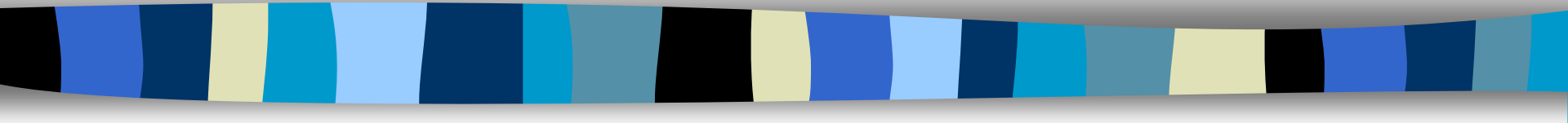


The Human Asteroid

The ‘natural’ phenomena of environmental change



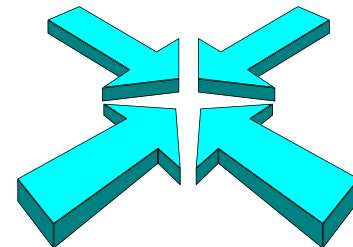
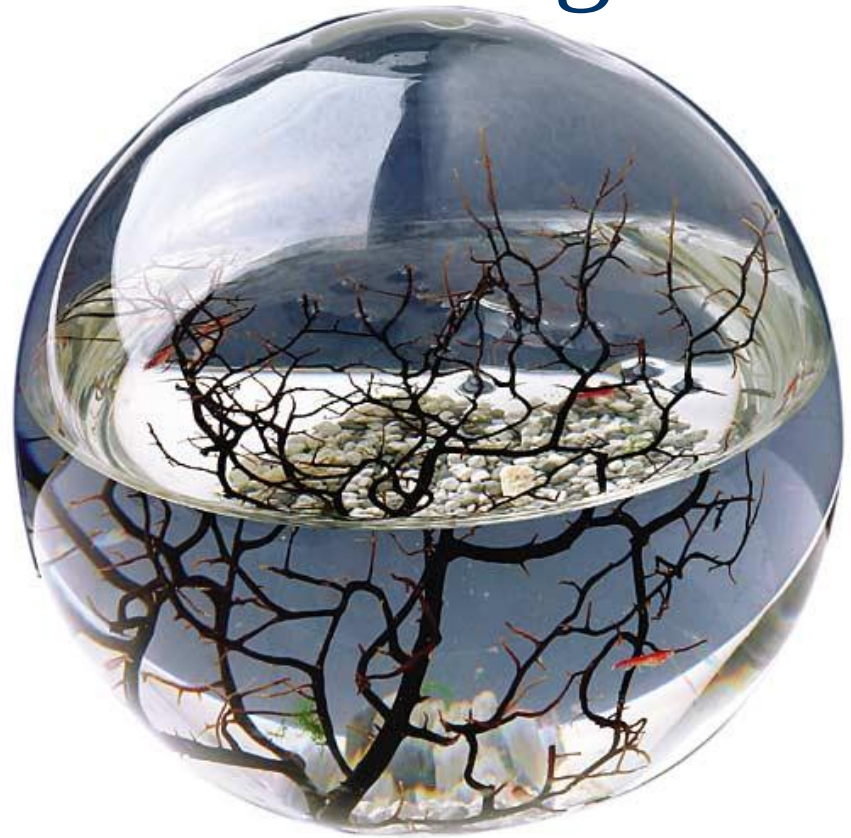
Introduction

- Our understanding of past env. Change is not complete.
- Our interpretation is often wrong
- Our goal of an ultimate theory is not achieved

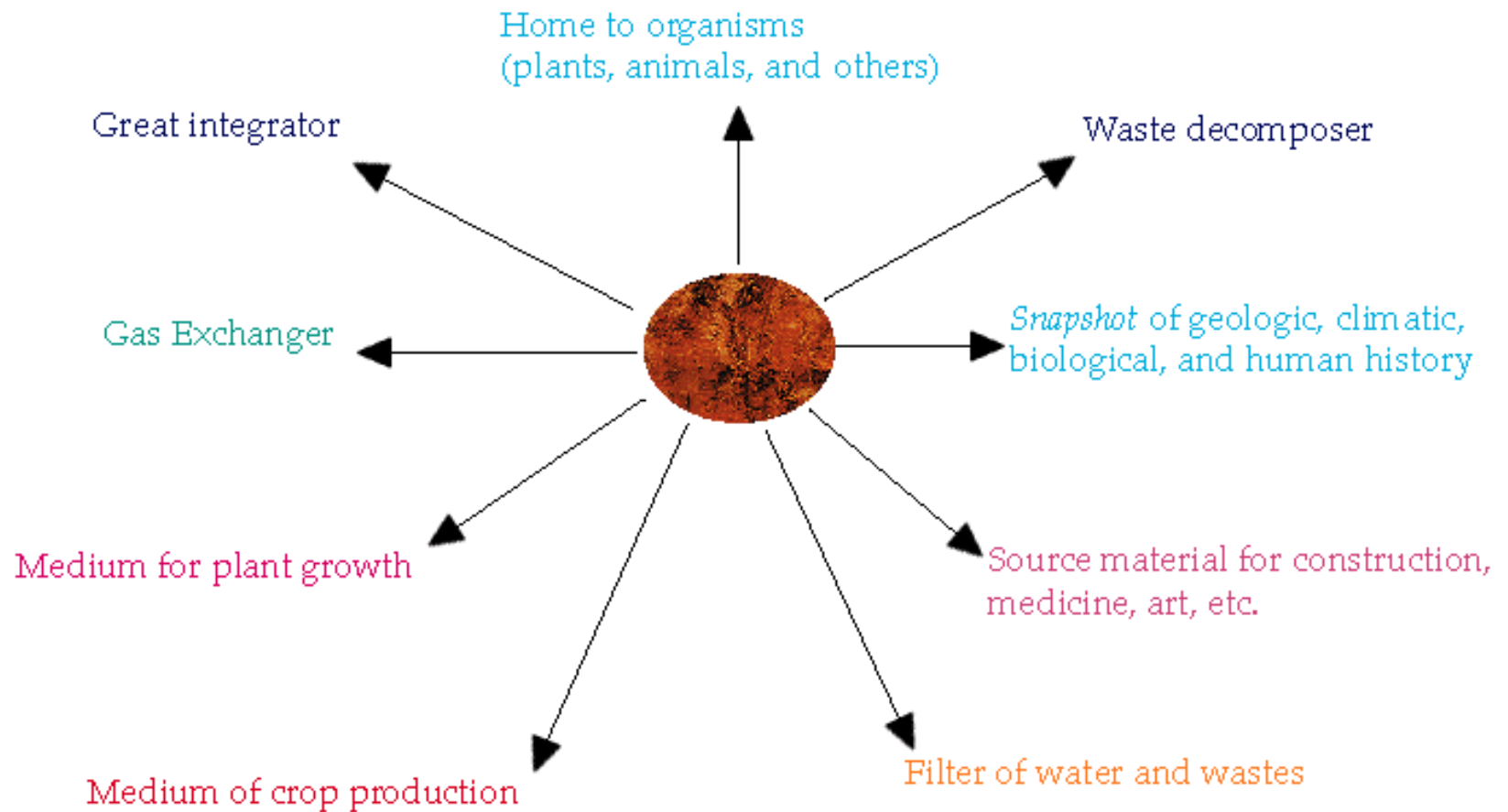
Why do we have env.change?

