

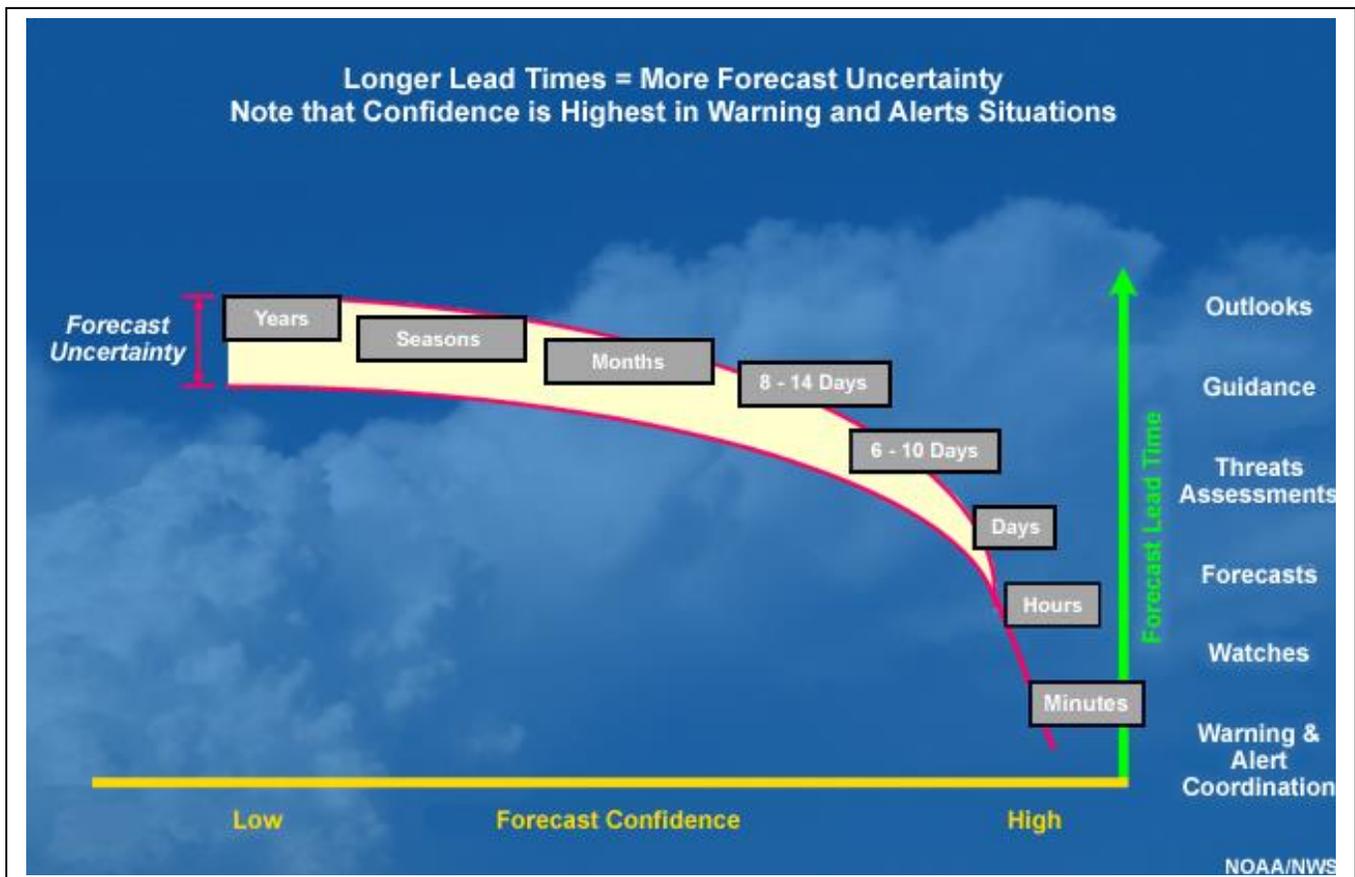
Weather Forecast Uncertainty

National Weather Service Louisville

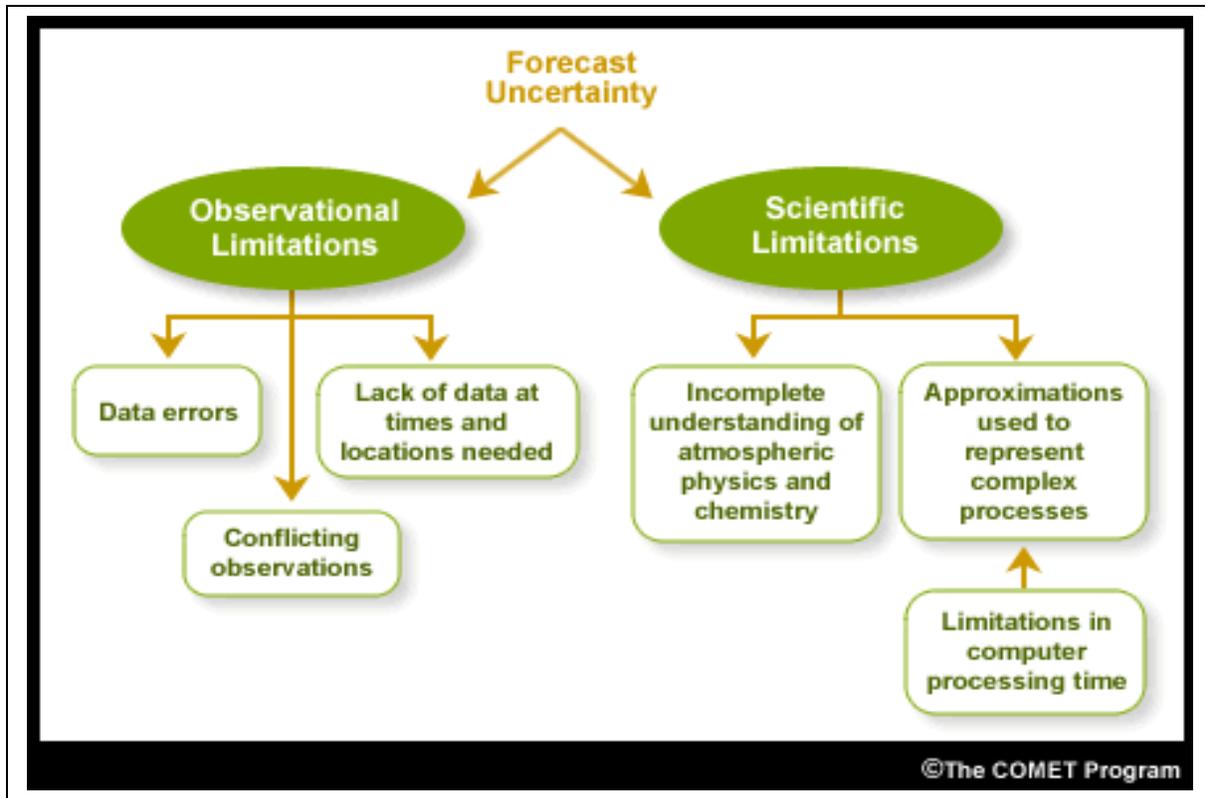
Why is there uncertainty in forecasts?

- Forecast uncertainty can arise due to the complex nature of our atmosphere, which is a chaotic “fluid” that is sensitive to initial conditions.
- A slightly inaccurate depiction of the current state of the atmosphere will often result in forecast uncertainty with time in model forecast data.
- The models themselves are only a simulation of the atmosphere, and their accuracy will be limited by how precisely they can represent complex atmospheric processes. Some processes can be difficult to model perfectly which can lead to error over time.
- NWS forecasters evaluate model output, incorporating knowledge of model strengths and weaknesses to prepare official NWS forecasts based on the models, which can reduce some uncertainty.
- Due to uncertainty in any one model, an “ensemble” approach to forecasting has been implemented recently. With this method, a series of slightly different initial conditions are inputted to a model to determine various possible outcomes. If the members of the ensemble show diverging results in time, then forecast uncertainty is higher for a given weather situation. However, when ensemble members agree, uncertainty is reduced and forecasters can be more confident in their official forecasts.

Overall, forecast confidence goes down in time:



Where does forecast uncertainty come from?



Forecast accuracy can be limited for a number of reasons

- Limitations in observations
- Data errors
- Data inconsistencies between different tools measuring the same thing
- Insufficient data at the times and locations needed (particularly over oceans)
- Incomplete understanding of complexities and interrelations between atmospheric physics and chemistry
- The need to use approximations and simplifications to represent complex processes
- Tradeoffs between the time required to get timely forecasts out to the public and the time required to process data and run models

How to deal with uncertainty?

- Monitor the weather on a daily basis by following the latest National Weather Service forecast, found here at the [NWS Louisville website](#)
- Avoid being complacent when the long-range forecast indicates benign weather
- Be cognizant when conditions are changing rapidly
- Provide your National Weather Forecast office with accurate, reliable weather reports on [web and social media](#) that will help improve short-term forecasts in rapidly changing situations
- Understand how to interpret probabilities
- Think about the potential impacts of the weather and have a [preparedness plan](#) in place