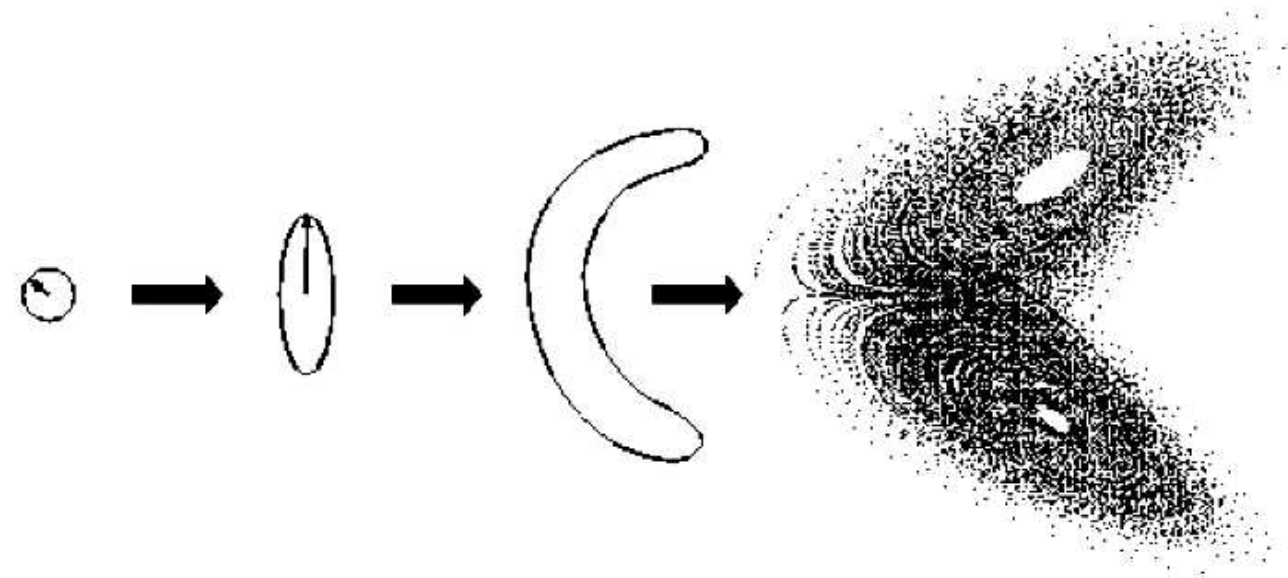


# Ensembles and stochasticity

## Problem

- Weather forecasting attempts to predict a highly chaotic dynamical system.
- Initial condition errors will grow exponentially.

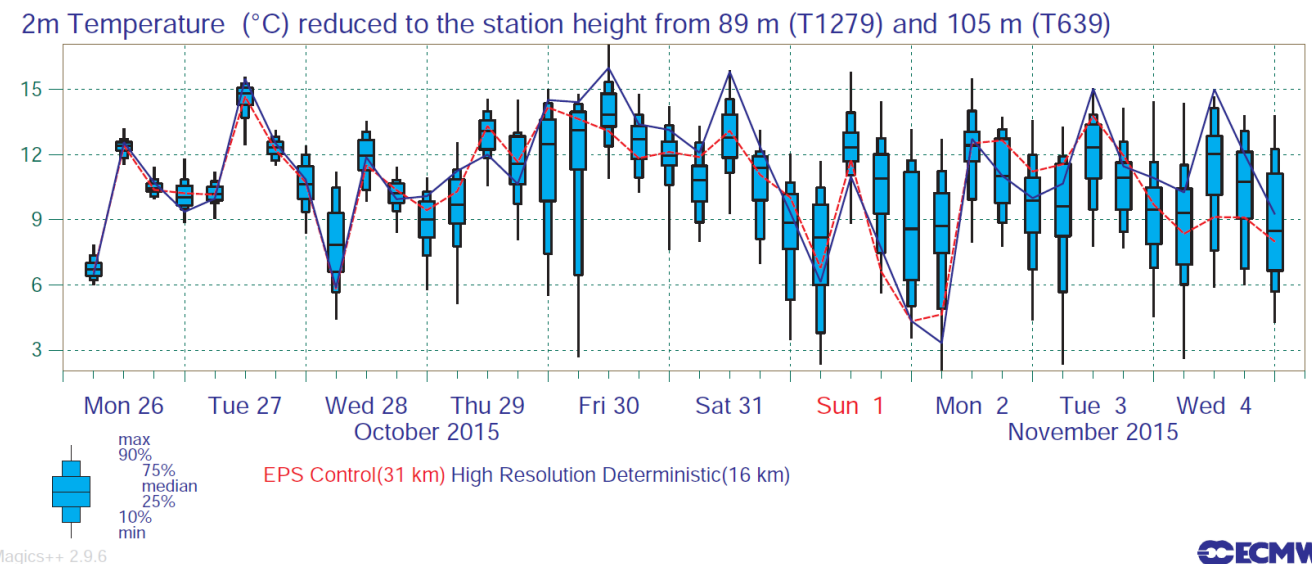


## Solution

- Propagate an ensemble of initial conditions forward to (hopefully) include the truth in the distribution of possible answers.
- Random elements are added to the model to increase spread. e.g. SPPT, SKEBS, SPT.

