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Final Project – Progress Report 3

Introduction:

Since the last progress report, I have added tornado movement that should reflect rather accurately. Though there is a lot of user input regarding the movement, the options have been given that reflect research done on average tornado movement – including lifetime, speed, direction of movement, and a choice of tornado reproduction into a "family" that reproduces on a small probability if the user allows for that to happen during the model run. I've also added functionality for the tornado to throw trees if it comes across any trees in its path which could potentially hit nearby buildings. I'm also calculating and displaying "city values" at setup that takes into account the total "value" of a city by taking average property prices in certain cities as my reference pattern. I'm currently working on the damage model that will calculate damage done to the city by the tornado(es) using a reference pattern to build the damage model. That is basically all that remains to be done. I've also updated my project proposal that includes the latest developments that will later change into the final paper. The updated code and proposal can also be found on the modeling commons website.

Agent behavior:

The tornadoes moves with a lot of input that the user can choose at setup – the options of which have been provided based on average tornado movement research. Average tornadoes live between several seconds and twelve minutes – and I've extrapolated the run time in terms of a certain number of ticks. I've also included a probability with which the tornado will move in a random direction forward since tornadoes can either move or stay in the same spot. Average tornadoes also move between 30 and 70 mph, and I've extrapolated that to reflect how "far" the tornado moves per "second". There is also a choice for the user to allow tornado reproduction into a "family". If they allow it, then with a 0.1% chance tornadoes will duplicate. I've chosen a small probability since families are rare to begin with.

The tornadoes also throw trees around if it encounters any its path. Depending on the tornado strength, it will throw a tree in some direction and the trees will check to see if they have hit a building. The trees are thrown in a random direction since it is unknown how the tornadoes' winds will be swirling (since I've chosen not to model that aspect). Therefore, I'm throwing the trees in a random direction since given the combination of tornado swirling winds and its own movement direction the tree could be thrown in an arbitrary direction because the exact directions are unknown to us.

System behavior:

The tornado starts moving according to the specifications given by the user at the time of setup. The tornado moves around and if it encounters a tree in its path it will throw it depending on its strength to another location and then will check to see if the tree hit a building or a home to begin the damage calculation function (which isn't working yet). If the tornado encounters a building or a home it is not doing anything as yet, though this is where the damage model will come in – and maybe change the color/shape of the buildings and homes to visually reflect some damage. After the tornadoes reach their lifetime limit, they die.

Rationale for agent rules:

I've given the user the options in a range based on real reference patterns of average tornado lifetimes, movement speeds, and probability of movement. I've also chosen only to give the user the option of a tornado family and not the reproduction probability since tornado families are very rare, I thought hard-coding the probability to 0.1% would be best, rather than give the user the chance to make a large probability and therefore unrealistic model. Since I'm not modeling the rotation of the tornado winds I did not specify how the trees should be thrown as that would become a little more complicated, so I'm throwing the trees in a random direction as if the wind rotation is unknown. As mentioned earlier, I'm still looking for reference patterns to give me the rationale for the damage model.

Model output:

The system is behaving exactly how I want it to so far. The only thing that is left is to incorporate a damage model to accurately calculate the damage tornadoes must have done to the city based on a reference pattern. The damage is not being calculated accurately as yet since I have not yet come up with a good model or a reference pattern for the damage. However, trees are being thrown and tornado movement seems to be accurate. I'm also wondering if I should show the damage visually in some way to the buildings and houses – either by color change or changing their shape depending on the damage done to it.

Questions:

I'm figuring out how to model the damage done – I will be using real data as a reference point, but I'm figuring out what to put emphasis on. I know that the tornado strength and perhaps movement speed will matter, as well as the amount of time the tornado spends on that particular building/home which will hurt it exponentially. The exact mathematical damage model is still being figured out.

Next steps:

I'm also going to try and finalize the damage model and see how I will incorporate all the components into determining final damage done. This is all that is really left. I believe everything else is done rather accurately, to the best of my ability.