Unit 3

S7-S9

- S7 :SLO1- Ice probes and sediment cover

  SLO2- Climate feed back
- S8 :SLO1- water vapour feedback

  SLO 2- Ice Albedo feedback

S9: SLO1- Vulnerability assessment

SLO2- case study on Vulnerability assessment- flood, drought and heat waves

Ice core

- They contain layer upon layer of snow that fell, never melted, and compacted into glacial ice. Within this ice are clues to past climate known as proxies. For example, gas bubbles trapped in the ice contain chemical clues that reveal past temperature.

Ice core Data

- The amount of dust in each annual layer provides information about airborne continental dust and biological material, volcanic ash, sea salts, cosmic particles, and isotopes produced by cosmic radiation that were in the atmosphere at the time the dust was deposited in the ice.

Sediment cores

- These cores are long cylinders of the earth's crust, drilled up from beneath the seafloor. The cores are arranged end-to-end, they show a glimpse of the Earth's past geology and climate.
- Scientists collect long sediment cores and examine the materials trapped within, to reconstruct past ocean conditions. The varieties and concentration of certain microorganisms record past changes in ocean temperature and composition.

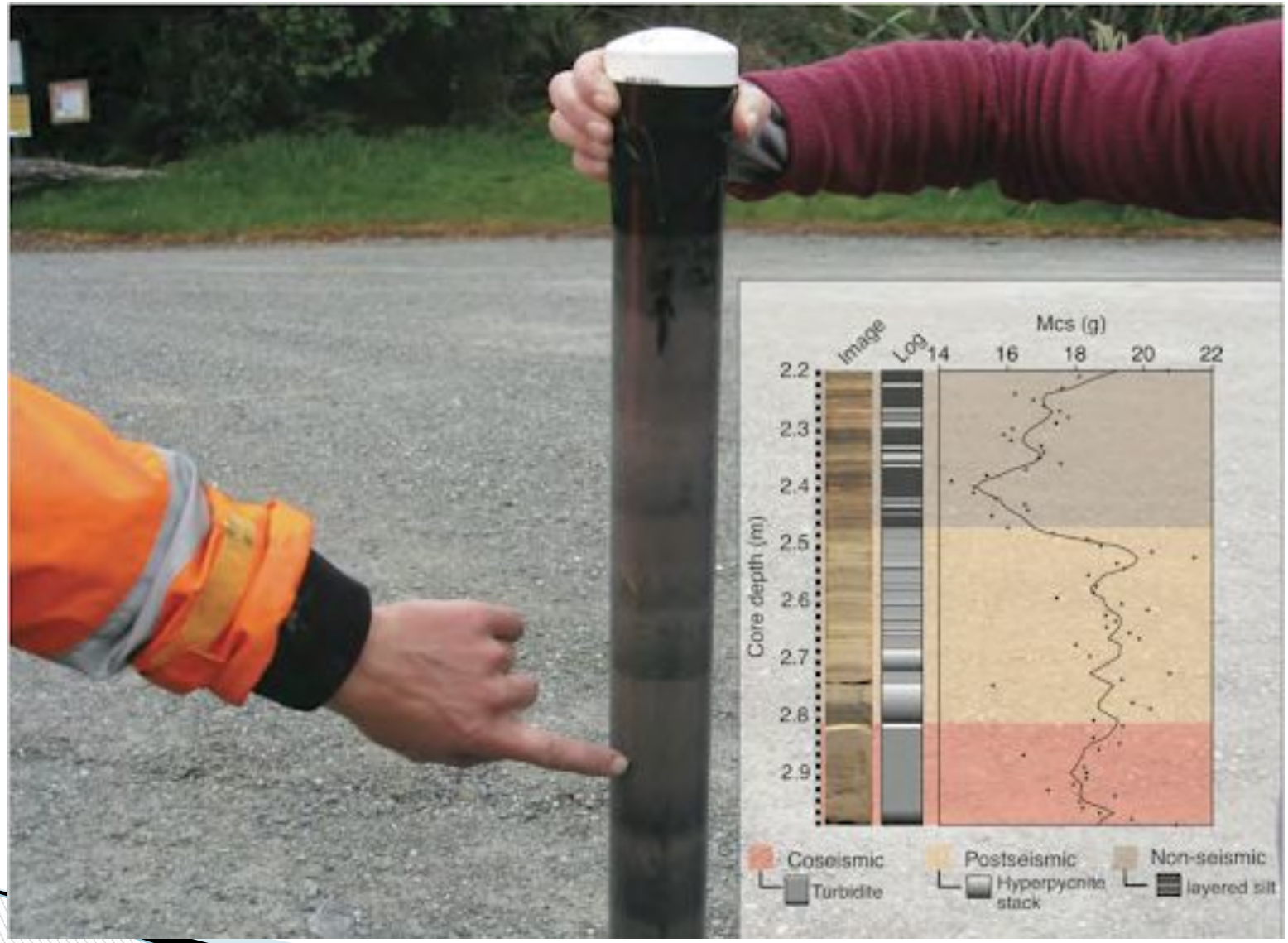
Image
Log
Mcs (g)
14
16
18
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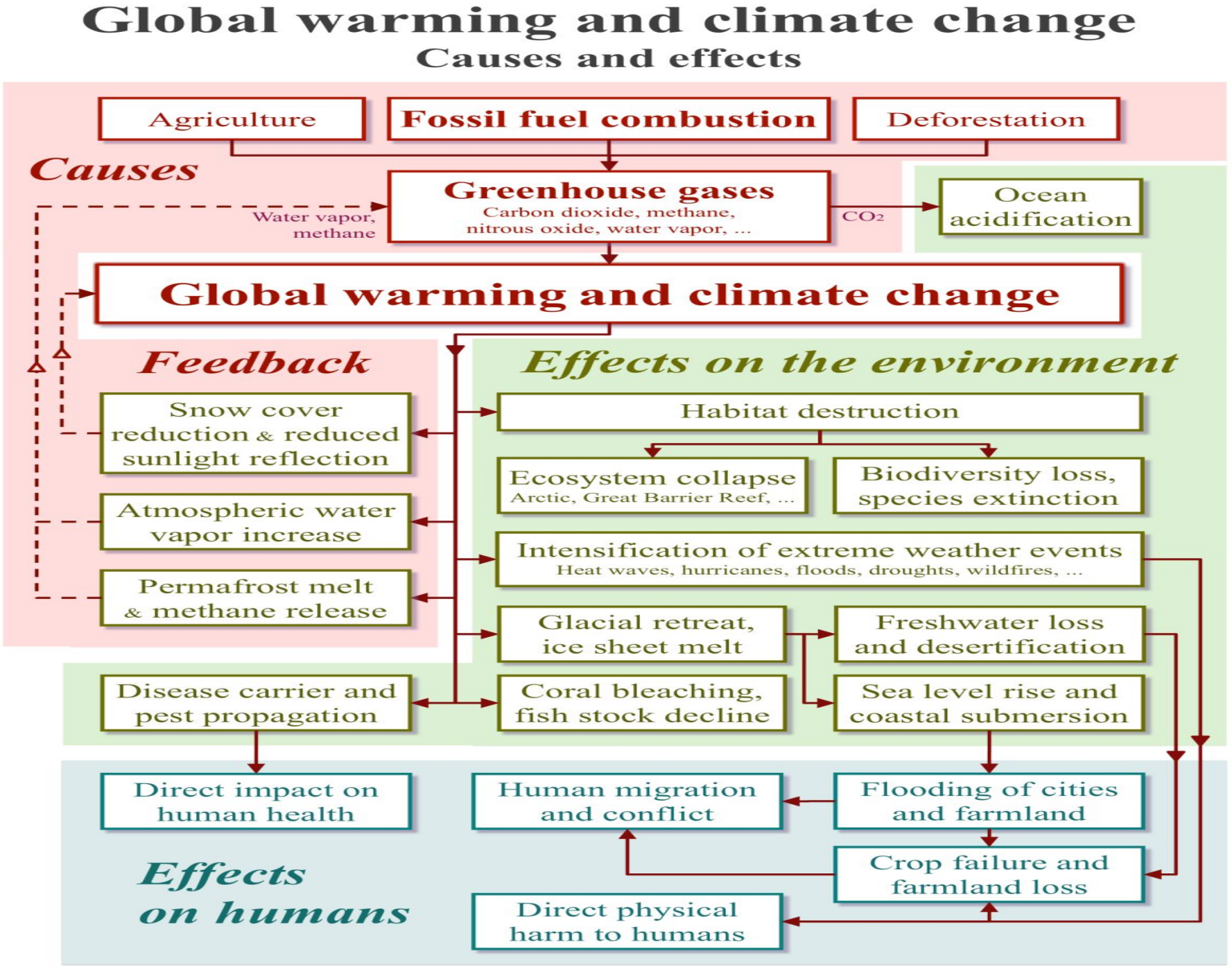
22
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
Core depth (m)
Coseismic
Turbidite
Postseismic
Hyperpycnite stack
Non-seismic
layered silt

- Sediment cores are collected by hammering 1-m sections of 3 inch (7.6 cm) aluminum pipe into the subsurface, capping the pipe, and extracting it using ropes and a farm jack.
- Sediment samples were wet sieved through 250 μm and 64 μm sieves to separate course from fine fractions.