- Ecosphere

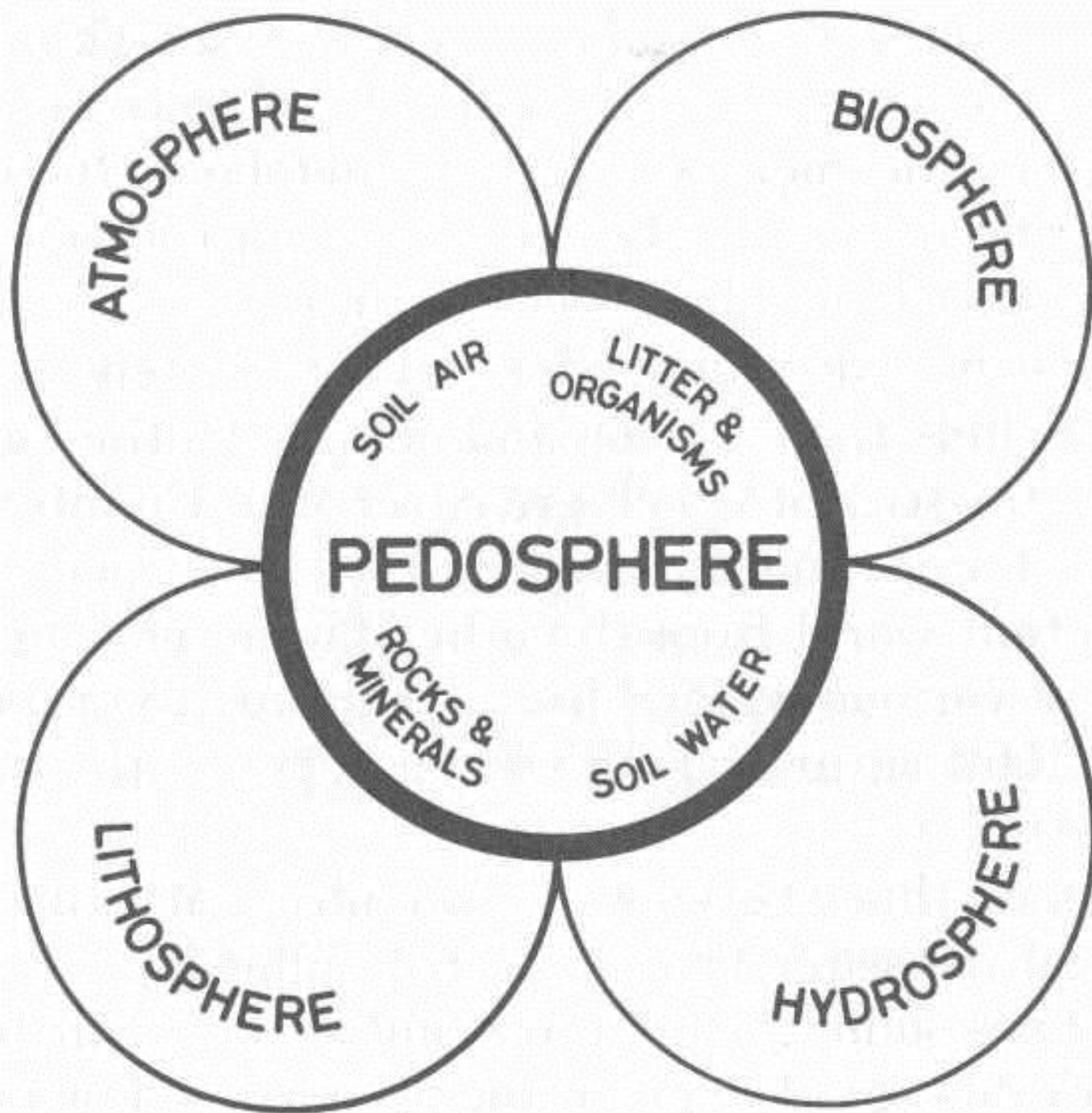
- atmosphere,
biosphere,
hydrosphere,
pedosphere,
toposphere
- Figure 1
- Directional trends



The soil is a:



There is a limited amount of soil, and so it must be properly cared for.



Why do we have env.change?

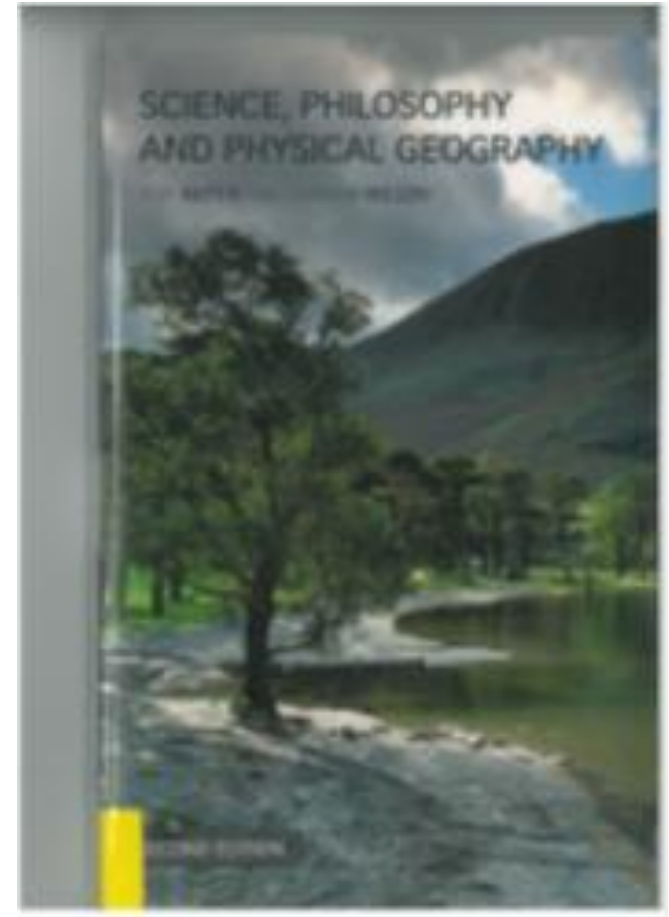
Continued

■ Cosmic

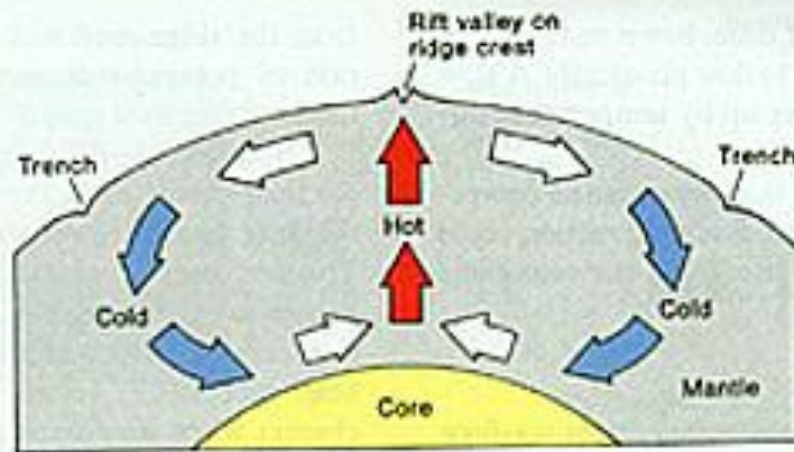
- Sun cyclical
- Astronomical trends
- Asteroids
- Gravity, tilt etc.
- Fine particles from meteorites

