Climate Science Market Place

Rules:

a) Everyone take one text card from the pile. Read it quietly to yourself.
b) Take it in turns to take a question card and read it aloud.
c) If you think a sentence on your text card answers the question, read it out. There may be more than one answer.
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e) If you think the issue is particularly relevant for your country, make a note of it on your negotiation card.
f) Repeat b/c/ d until the time runs out

RMetS
Royal Meteorological Society

Coral reef systems are complicated ecosystems. As carbon dioxide concentrations rise, the ocean's warm and become more acidic. This leads to reef death. With a 2°C warming, 99% of coral reefs will be gone by 2100. Many communities rely on coral reefs for fishing and tourism.

Tropical areas in Africa, South America and South-East Asia are expected to see the biggest increase in heat waves. These include areas where the population is growing, and urbanisation is increasing rapidly. The duration of heat waves in these areas is projected to increase to 2 months with a 1.5°C warming or 3 months with a 2°C warming.

Between 1901 and 2010, global sea level has risen 0.19m at an average rate of 1.7mm/ year. Global mean sea level will continue to rise through the 21st Century at an ever increasing rate, due to increased ocean warming and melting of glaciers and ice sheets.

If daytime temperatures reach 30°C, many crops are badly affected. If the local temperature increases more than about 1°C there will be negative effects on the yields of major crops (wheat, rice and maize) in both tropical and temperate regions.

Two degrees isn't a 'safe' level of climate change – there will be unpleasant consequences even if the temperature doesn't rise that much. However, it is easy to understand and a useful marker of how we're doing at limiting climate change that has helped focus minds on the scale of the challenge. Scientists say it is still theoretically possible to limit warming to two degrees as long as greenhouse gas concentrations in the atmosphere start falling soon.

The difference between a 1.5°C warming and 2°C warming is particularly stark when looking at long term sea- level rise. Holding global warming to 2°C may lead to a 50cm rise by 2100 and a 2-3m rise by 2300 at which point it would still be rising. However, a 1.5°C warming would give a 40cm rise by 2100 and a maximum sea level rise of 1.5m.

Water availability is already amongst the biggest challenges for ecosystems and human societies in many regions. With a warming of 2°C, reductions in water availability of up to 30% are projected in several regions including the Mediterranean, South Africa, Central and southern South America and South Australia. The difference between a 1.5°C and 2°C warming are most obvious in the Mediterranean where the reduction in run-off increases from 9% at 1.5°C to 17% at 2°C.

With a 2°C warming, several elements of the cryosphere will reach tipping points – points at which the system changes rapidly from one 'normal' state to another one. These are projected to include the West Antarctic Ice Sheet, the Greenland Ice Sheet, summer sea-ice in the Arctic and Alpine glaciers. It is likely that the Arctic Ocean will become nearly ice-free in September before 2050. The transition will be abrupt but, if the amount of CO_2 in the atmosphere falls, the loss of sea-ice could be reversed within years or decades. The effect of rapid changes to Arctic sea-ice might have consequences throughout the climate system, particularly on cloud cover.

Future challenges of climate change:

- Physical impacts: Sea level rise, extreme events and changes to the water supply pose major challenges to vital transport, water, and energy infrastructure and can weaken countries socially and economically.
- Territorial impacts: For example those countries highly vulnerable to sea level rise.
- Transboundary impacts: Changes in sea ice, shared water resources, and the migration of fish stocks, have the potential to increase rivalry between countries.
- Violent conflict can in turn undermine livelihoods, encourage migration and weaken valued cultural expressions and practices.
- Adaptation and mitigation strategies, such as those which develop large infrastructure or resettle communities against their will to reduce exposure to climate change, carry risks of disrupted livelihoods, displaced populations, deterioration of valued cultural expressions and practices, and in some cases violent conflict.

In order to avoid dangerous climate change a target level of greenhouse gases should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. The power of the 2°C target is that it is simple and straightforward to understand and communicate, all important elements when science is brought to policymakers. It can be compared to a speed limit for cars on the road. The level of danger at any particular speed depends on many factors e.g. how slippery the road is, how far the driver can see, how good the car's brakes are. It would be too complicated and unworkable to set individual speed limits for individual circumstances taking into account all these factors, so clear and simple general speed limits are set using judgement and experience to try to get an overall balance between advantages and disadvantages of higher speeds for the community of road users as a whole.

