Formation of Wind

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Background:

Wind in simple terms is the movement of air. Often, this movement is caused by temperature differences in the atmosphere due to solar heating.

Tornadoes are formed when two regions of air, one hot and one cold, meet and create violent funnels of wind.

Goal:

- Calculate wind location, direction, and speed from different sets of initial conditions

Possible Objectives:

1. Track pressure changes in the atmosphere down to ground level and calculate wind speed on the ground assuming that everything begins at isobaric, thermal equilibrium (to eliminate other effects)
2. Simulate the movement of a cloud
3. Simulate a tornado from the necessary initial conditions

Approach:

Necessary Data:

- atmospheric layer locations
- distribution of solar radiation energy
- air temperatures
- air moisture levels
- air densities

Steps:

1. create array of air densities, moisture levels, pressures, temperatures and velocities
2. calculate energy being added to air
3. calculate air pressures
4. calculate velocities of air
5. calculate resultant change in pressures
6. calculate new pressures
7. repeat steps 4-6 for all time steps

Important Equations and Techniques:

- Vorticity equation
- Momentum equation
- Hydrostatic balance
- Geostrophic balance

Objective 1:

1. Follow steps with array in step one constant for all entries

Objective 2:

1. Take the result of Objective 1 (gives more realistic values than constant values) or find values
2. Scale the moisture levels of a region to the moisture levels of a cloud
3. Simulate

Objective 3:

1. Take the result of Objective 1 (gives more realistic values than constant values) or find values
2. Scale two areas of the array to create one hot and one cold region (conditions for tornado)
3. Simulate

Resources:

- http://www.uio.no/studier/emner/matnat/geofag/GEF4500/h08/unisdyn1.pdf
- http://www.cgd.ucar.edu/staff/islas/teaching/2_Equations.pdf