■ Geology

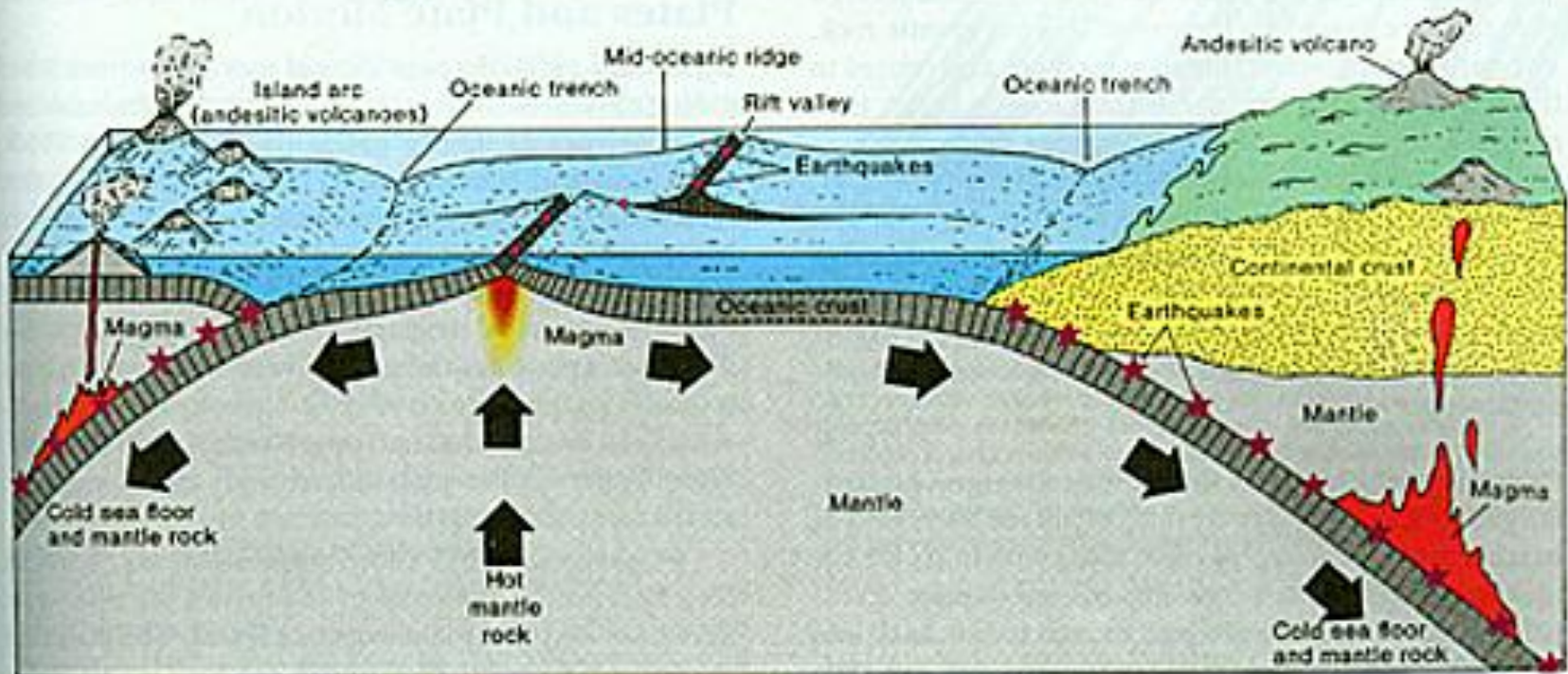
- Plate tectonics
 - Continental drift and biodiversity
- Physical landscape



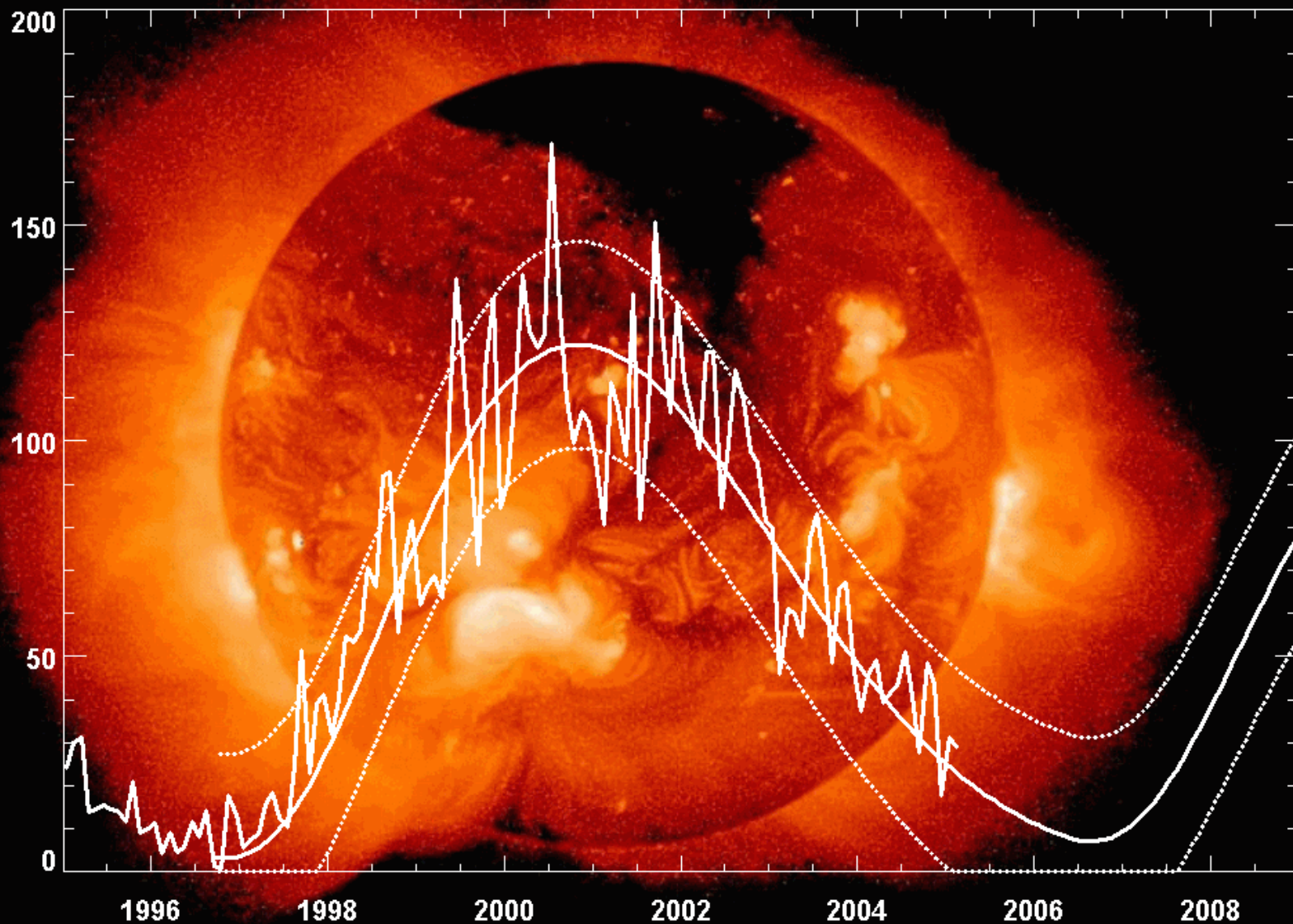
In George Thompson library



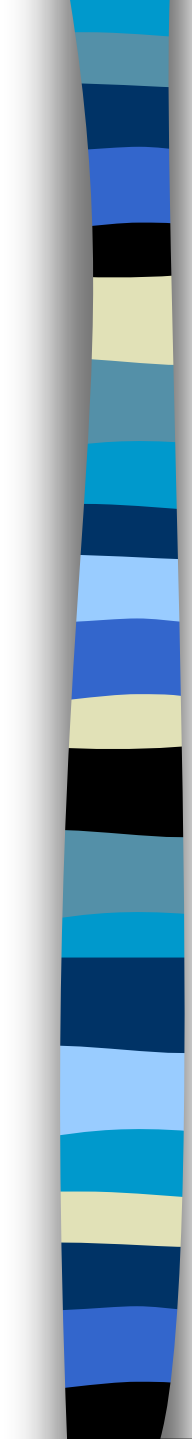
A



Cycle 23 Sunspot Number Prediction (March 2005)

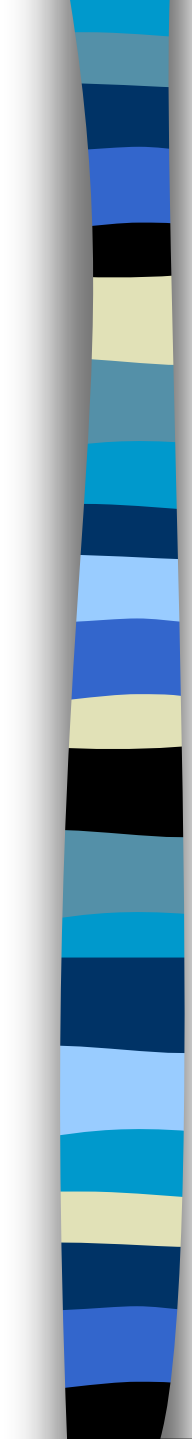


NASA/NSSTC/Hathaway



How do we know?