Climate feedback

- Climate feedback is important in the understanding of global warming because feedback processes may amplify or diminish the effect of each climate forcing.
- The term "forcing" means a change which may "push" the climate system in the direction of warming or cooling.
- An example of a climate forcing is increased atmospheric concentrations of greenhouse gases. By definition, forcings are external to the climate system while feedbacks are internal; in essence, feedbacks represent the internal processes of the system.

https://www.youtube.com/watch?v=363HhzYzJlA


Global warming and climate change
Causes and effects
Agriculture
Fossil fuel combustion
Deforestation
Causes
Greenhouse gases
Carbon dioxide, methane, nitrous oxide, water vapor, ...
Water vapor, methane
CO_2
Ocean acidification
Global warming and climate change
Feedback
Effects on the environment
Snow cover reduction & reduced sunlight reflection
Atmospheric water vapor increase
Permafrost melt & methane release
Habitat destruction
Ecosystem collapse
Arctic, Great Barrier Reef, ...
Biodiversity loss, species extinction
Intensification of extreme weather events
Heat waves, hurricanes, floods, droughts, wildfires, ...
Glacial retreat, ice sheet melt
Freshwater loss and desertification
Disease carrier and pest propagation
Coral bleaching, fish stock decline
Sea level rise and coastal submersion
Direct impact on human health
Human migration and conflict
Flooding of cities and farmland
Crop failure and farmland loss
Direct physical harm to humans
Effects on humans

- Feedback occurs when outputs of a system are routed back as inputs as part of
  a chain of cause-and-effect that forms a circuit or loop. The system can then be said to feed back into itself.
- Feedback in general is the process in which changing one quantity changes a second quantity, and the change in the second quantity in turn changes the first.

