000
Irenes Serenade	Navarino Bay, Greece	1980	100,000
Urquiola	A Coruña, Spain	May 12, 1976	100,000

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2010 Gulf Oil Spill




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Gulf's River of Oil



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May 24, 2010 NASA Terra Satellites



Deepwater Horizon oil spill
(Apr 20 - July 15: 4.9 million barrels ~ 245 million tons)

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As of June 21, 2010, the area closed to fishing encompassed 86,985 square miles (225,290 km²), or about 36% of Gulf of Mexico federal waters.

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大太平洋垃圾塊(Great Pacific Garbage Patch)

漂浮垃圾塊約莫有德州的兩倍大。

長期來看，許多漂流物是可生物分解的，現在此環流系統中增積了大量的塑膠物和海洋廢棄物。相較於生物分解，塑膠類因光而碎裂成細小的碎片後，這些碎片仍為聚合物，即使破碎得再小，依然很難分解掉。有些塑膠因光照碎裂後，形成另一種汙染，因為漂浮廢物和浮遊動物相似，被水母攝取後進入了食物鏈。以2001年的發現為例，大量的塑膠廢物已超越了浮遊動物的數量(該區的主要動物)，這些塑膠碎片最後進了海鳥和海洋動物的胃。

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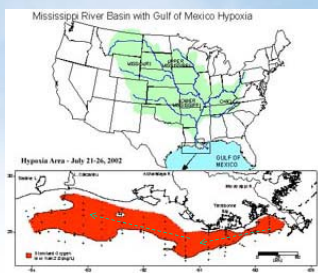
The **Great Pacific Garbage Patch**, also described as the **Eastern Garbage Patch** is an area of marine debris in the central North Pacific Ocean located roughly in an area between 135° to 155° W and 35° to 42° N.



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墨西哥灣 密西西比河出口

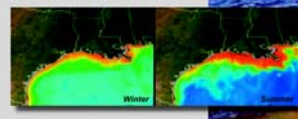


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Case Study: Mississippi Dead Zone

2004
Recent reports indicate that the large region of oxygen-depleted water—a dead zone—spreads across nearly 15,000 km² (5,800 square miles) of the Gulf of Mexico in what appears to be an annual event. NASA satellites monitor the health of the oceans and spot the conditions that lead to a dead zone. The photo (right) shows sediment-choked water from the Neuse River flowing out into the Gulf of Mexico near the coast (NASA 2004b).



流入海洋的河水
(Neuse river)

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What is the Gulf of Mexico **Dead Zone**?

The Gulf of Mexico dead zone is an area of **hypoxic (less than 2 ppm dissolved oxygen, 溶氧量低於2ppm) waters** at the mouth of the Mississippi River. Its area varies in size, but can cover up to **6,000-7,000 square miles**. The zone occurs between the inner and mid-continental shelf in the northern Gulf of Mexico, **beginning at the Mississippi River delta and extending westward to the upper Texas coast**.

