

**Wednesday 9 January 2013 – Morning**

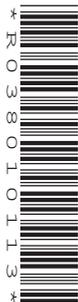
**LEVEL 2 CAMBRIDGE NATIONAL IN SCIENCE**

**R072/02/I**

How scientific ideas have developed

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**Duration: 1 hour**



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- This Insert contains the article required to answer question 1.

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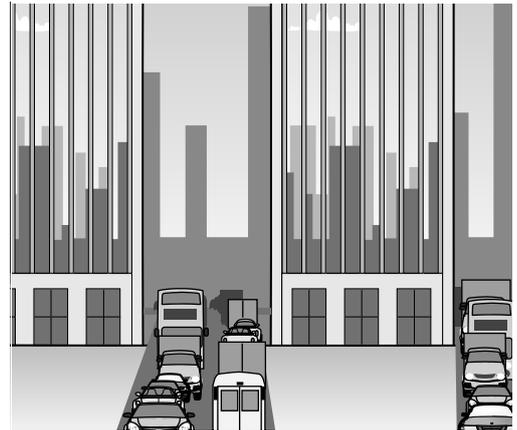
## Collecting data and making predictions about climate

Today, the average global temperature is about 15°C. During the last Ice Age, the average global temperature of the Earth was about 5°C cooler than it is today. Scientists disagree about the actual values. This is because they have different views on how data about the Earth's temperature should be collected and analysed.

### Collecting and analysing data about temperature

It is difficult to agree a value for average global temperature because...

- readings must be collected from as wide a range of places as possible.
- readings have to be collected at regular intervals through the day and through the year.
- readings are taken at the land surface, but could also be taken in the upper atmosphere or in the oceans.
- cities give unreliable data because they are 'hot spots'. This can be more to do with the actions of people rather than a change in climate.
- all scientific instruments have errors in their readings.



### Making predictions

Scientists agree about how the greenhouse effect works, but they do not agree about how much the temperature will change if greenhouse gas levels increase. This makes it difficult to predict how the climate will change in the future. The prediction depends on scientists understanding about...

- how the atmosphere is changing.
- how the change will affect future temperatures.

## How the atmosphere is changing

Scientists have only been collecting reliable data about the Earth's atmosphere for about 100 years. If scientists want to collect data about the composition of the atmosphere before that, they need to analyse the air trapped in frozen ice. Scientists collect frozen ice cores from holes drilled into the ice caps. Scientists need to use very complicated measuring equipment to take accurate readings of tiny changes in the composition of the trapped air. These readings need to be analysed using computers. The measuring equipment and the computers can lead to errors.



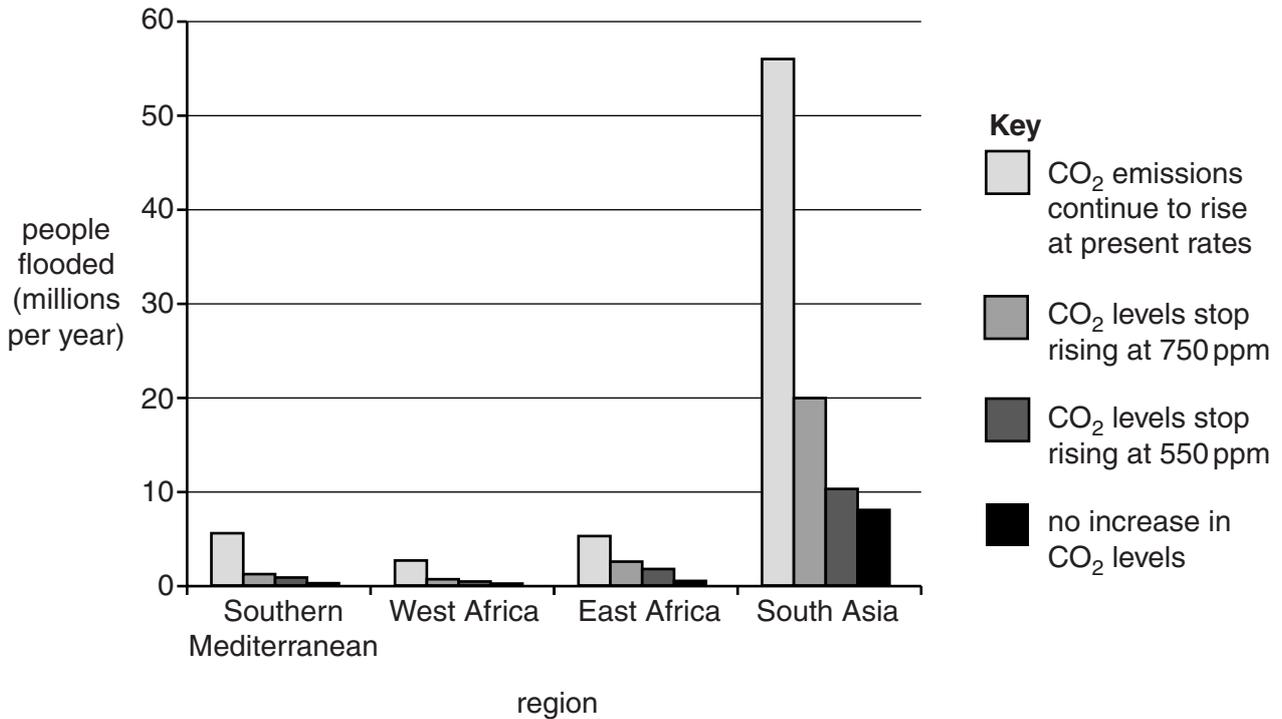
## How the change will affect future temperatures

Scientists agree that the average temperature of the Earth may have increased by  $0.6^{\circ}\text{C}$  over the last 100 years. Some estimates are  $0.2^{\circ}\text{C}$  higher or lower than that. The large error value of  $\pm 0.2^{\circ}\text{C}$  means that the range of accepted values for the average temperature is still quite broad. Using this data gives only broad predictions about future global temperatures.

## Predicting the effect of global temperature changes

Scientists working for Middlesex University have made some predictions about the number of people who will be affected by flooding in the future. They have made their predictions using different data about the future concentration of carbon dioxide in the atmosphere in ppm (parts per million).

The graph shows predictions for the average number of people who could be flooded each year in the 2080s, in regions that are likely to flood. The predictions are based on what will happen if carbon dioxide levels in the atmosphere stay the same or rise at different rates.



Different scientists have published different views about how changes in the atmosphere could affect the climate in the future. Even if agreement about average global temperatures was reached, predictions are difficult. Future trends in temperature are unlikely to depend on a single variable. Many factors such as dust or ash in the air, cloud cover and ocean currents all affect the climate. Any model that tries to make predictions has to be very complex to take many factors into account.

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