Why do small errors make it impossible to predict the weather system with a high degree of accuracy?

Beyond two or three days, the world's best weather forecasts are speculative, and beyond six or seven, they are worthless.

The Butterfly Effect is the reason.

For small pieces of weather — and to a global forecaster, small can mean thunderstorms and blizzards — any prediction deteriorates rapidly.

Errors and uncertainties multiply, cascading upward through a chain of turbulent features, from dust devils and squalls up to continent-size eddies that only satellites can see.

The modern weather models work with a grid of points of the order of sixty miles apart, and even so, some starting data has to be guessed, since ground stations and satellites cannot see everywhere.

But suppose the earth could be covered with sensors spaced one foot apart, rising at one-foot intervals to the top of the atmosphere.

Suppose every sensor gives perfectly accurate readings of temperature, pressure, humidity, and any other quantity a meteorologist would want.

Precisely at noon, an infinitely powerful computer takes all the data and calculates what will happen at each point at 12.01, then 12.02, then 12.03 ...

The computer will still be unable to predict whether Princeton, New Jersey, will have sun or rain on a day one month away.

At noon, the spaces between the sensors will hide fluctuations that the computer will not know about, tiny deviations from the average.

By 12.01, those fluctuations will already have created small errors one foot away.

Soon, the errors will have multiplied to the ten-foot scale, and so on up to the size of the globe.

By ‘small pieces of weather’, the author means almost any weather event, including thunderstorms and blizzards (which may not seem ‘small’ to the average man).

Modern weather models work on a grid of points roughly sixty miles apart.

In this passage, the phrase ‘the Butterfly Effect’ probably means the effect that minor changes have on the weather which makes it impossible to forecast weather accurately.

Many financial forecasts are highly speculative because no one knows what might happen tomorrow to affect the money markets.

Air pollution is a global problem, not one that affects just a few industrialized countries.

There is one main road to the south, and the farther south you travel, the more it deteriorates.

The patient recovered very rapidly after her operation.

Insects seem to multiply in hot weather.

The early twentieth century was a turbulent period in the history of that country.

Suppose it rains, what shall we do then?

This old clock is so accurate that I can even set my computer clock by it.

The time is now 11.05 and 20 seconds precisely.

At this time of year, there are quite wide fluctuations in the price of vegetables.

The average salary for an office worker is £8,000 a year.

An accountant nearly always has to take account of errors in his clients’ calculations.

There’s a fault in the Earth’s crust running along the west coast of the U.S.A.

The hurricane hit Florida, sweeping away everything in its path.

I noticed the lights were on, assuming they were at home.

The President emerged from the airport, waving to the reporters.

You can go home early, provided you finish your work.

We can offer you a job on the condition that you start next Monday.

You can come in any time you like tomorrow morning so long as you come in on Saturday as well.

I won’t phone you unless I need some help.

He’ll win even if he gets a slow start.

He won’t receive this fax tomorrow morning.

He will have received this fax by tomorrow morning.

He won’t leave Beijing until this message arrives.

By the time this message arrives, he will have left Beijing.

They will complete the new motorway by next June.

They won’t have completed the new motorway until next June.

Some starting data has to be guessed since ground stations and satellites cannot see everywhere.

John feels much happier since he changed his job.

Susan left in July, and we haven’t seen her since.

It hasn’t stopped raining since eight o’clock this morning.

Since you’re so clever, see if you can solve the problem!

Whether he has signed the contract (or not) doesn’t matter.

The question is whether he has signed the contract.

I want to know if/he has signed the contract.

I’m concerned about whether he has signed the contract.

Do you know if/whether she’s arriving by bus or by car?

The reason it’s hard to forecast the weather is that the effect of tiny changes cannot be detected or calculated.

Even with grid points that are sixty miles apart, forecasters have to make assumptions about some of the data.

Which of these statements is true?

At present, there is no way of making accurate predictions.

Tiny variations in temperature, pressure, and humidity can lead to completely unexpected weather conditions.

Generally speaking, any prediction will deteriorate rapidly.

Only satellites can see continent-sized features.

Say the Earth could be covered with sensors.

The computer will be incapable of predicting whether Princeton will have sun or rain one month away.

The world’s best weather forecasts are based on guesswork.

The modern weather models work with a network of points.

‘Humidity’ refers to water vapor.

An infinitely powerful computer takes in all the data and works out what will happen.