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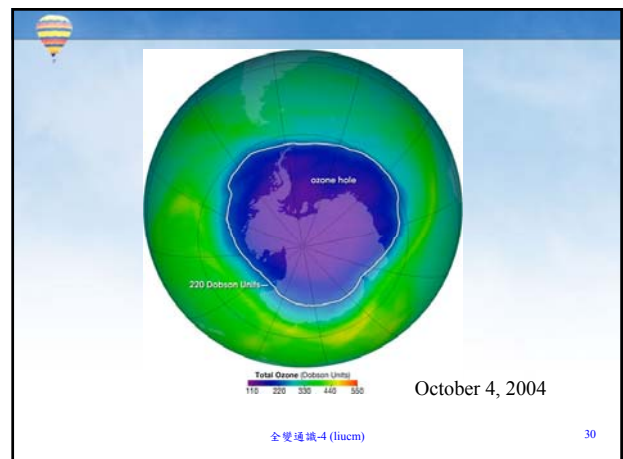
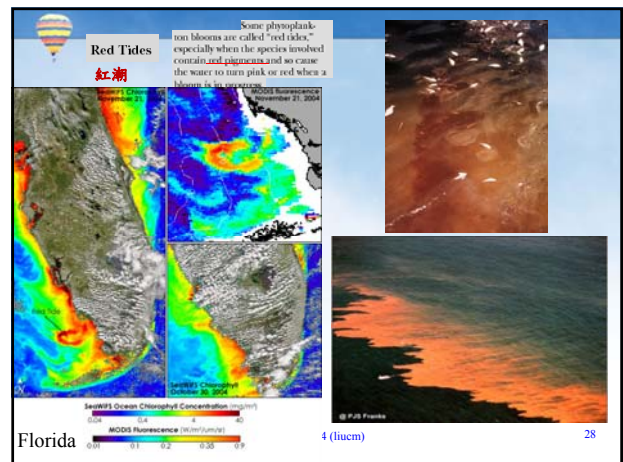
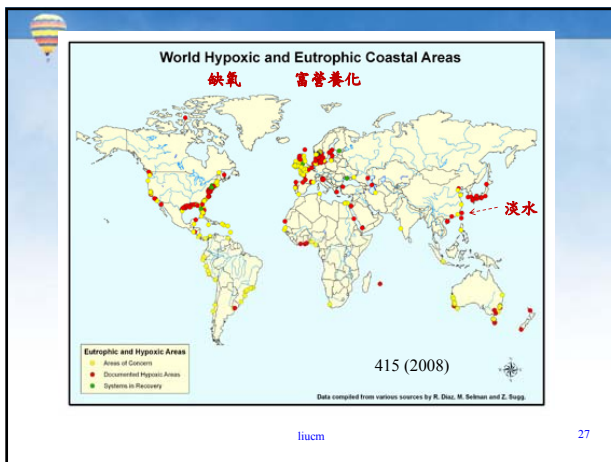