People and ecosystems across the world experience climate in many different ways. Average climate conditions give a starting point for understanding what grows where, tourist destinations and other business opportunities. However, changes in average (climate) conditions are often closely linked to changes in the frequency, intensity or duration of extreme weather events. Extreme weather places excessive and often unexpected demands on systems unable to cope and leads to losses and disruption. For example wet conditions lead to flooding when storm drains and other infrastructure for handling excess water are overwhelmed; buildings fail when wind speeds exceed design standards;. Drought can cause crop failure and heat waves can cause sickness and death.

Tropical oceanic rainfall is likely to increase with warmer oceans, particularly in the equatorial Pacific. As the ascending air associated with tropical rainfall drives the Hadley Cell, increasing tropical rainfall may intensify and broaden (poleward) the subtropical and mid-latitude dry zones that exist at the Hadley Cell's outer edges, reducing rainfall there and expanding deserts. In wetter mid-latitude regions and in high latitudes, average precipitation will likely increase, due to the poleward shift in the storm tracks and a greater atmospheric capacity for moisture at warmer temperatures. This increased moisture capacity will probably also produce more intense and frequent extreme precipitation events over most mid-latitude land masses and wet tropical regions.

Coral reef systems are slow-growing, complex ecosystems that are particularly susceptible to the impacts of increased CO_2 concentrations through warming and ocean acidification. Under a 1.5°C warming, 90% of reefs will be affected by 2050, but this will recover to 70% by 2100. Under a 2°C warming, 98% will be affected in 2050 and 99% will be affected in 2100. Only limiting warming to 1.5°C may leave a window open for some ecosystem adaptation. The projected losses will greatly affect societies which primarily depend on coral reefs for fishing and tourism. Coral reefs also provide coastal protection – more important as sea levels rise and tropical cyclone intensity increases.

However much CO_2 we emit, sea levels will continue to rise beyond 2100. On a 2000 year timescale, sea-level sensitivity to global mean temperature increase is about 2.3m per °C. However, if a 'tipping point' is reached for the Greenland ice sheet, the eventual sea level rise could be 5-7m over several millennia. A tipping point for the West Antarctic Ice Sheet may have already been reached. This could lead to an extra sea level rise of 1m over several centuries. Paleoclimate records suggest that in the past, when the world was not more than 2°C warmer, sea levels were 6-9m above present day levels.

The world's governments agreed to limit global mean temperature change to below 2 °C compared with pre-industrial levels in the years following the 2009 climate conference in Copenhagen. This 2 °C warming target is perceived by the public as a universally accepted goal, identified by scientists as a safe limit that avoids dangerous climate change. This perception is incorrect: no scientific assessment has clearly justified or defended the 2 °C target as a safe level of warming, and indeed, this is not a problem that science alone can address. We argue that global temperature is the best climate target quantity, but it is unclear what level can be considered safe. The 2 °C target is useful for anchoring discussions, but has been ineffective in triggering the required emission reductions; debates on considering a lower target are strongly at odds with the current real-world level of action. These debates are moot, however, as the decisions that need to be taken now to limit warming to 1.5 or 2 °C are very similar. We need to agree how to start, not where to end mitigation.

How would a 1.5°C target be better than a 2°C target?	Is a two degree target the best way to talk about limiting climate change?	Is climate change worth worrying about?
What are the threats from a 2°C temperature change on sea-level and water supply?	Why do politicians need to engage with climate change?	Is climate change everyone's problem?
What are the threats from a 2°C temperature change on agriculture, fishing and other industries?	Which regions of the world will face the biggest problems with a 2°C global temperature rise?	What is a tipping point, and which tipping points could be reached with a 2°C warming?
How could climate change lead to war?		

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Market Place: Adaptation and Mitigation

Rules

- In turns, read out one of the climate change adaptation or mitigation examples from around the world.
- Make sure everyone in the market place understands the example and how it is either an example of adaptation to, and/ or mitigation (prevention) of climate change.
- Each delegate then says for their country,
    - "**We don't need this**"
    - "**That won't work for us**"
    - "**We can't afford this without help from other countries**" or
    - "**Good idea!**"
- If you run out of statements, discuss other ways to mitigate or adapt to climate change.