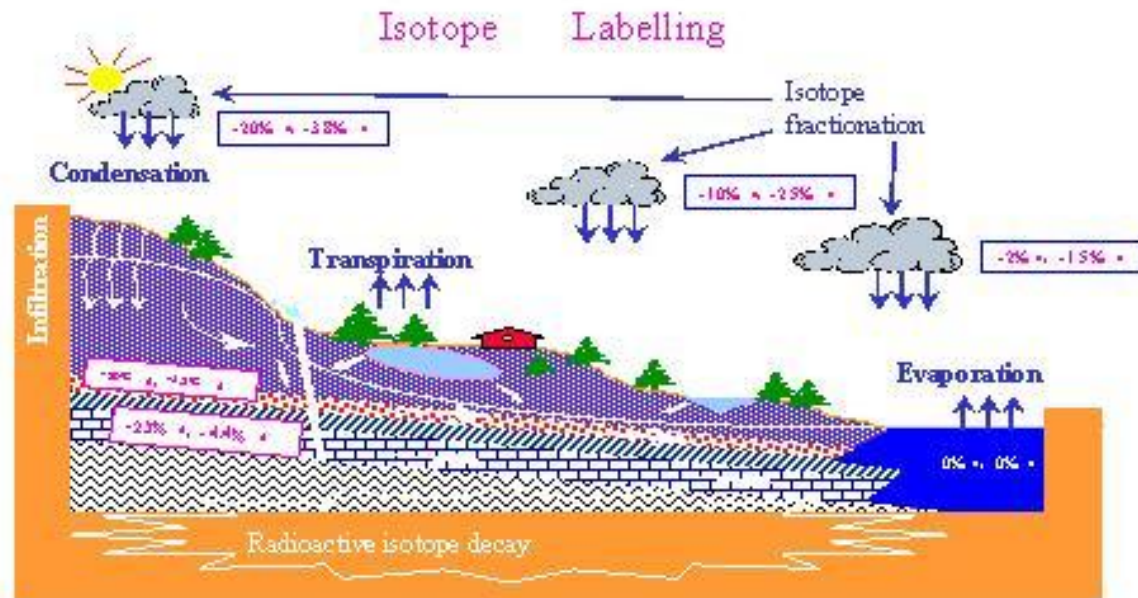
- The environment records its own history but not in a book form
- At best, the picture is an interpretation of the past
- Theorising and evidence gathering
- Evidence: Geochemistry, Physical Geography, Biology and History
 - Need for a holistic approach



Geochemistry

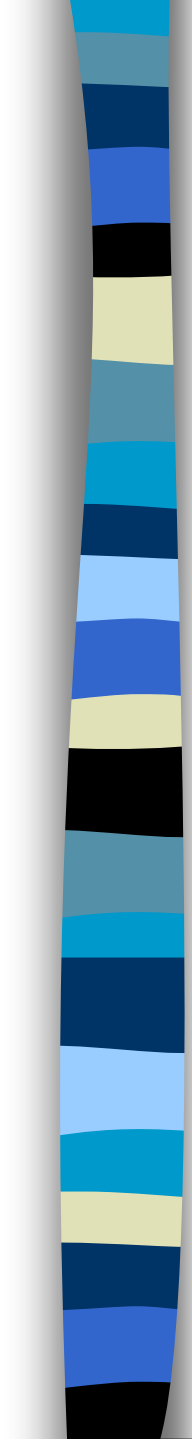
- Minerals. Coal, Calcium Carbonate
- Mineral ratios
- Clay. Precipitation e.g the % of kaolinite increases with > precip.
- Substitution: Magnesium for calcium in > heat
- Isotopes esp. carbon, oxygen and sulphur

Natural water cycle



Schematic sketch of the evaporation and condensation processes

Environmental isotopes are naturally or man-made. In either case, natural processes govern the distribution in the environment and these processes include isotope fragmentation during evaporation and condensation of water. And in the case of radioactive environmental isotopes, radioactive decay during the residence time in the ground water.



Physical Geography

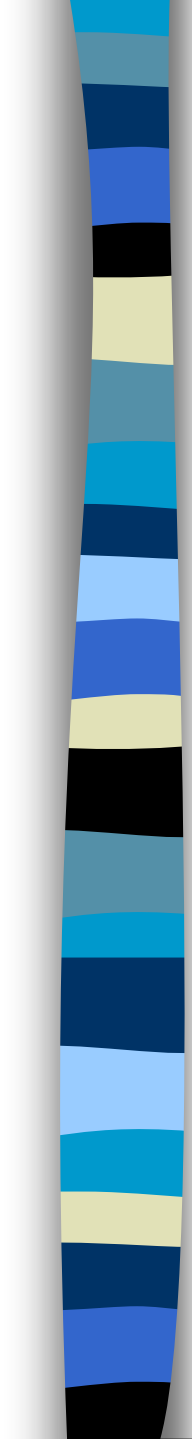
■ Erosional

- Glaciation & Periglaciation
- Fluvial & Coastal etc

■ Depositional

- Alluvium and till fabrics
- Particle size analysis
- Palaeosols (buried soil profiles)
- Marine & Lake (Varves)
- Glacial

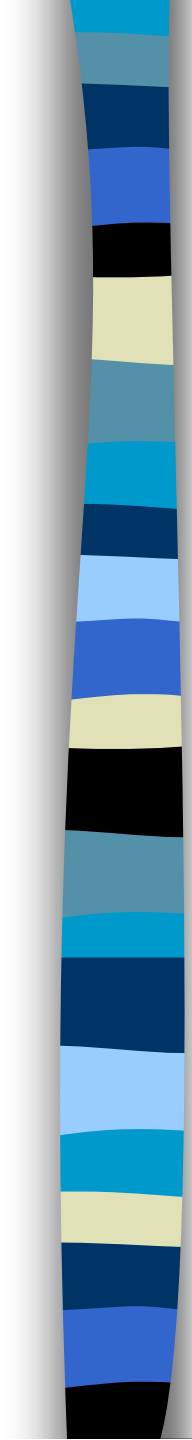
■ Natural chronometers



Biology

■ Flora

- Macrofossil & Microfossil
- Tree rings
- Floral lists (CLAMP Climate analysis multivariate program)
- Leaf Physiognomy



Biology cont'd

■ Fauna

- Mammal physiology
- Amphibians/ reptiles
- Insects esp. beetles narrow feeding range
- Molluscs
- Coral
- Bacteria / Algae



Figure 5.1 Graffiti on a protected site near Krakow, Poland.



Figure 5.12 Irresponsible coring of the Sandwich Fish Bed near Stromness, Orkney, Scotland. Despite there being numerous less well exposed faces to choose from, the holes have been drilled in highly visible surfaces. (Reproduced by permission of Colin CJ MacFadyen, Scottish Natural Heritage.)



Figure 5.10 Vehicle access to sand dune areas can initiate significant erosion, Donegal Ireland.