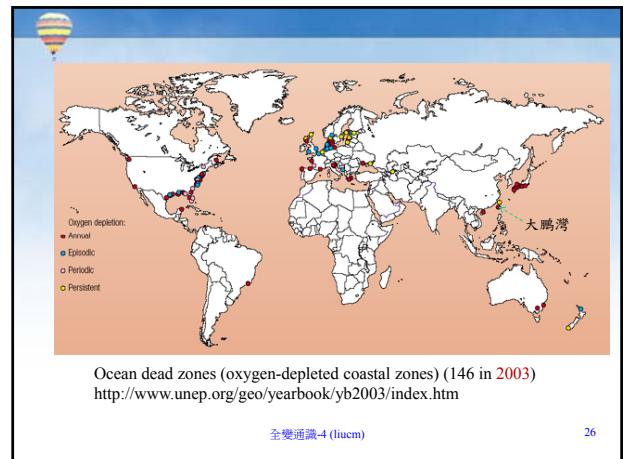
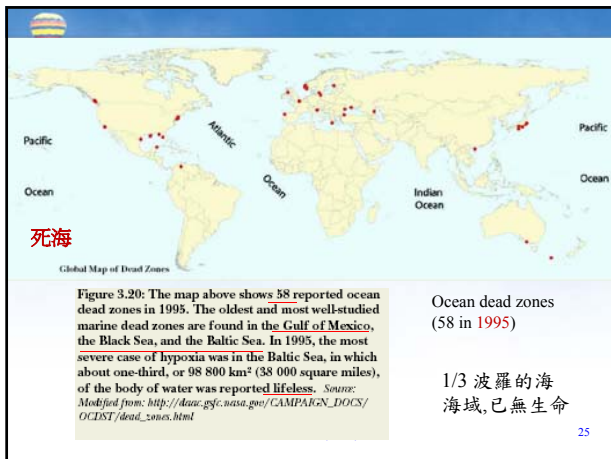
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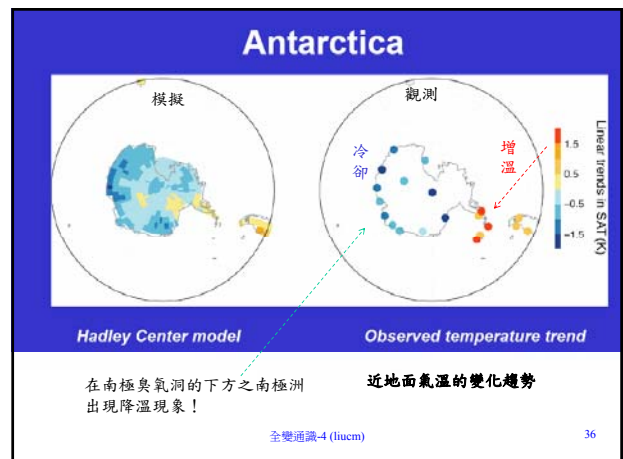
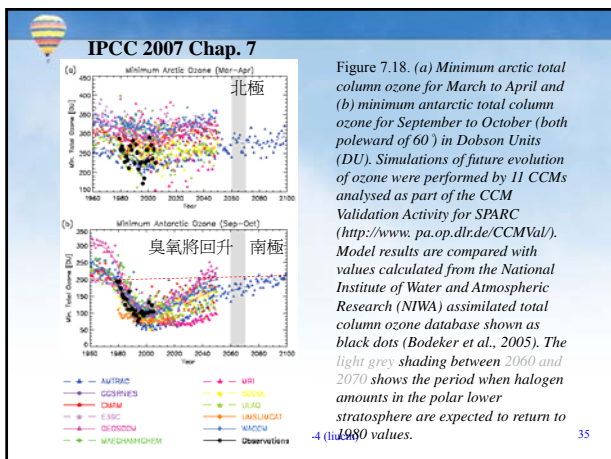
