



# Using Machine Learning to Improve the NASA GISS Climate Model



Gregory Elsaesser

Predicting changes to the earth's climate is an incredibly complex problem -so many aspects interact with each other and influence the way the system works, with everything continuously changing over time. The NASA GISS Earth System Model (ModelE) must simulate a wide range of complex interactions between solar and terrestrial radiation, clouds, the ocean and land surfaces, etc. if we are to accurately predict how the earth's climate system will respond to different changes.

Here at Goddard, we have created a computer model that can solve for 45 factors at once, each one influencing the others. Machine Learning (ML) does the job of searching the large complex set of model equations for results that match the real system –our satellite observations. ML acts like an arrow aiming to hit as many targets as possible (see top-right schematic, an endeavor impossible to undertake using human exploration only). ML finds all combinations of numerous Earth System Model equation parameters that give improved agreement with nearly 35 NASA satellite datasets.

Aside from the incredibly important task of modeling and predicting changes in our climate, the new ML-aided models can be used in many different scientific problems, from our solar system to exoplanets.