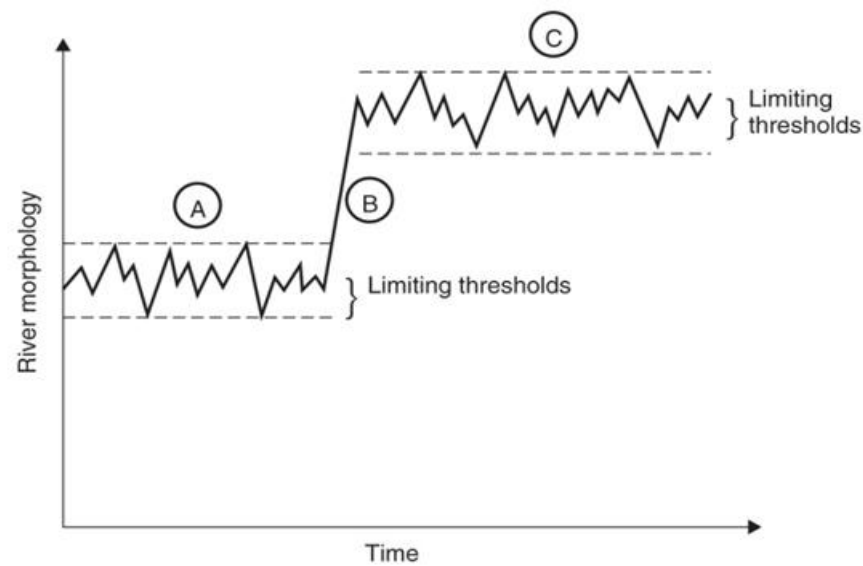


(a)

(b)

Figure 5.14 Fragile speleothems in Tasmanian caves, Australia (a) shawl speleothems in the 'Silk Shop' section of Kubla Khan Cave in the Mole Creek karst. Approximately 0.5m between foreground shawls, (b) straws and stalagmites in the 'Ballroom' section of one of Australia's longest caves, Exit Cave in Tasmania. The longest straws in this view are about 4m high. (Photos by permission of Ian Houshold.)

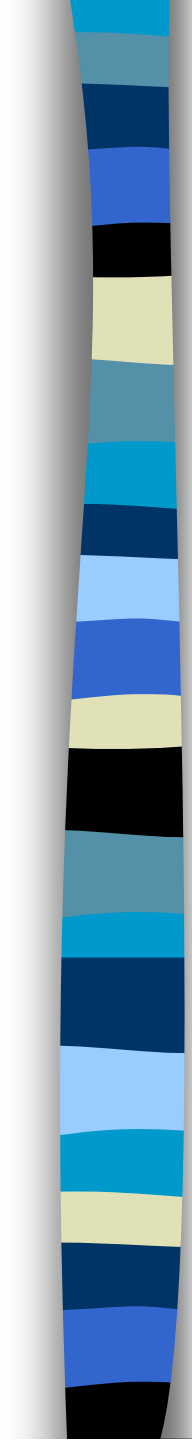
How does B influence habitat and biodiversity?



How does this geodiversity influence conservation?

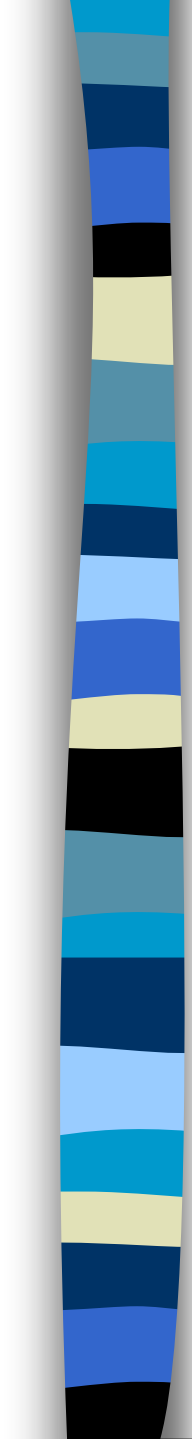
- (A), (C) robust behaviour—river repeatedly crossing intrinsic thresholds but overall response stable within limiting thresholds. Negative feedback regulates change. Landforms retain stable identity as they form and reform.
- (B) sensitive behaviour—in response to externally imposed change river moves across extrinsic threshold to new process regime. Landforms in original regime (A) destroyed and replaced by new landforms created in regime (C).

Figure 5.15 The distinction between robust and sensitive behaviour in geomorphological river systems (after Werrity, A. and Brazier, V. (1994) Geomorphic sensitivity and the conservation of fluvial geomorphology SSSIs. In Stevens, C., Gordon, J.E., Green, C.P. and Macklin, M.G. (eds) *Conserving our Landscape*. English Nature, Peterborough, 100–109. Reproduced with permission of Natural England).



History

- Weather records
- Ship logs
- Newspapers other documentary evidence
- Crop prices
- Lake levels
- Flooding (Nile)
- Paintings



Summary

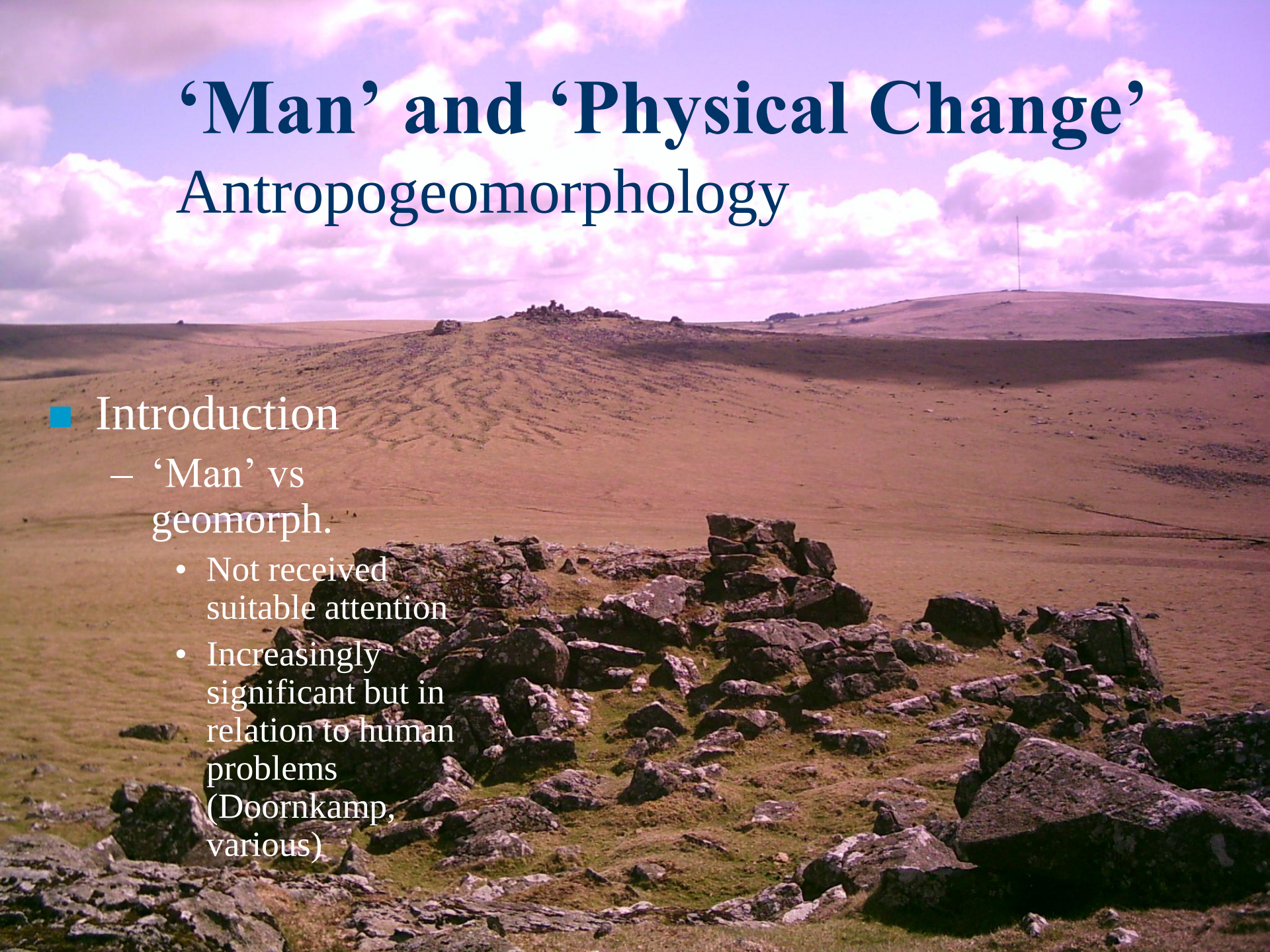
- All this evidence needs to be cross referenced to build up a comprehensive picture that is supported by well constructed information.
- The importance of ‘natural change’
- However: What about change induced by humans?
 - Consider some examples