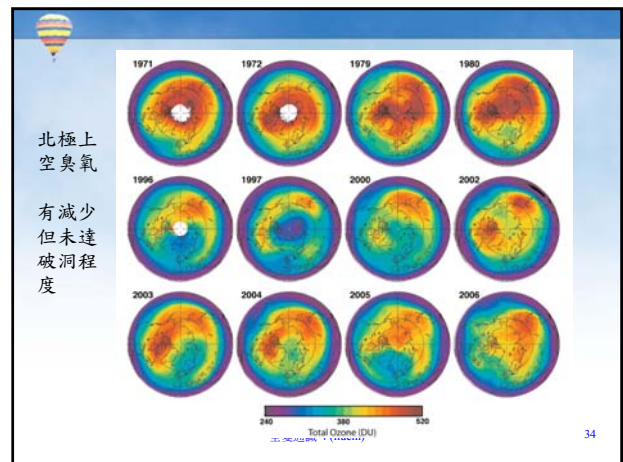
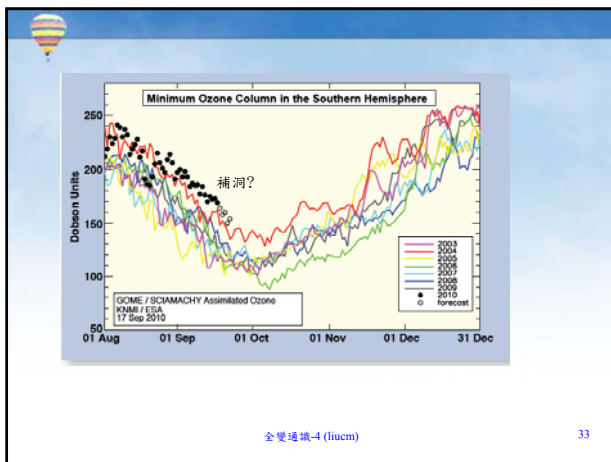
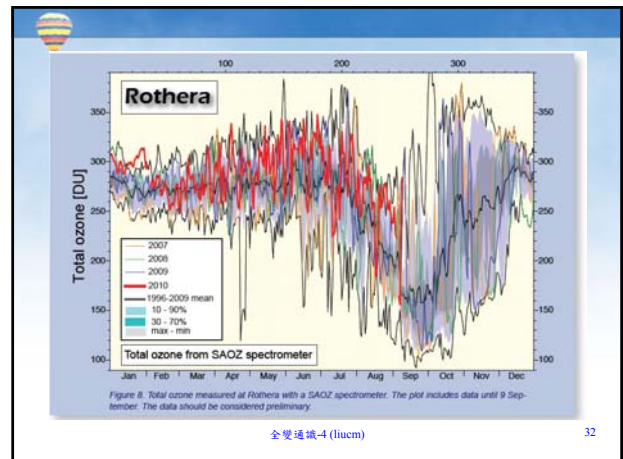
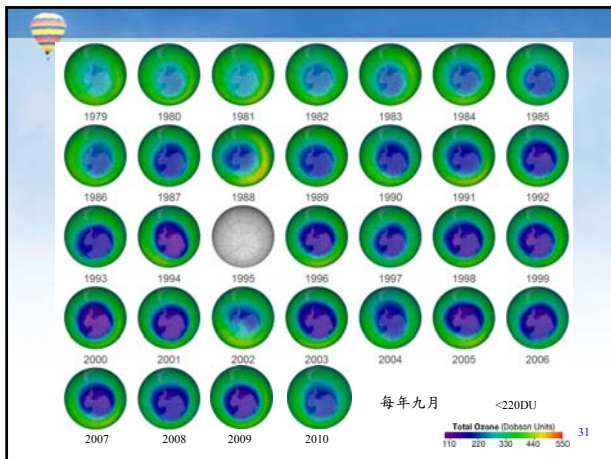
What Causes the Dead Zone?

