A beautiful patterns of Clouds

One day in a random evening of my vacation after my 12th CBSE board and Entrance Exams ended, I saw a beautiful cloud formation that looked like a dog running behind a cat or a cheetah running behind a deer. I was intrigued and thought "if we had to predict this beautiful cloud formation 10 years ago then how will we even possibly pull this level of approximation?".

Clouds are made by water vapours from many sources coming from the ground to the troposphere then with appropriate temp-pressure they form a cloud, however it's a very chaotic system I guess because clouds move with air and small water sources also move with time that could deeply affect the position of cloud in a longer period of time like 10 years so it's really a chaotic system, but just because I am bored let's take the challenge to predict this same beautiful cloud formation would happen theoretically. We have multiple ways to approximately do this –

1) **Grid-Based Sky Tracker with a Neural Network**
   We will go back 10 years earlier and start mapping every factors affecting cloud formation data(like location of ponds, river, water storage areas of villages, etc) over some years (say like 8 years) then feed it to a powerful neural network in a supercomputer and then also divide the sky in like a grid made with small 1cm² squares(see fig 1) and then also feed the changes in those small square grids(over say like 8 years) to the machine neural network but here's the catch measuring the changes in one grid square independently is really foolish thing to do, instead we will choose like suppose taking a five patches of square grids in the random place in sky but some squares of those different patches must be overlapping(see fig 2) so that the neural network instead of adjusting its weight according to only the change in one square it adjusts its weight by also adjusting them to the squares that are around it, this overlapping of data sets will I guess make some sort of contextual overlapping that will make the prediction more accurate. Then combining both of those two mega neural networks to get a actual representation of what a cloud will approximately look like at some point in time in future. Then I guess this could be one way to do that.

Fig 1

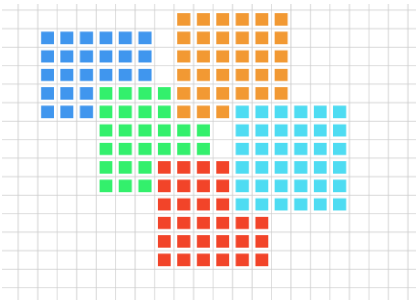

Fig 2

2) **Pure Physics + Differential Equations**
   2nd way is different and is purely mathematical-physics, like we go 10 years back at some point of time in instant and get an accurate measurement of volume of water on ground and in clouds, then make a differential equation that shows the effects of how water on ground might be affected by the heat and sun and many other things then putting the volume of water from the earth to that differential equation could possibly try to tell us some patterns in the cloud happening at some time in future.

Real Findings -

1. How Cloud Prediction is Actually Done:
   - Meteorological centers use massive supercomputers and models like GFS and ECMWF.
   - These simulate fluid equations on grid scales of kilometers, not centimeters.
   - Satellite data (like from GOES or Meteosat) feeds into these systems daily.

2. Limits of Prediction:
   - Due to cloud formation being a chaotic system, exact prediction beyond 2 weeks is currently (May 2025) impossible.
   - The Lorenz attractor shows that initial uncertainty grows exponentially in weather systems.

3. Key Equations Used:
   - Navier-Stokes Equations (for atmospheric fluid motion)
   - Clausius-Clapeyron relation (describes water vapor capacity at different temperatures)
   - Conservation laws of mass, momentum, and energy

5. Why my Idea Is Theoretically Fascinating But Impractical:
   - To simulate 1cm² grid over entire sky for 10 years would need massive yottabytes of data.
   - Still, my overlapping grid with neural network system is conceptually similar to spatiotemporal transformers used in modern research.