‘Man’ and ‘Physical Change’ Antropogeomorphology

■ Introduction

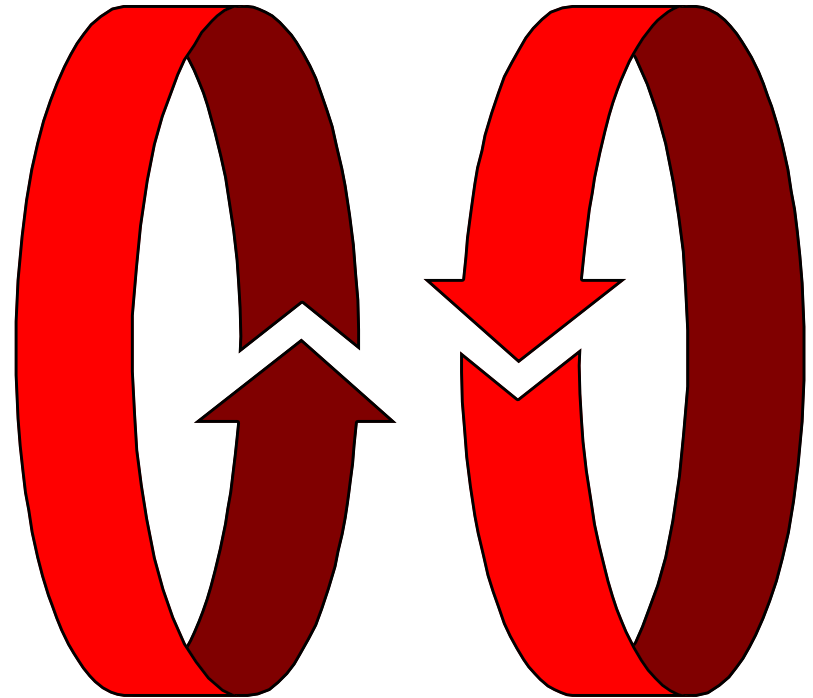
– ‘Man’ vs
geomorph.

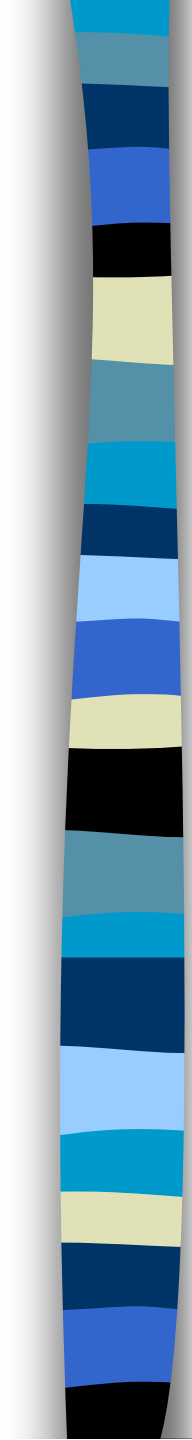
- Not received suitable attention
- Increasingly significant but in relation to human problems (Doornkamp, various)



Direct and Indirect Influences

- Antropogenic landforms
- All human activity = some effect
- BUT some direct and some indirect
- Deliberate and accidental