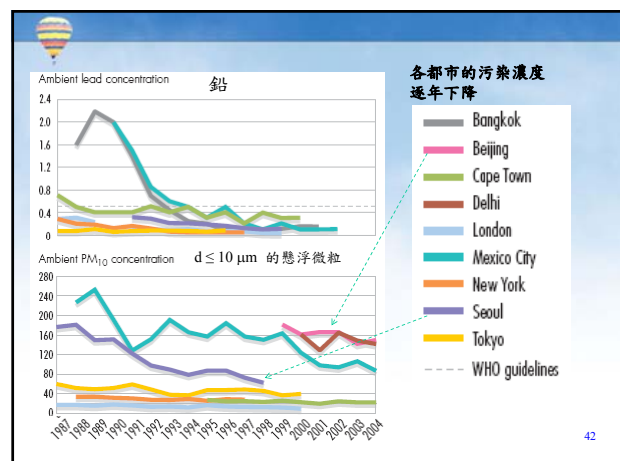
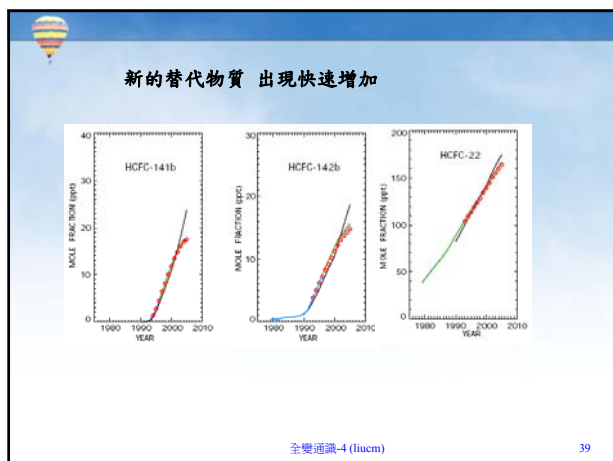
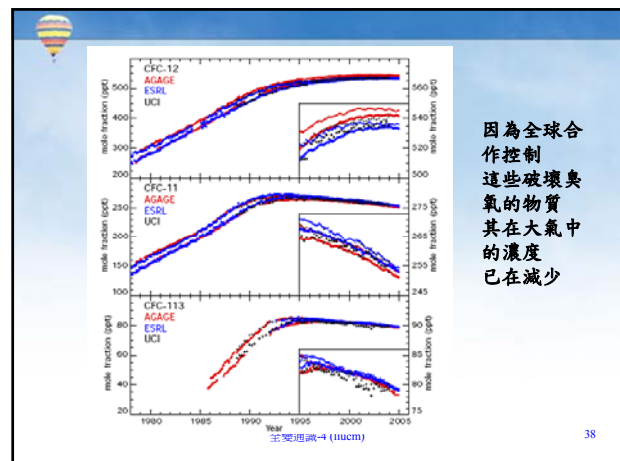
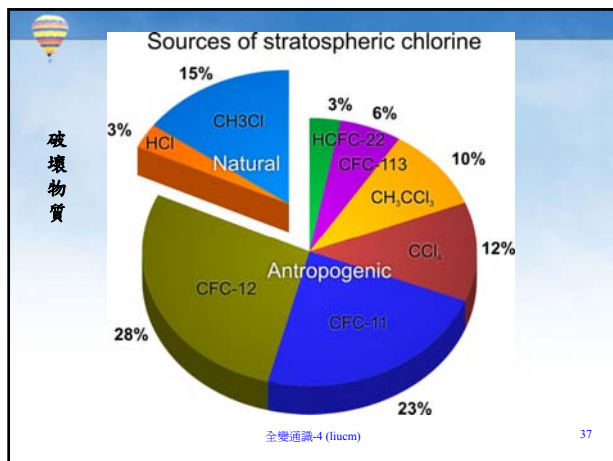
The dead zone is caused by **nutrient enrichment from the Mississippi River**, particularly nitrogen and phosphorous. Watersheds within the Mississippi River Basin drain much of the United States, from Montana to Pennsylvania and extending southward along the Mississippi River. Most of the nitrogen input comes from major farming states in the Mississippi River Valley, including Minnesota, Iowa, Illinois, Wisconsin, Missouri, Tennessee, Arkansas, Mississippi, and Louisiana. Nitrogen and phosphorous enter the river through upstream runoff of fertilizers, soil erosion, animal wastes, and sewage. In a natural system, these nutrients aren't significant factors in algae growth because they are depleted in the soil by plants. However, with anthropogenically increased nitrogen and phosphorus input, algae growth is no longer limited. Consequently, **algal blooms develop, the food chain is altered, and dissolved oxygen in the area is depleted**.