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Climate Change Adaptation or Mitigation Examples from Around the World

Developing solar energy helps meet India's energy needs and also addresses climate mitigation issues. In 2017, solar power became cheaper than power from coal. India is a country that has tremendous solar energy potential, receiving nearly 3000 hours of sunshine every year and has available barren land in the sunniest regions.

The Environment Agency in Britain has recently developed the Thames Estuary 2100 plan to manage future flood threats to London. The Thames Barrier (completed in 1982) currently protects London, but won't cope the sea level rise expected as the climate changes. Over the next 25-60 years, existing flood defences will be improved and in the longer term (beyond 2070) more substantial measures might include a new barrier.

In the Netherlands, coastal areas house 9 million residents and produce 65% of the country's GDP. Schemes to protect the country from sea level rise include expanding beaches, allowing some land to flood naturally and increasing the flow in large rivers such as the Rhine. The project is extremely expensive – up to 0.5% of Dutch GDP, but is much cheaper than the potential costs of flooding, particularly to port based industries.

Bolivia is already suffering from climate change impacts, in particular reduced water supply as a result of glacial retreat. As agriculture is the main source of community income, water availability is the key constraint for crop production. New technologies increase water availability through constructing artificial water reservoirs to harvest rainwater. Micro-irrigation is replacing traditional flood irrigation to make water use more efficient.

The wind industry plays a crucial role for the Danish economy with exports of energy to neighbouring countries amounting to more than 6.5 billion euros. More than 31,000 people work in the Danish wind industry. In February 2017, Denmark ran entirely on wind energy for a day. The country has very large offshore wind resources, and large areas of sea territory with a shallow water depth of 5–15 m, where siting wind turbines is most straightforward. Since the 1980s, Denmark has been replacing nuclear and coal fired power stations with wind farms.

Climate change can cause land loss in low lying Pacific island communities such as Tuvalu, the Solomon Islands, Micronesia and Kiribati. The impacts of climate change can be the final straw which results in an individual or family deciding to migrate. Some Pacific island countries have access agreements with Australia, New Zealand and the United States of America allowing their citizens to migrate internationally. However, migrants face problems to do with land ownership and their cultural identity.

In Bhutan, glacial melt is leading to flash floods, landslides and glacial lake outburst floods. Adaptation is needed to save lives, arable land and productive forests. Schemes have included lowering the level of glacial lakes which could burst their banks, and landslide protection.

In Canada's Columbia Basin, a remote, mountainous and wooded area, wild forest fires are an increasing threat. Climate change also threatens summer drought, winter floods and increased insect borne disease. The local community has increased its future resilience to climate change by making sure new developments assess their fire and flood risk and improving the local firefighting capacity.

Adaptation and Mitigation are more socially acceptable if they are combined with other goals. In Paris, new urban policies combine climate change mitigation (reducing greenhouse gas emissions from transport, heating and air conditioning) and adaptation (reducing the number of people living in flood prone areas) with natural area and biodiversity protection and improving housing affordability.

Over 25% of China is desert, with recent desertification caused by deforestation, overgrazing and over use of water. The government has tried various ways to reduce desertification, including tree planting (to protect the soil from the wind), and returning farm and grazing land to forest or grassland, which is more effective. These schemes both reduce greenhouse gas emissions and help the country adapt to a changing climate.

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Economics Market Place

Climate finance and justice

Climate Justice looks at the ethics of climate change, examining issues like Equality, Human Rights, and Collective Rights. Which countries have, in the past, been responsible for the greenhouse gas emissions and land use changes which have contributed to the climate change we see today?

What is the fair way for us, as a global community, to prevent climate change in the future and help countries deal with the consequences which are already inevitable?

Those who are least responsible for climate change often suffer its most serious consequences.

Who should pay for countries to adapt to climate change, or to make changes that reduce their greenhouse gas emissions?

Instructions

Find a partner within the market place:

Task

1. Should you or should your partner pay money into the Green Climate Fund? If both say yes, who should pay more? Remember to represent the interests of your country as well as what you, as an individual, think is fair.
   [You may like to refer back to your country facts at this stage]

2. Should you or should your partner receive money for loss & damages incurred through climate change, and to help you reduce your future greenhouse gas emissions?
3. Now find a new partner.

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