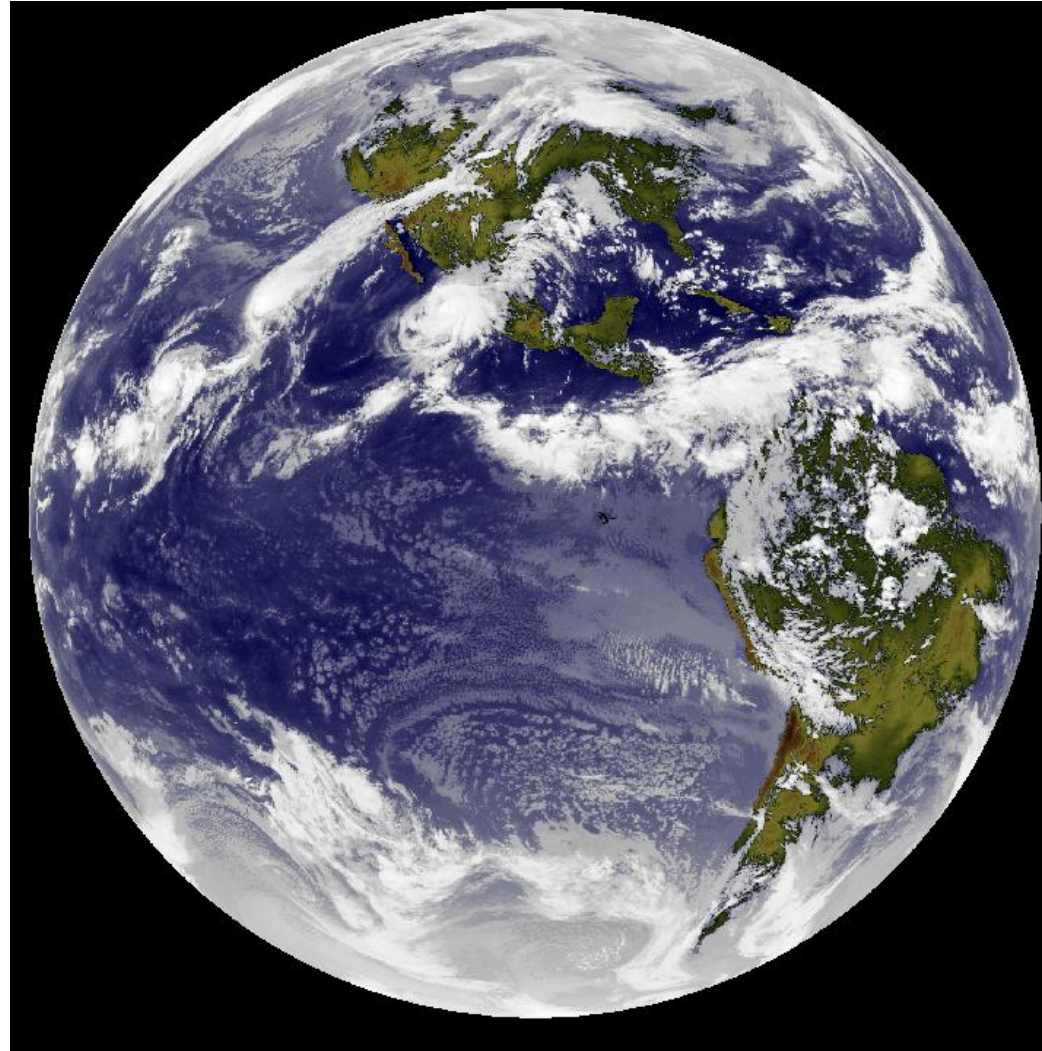


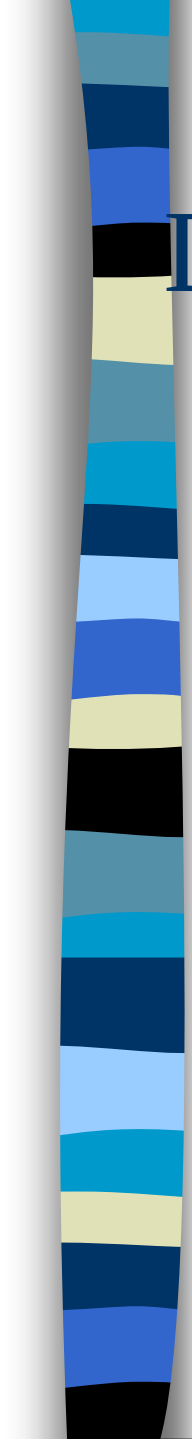
Points for Consideration

- Direct consequences of *the **human** role*, where **human** activity affects river channels through engineering works including channelization, dam construction, diversion and culverting, have been long recognised Marsh, 1864 and Thomas, 1956.
- Indirect more difficult to recognise connections (Gregory, 2005)
- Generally not ‘new’ processes but accelerations of existing
- Indirect probably more important because it is a series of not anticipated events.
- Difficult to recognise and distinguish from ‘natural’ processes
- Difficult to ‘manage’ and assess impact
- Often diachronic in form
- What will be the future?

Practical (15 mins)

- Make a 'spider diagram' of direct and indirect examples (brain storm in 2's)
- Class discussion





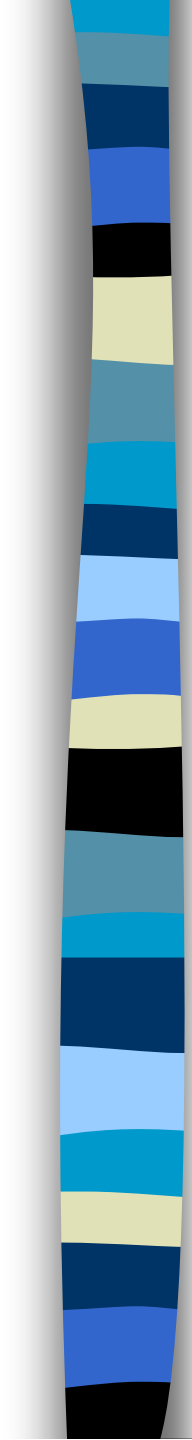
Direct Processes (some examples)

■ Constructional

- Embankments: historical
- Tipping: loose, molten, graded e.g coal tips 2,000 million tonnes UK (Richardson, 1990), Sea reclamation: Singapore
- Ploughed, terraced, compacted

■ Excavational

- Mining, digging, blasting of cohesive and non cohesive materials global 3,000 billion tonnes compared to 24 billion by all the worlds rivers (Holdgate, 1996)
- Craters
- Trampling



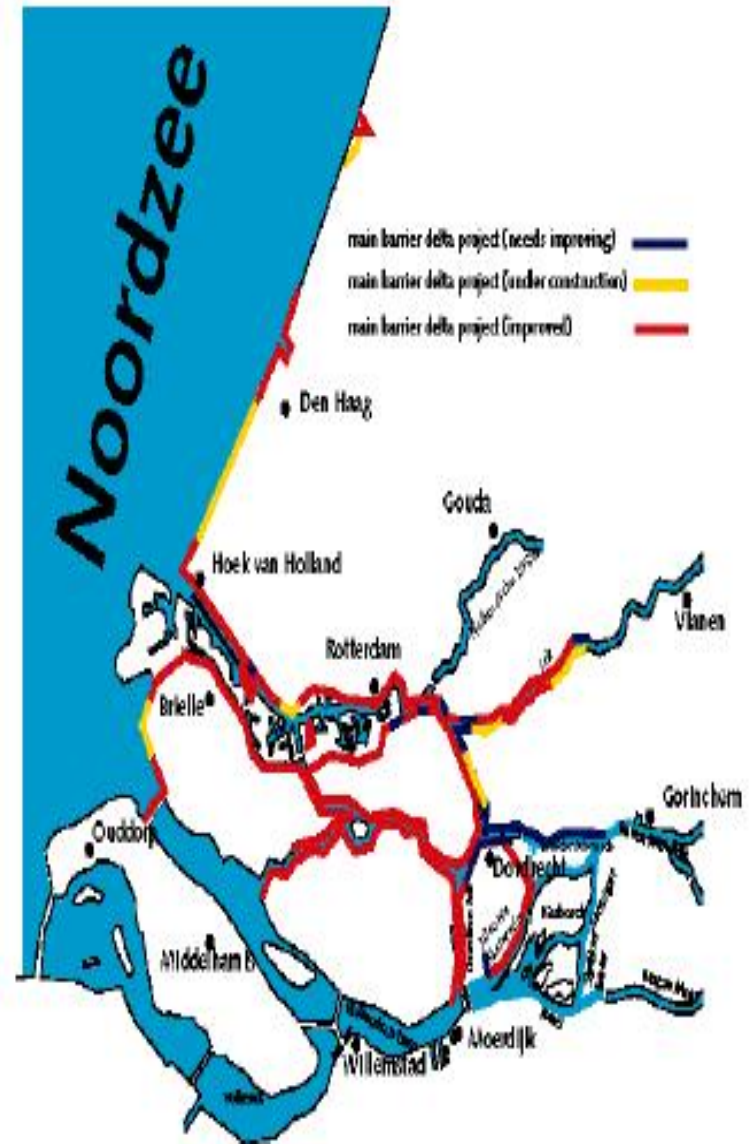
Direct Cont'd

■ Hydrological interference

- Draining
- Coastal protection
- Flooding, damming, canal construction, dredging, channel alterations
 - The Example of Netherlands

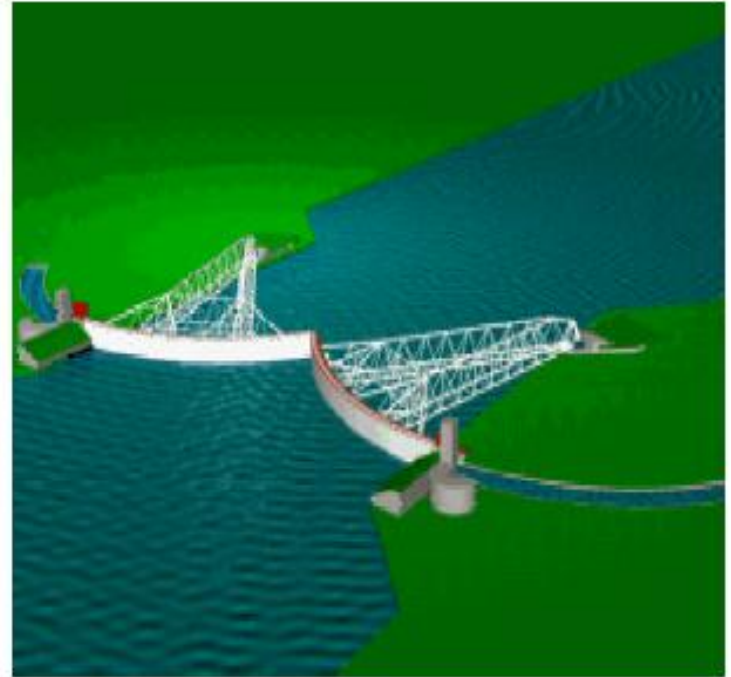


Dyke Map



Southern Netherlands

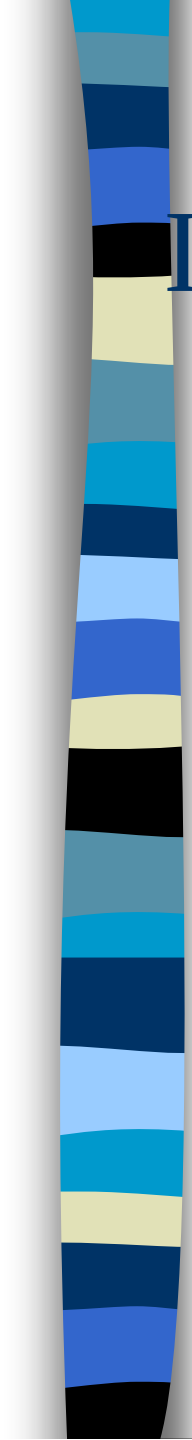
Amsterdam Ordnance Datum (NAP) is reduced from once every 100 years on average to once every 10,000 years on average. The failure risk of the barrier itself is only once in 10,000,000 years.