Initial      Short-range (linear)      Medium-range (non-linear)      Loss of predictability

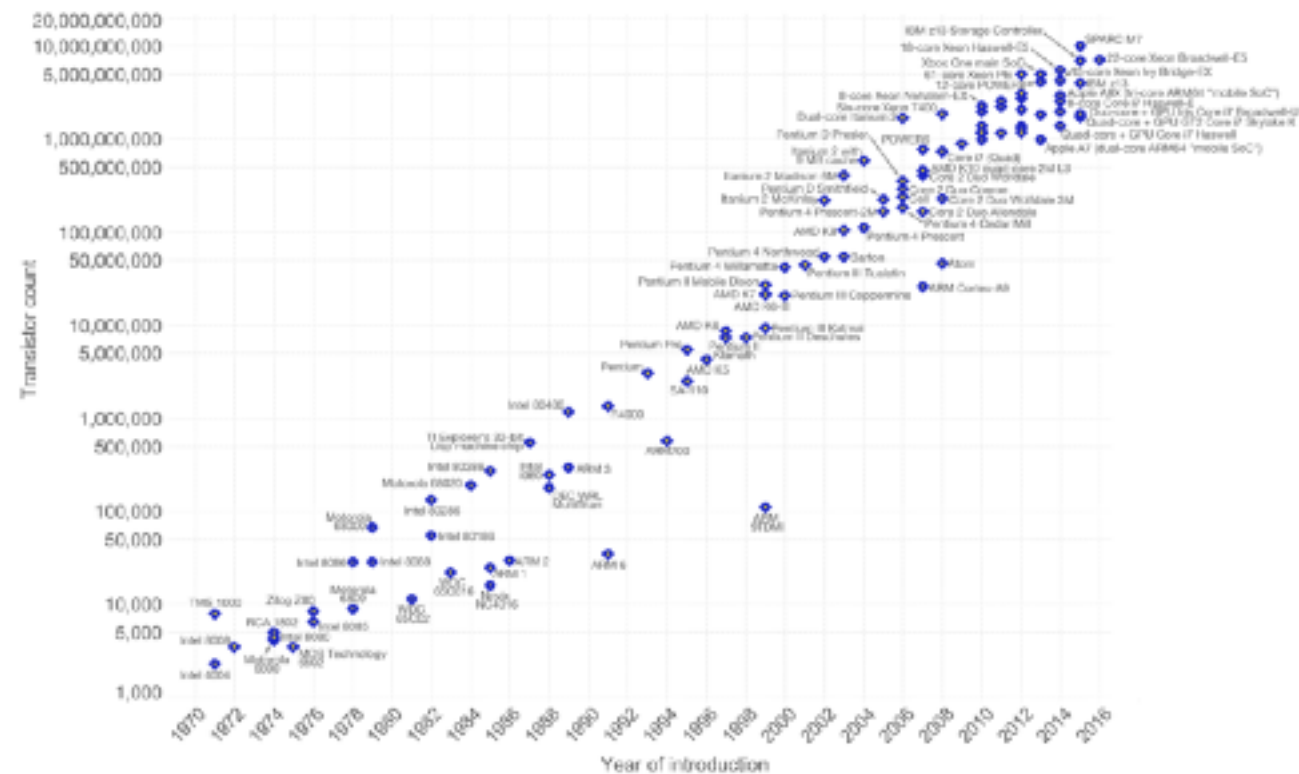
Source: ECMWF IFS documentation



# Why care about precision?

Moore's Law – The number of transistors on integrated circuit chips (1971-2016)

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important as other aspects of technological progress – such as processing speed or the price of electronic products – are strongly linked to Moore's law.

Data source: Wikipedia ([https://en.wikipedia.org/wiki/Transistor\\_circuit](https://en.wikipedia.org/wiki/Transistor_circuit))

The data visualization is available at [OurWorldinData.org](https://ourworldindata.org/energy-consumption). There you find more visualizations and research on this topic.

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New computers are bigger but not faster.

- Reaching physical limits of transistor size.
- Parallel computing is the main route to higher grid resolution.

# Energy consumption

- MetOffice supercomputer: 2.7 MW of electricity.

Moore's "law":  
twice as many transistors per chip every 2 years

Looking for any possible paths to faster/more efficient code.