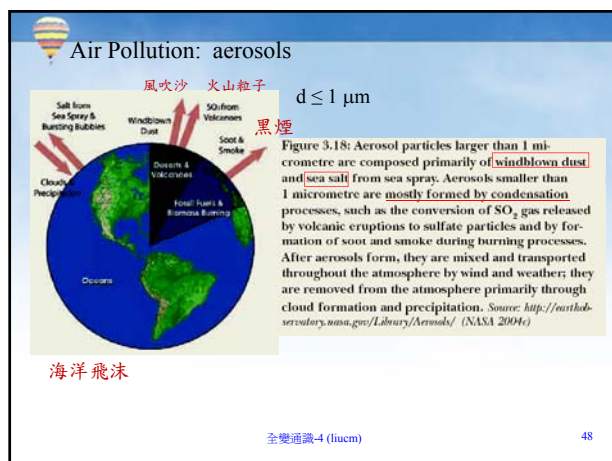
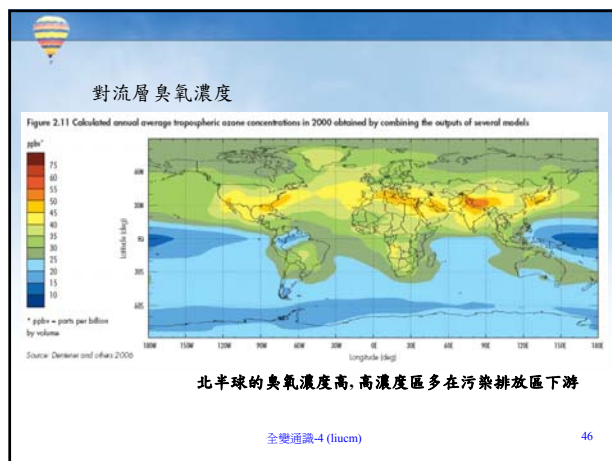
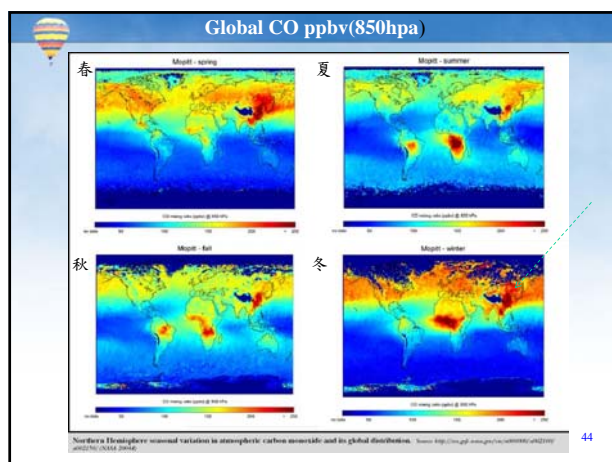
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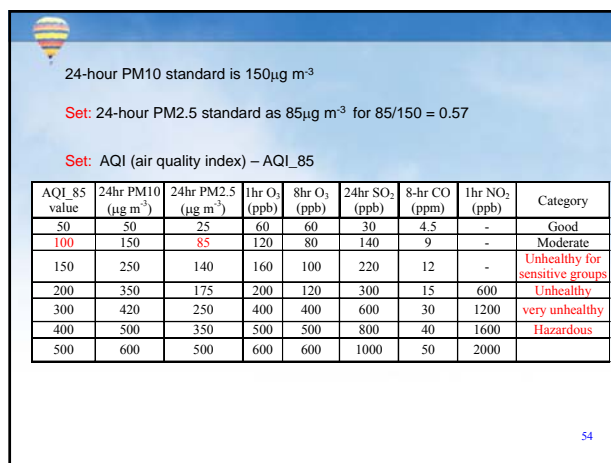
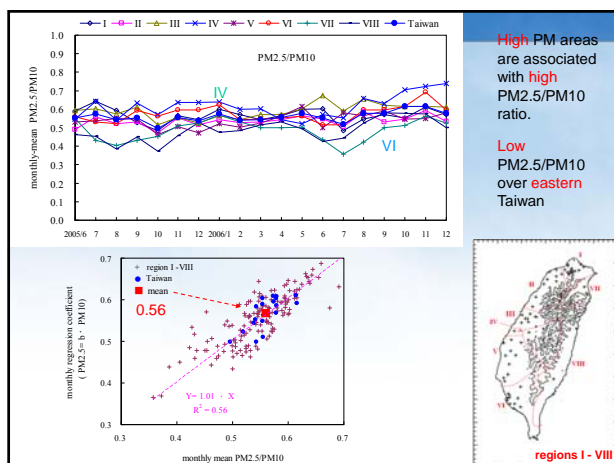
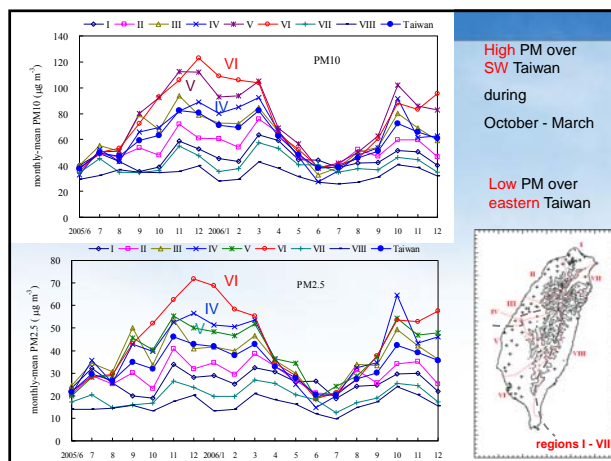
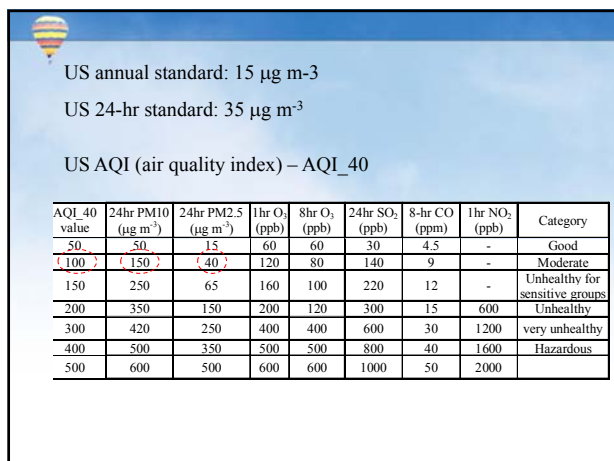
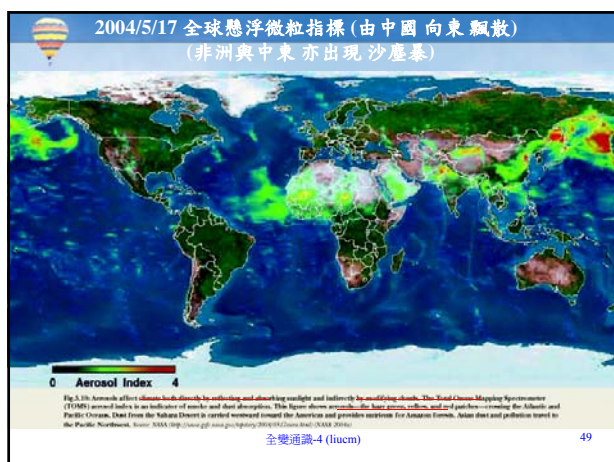
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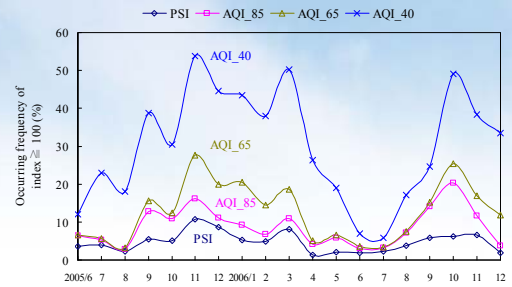


Break points for 24hr PM2.5 sub-indices of AQI_40, AQI_65 and AQI_85.

AQI_40 value	24hr PM2.5 ($\mu\text{g m}^{-3}$)	AQI_65 value	24hr PM2.5 ($\mu\text{g m}^{-3}$)	AQI_85 value	24hr PM2.5 ($\mu\text{g m}^{-3}$)
50	15	50	15	50	25
100	40	100	65	100	85
150	65	150	100	150	140
200	150	200	150	200	175
300	250	300	250	300	250
400	350	400	350	400	350
500	500	500	500	500	500

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Selection of the break point affects the occurring frequency of unhealthy days.



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- 台灣西北部外海油船擱淺，重油漏出。在東北季風強盛下，那些生態會受到衝擊？該怎麼辦？

註：平時討論成績佔總成績的 40%：依每次參加分組(約五~六人一組)討論的過程與結論評分。

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