*Rotterdam Storm
surge Barrier*

Flooding in the Netherlands, 1945, provoked by the retreating Germans who blew up the dykes to delay the advance of Allied troops.





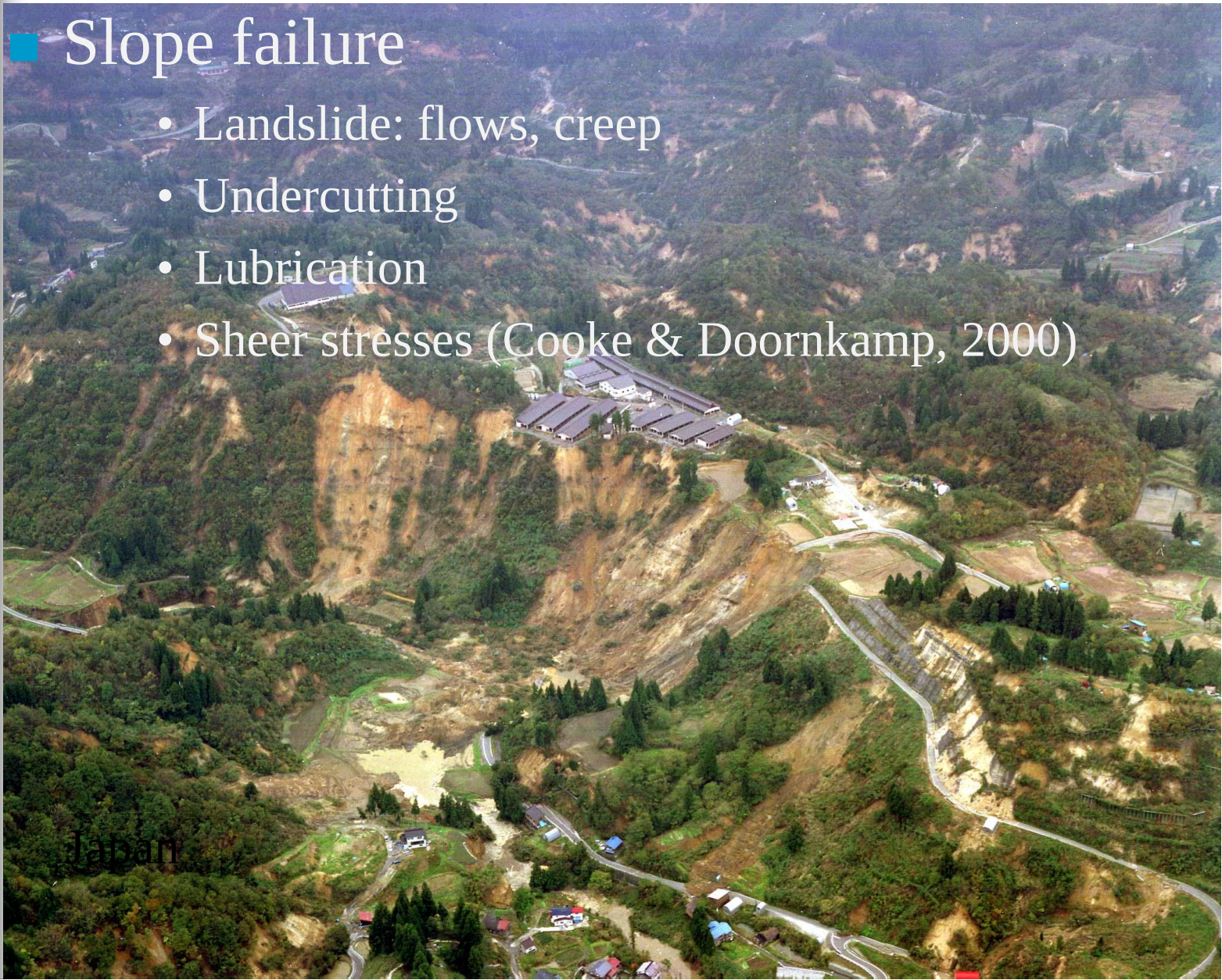
Indirect Processes (some examples)

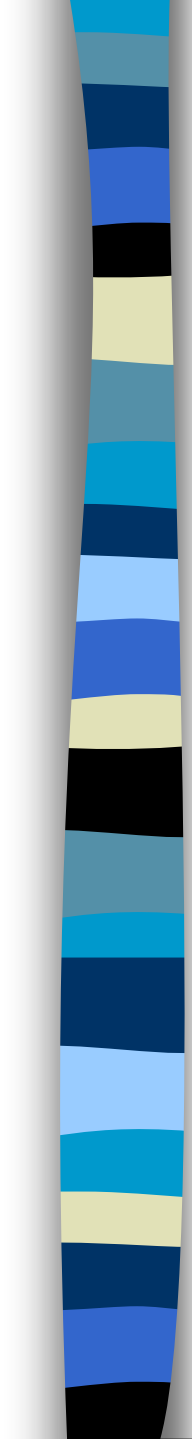
- Acceleration of erosion and sedimentation
 - Agricultural activity
 - Veg. Clearance
 - Engineering: Road construction, urbanisation, accidental hydrological impacts
 - Increased sedimentation rates e.g Llangorse, Jones, 1985)
 - 9000 BP 3.5 cm yr – now > 59 cm
 - Sand dunes
- Subsidence
 - Collapse/subsidence/settling
 - Mining

Indirect Cont'd

■ Slope failure

- Landslide: flows, creep
- Undercutting
- Lubrication
- Sheer stresses (Cooke & Doornkamp, 2000)





Indirect cont'd

■ Tectonic activity

- Loading (reservoirs)
- Lubrication (fault plane)

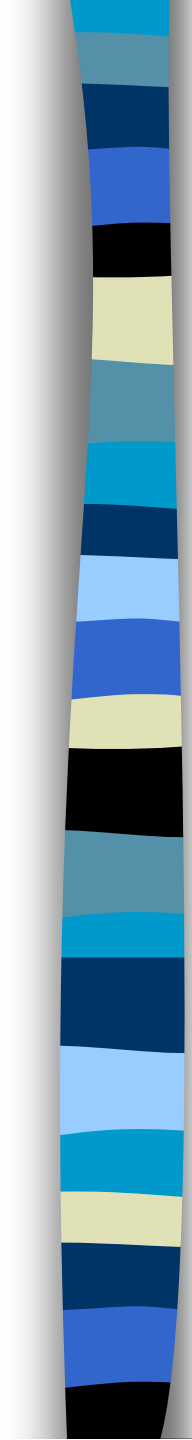
■ Climate Change

- E.g increased rainfall in the Netherlands farmland (Hale, 2005)

Conclusion

- We need more detailed inform./understanding Esp. of indirect
- Change from human problems to human influence on the PL
- Future: influence will probably increase
- Conservation
- Seminar (excavation)





Practical

- Video and exercise Natural environmental change on ‘mother earth’
- class discussion
 - *“Were it not for a trend towards cooling and aridification during tertiary times, modern humans might not exist. Paradoxically, the sapient species whose origin was occasioned by a global environmental change is now changing the environment on a global scale.”*
(Huggett, 1999, p. 6)