Water vapor feedback

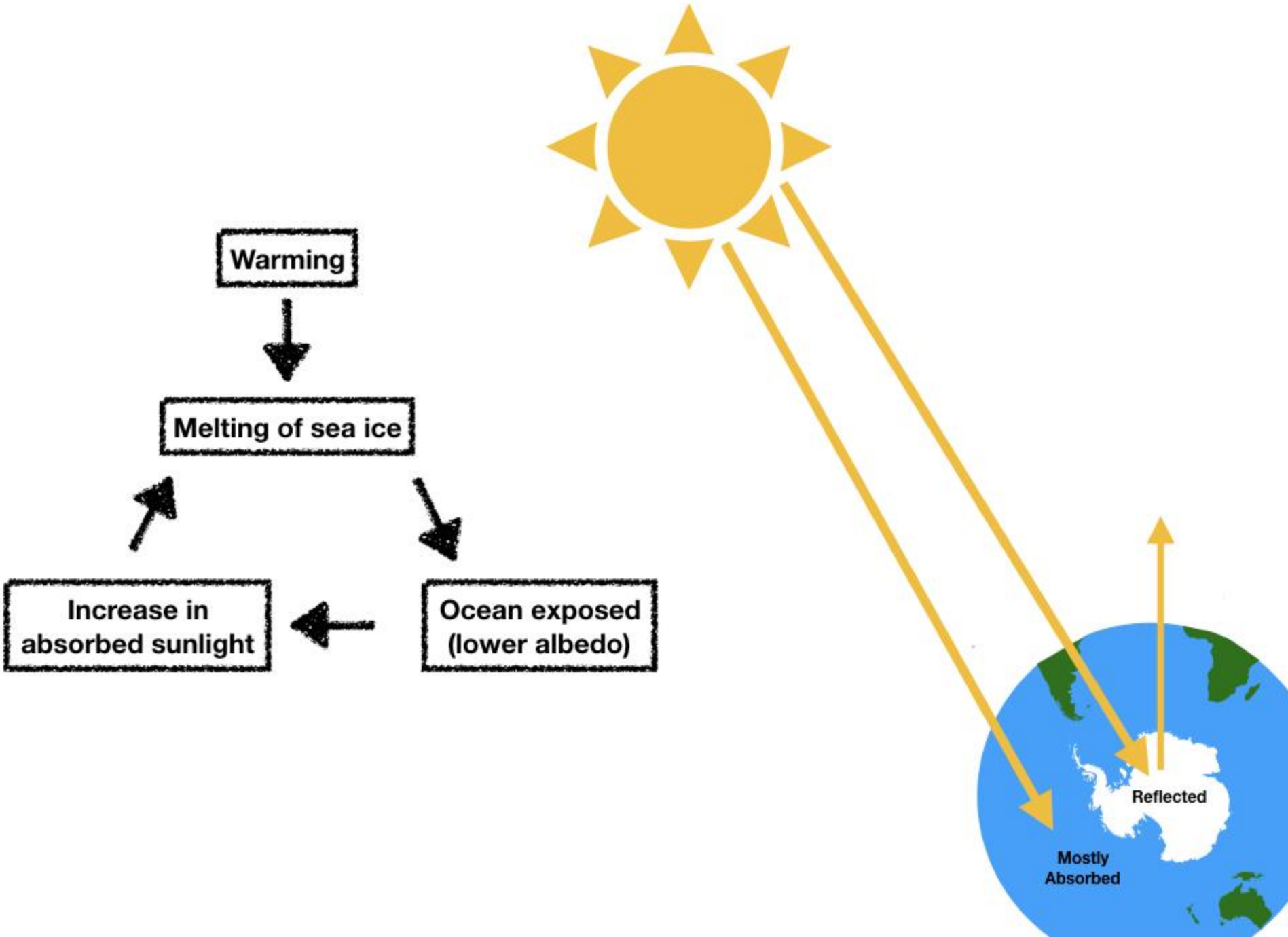
- If the atmospheres are warmed, the saturation vapor pressure increases, and the amount of water vapor in the atmosphere will tend to increase.
- Since water vapor is a greenhouse gas, the increase in water vapor content makes the atmosphere warm further; this warming causes the atmosphere to hold still more water vapor (a positive feedback).
- The result is a much larger greenhouse effect than that due to CO_2 alone.

Contd.

- When ice melts, land or open water takes its place.
- Both land and open water are on average less reflective than ice and thus absorb more solar radiation.
- This causes more warming, which in turn causes more melting, and this cycle continues.
- During times of global cooling, additional ice increases the reflectivity which reduces the absorption of solar radiation which results in more cooling in a continuing cycle.

Ice–albedo feedback

- Ice–albedo feedback is a positive feedback climate process where a change in the area of ice caps, glaciers, and sea ice alters the albedo and surface temperature of a planet. Ice is very reflective, therefore some of the solar energy is reflected back to space.
- Ice–albedo feedback plays an important role in global climate change.


Warming
Melting of sea ice
Ocean exposed (lower albedo)
Increase in absorbed sunlight
Reflected
Mostly Absorbed

Vulnerability assessment

- Methods of vulnerability assessment have been developed over the past several decades in natural hazards, food security, poverty analysis, sustainable livelihoods and related fields. These approaches—each with their own nuances—provide a core set of best practices for use in studies of climate change vulnerability and adaptation

- Climate change vulnerability assessments help establish understanding of the extent to which changing climate will affect the system in question (e.g. basin, water use sector, country, city, etc.).
- Three key components of vulnerability – exposure, sensitivity and adaptive capacity.

- Thus vulnerability assessments eg : in temperature and rainfall (exposure), assessing the characteristics of the system itself and how it may respond to such hazards is (sensitivity), as well its ability to deal with the anticipated impacts is (adaptive capacity).

- In the context of water resource management, vulnerability assessments may focus system vulnerability to reduced water availability, increased seasonal variability, changes in water quality, vulnerability to increased seasonal water variability, but also vulnerability to extreme events such as floods and droughts, amongst other things

- **Vulnerability Assessments can support adaptation planning in several ways:**
- Identify areas most likely to be impacted by projected changes in climate;
- Build an understanding of why these areas are vulnerable, including the interaction between climate change, non-climatic stressors, and cumulative impacts;
- Assess the effectiveness of previous coping strategies in the context of historic and current changes in climate; and
- Identify and target adaptation measures to systems with the greatest vulnerability.