



Atmospheric electricity education through laboratory demonstrations

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Lightning is a widely-experienced atmospheric phenomenon, which is commonly recognised as electrical in origin. Studying atmospheric electrical effects in the classroom, however, generally requires high voltage sources and in some cases may not be possible because of safety considerations. Generating high voltages through electrostatics can provide good and controllable laboratory demonstrations, through which phenomena related to lightning discharges can be experienced and explained. The Kelvin water dropper generator, for example, can be constructed simply, and used to generate sufficiently high voltages to cause small sparks with just water and gravity. This provides a basis for explaining inductive charging and the polarisation of water droplets, and a source of detectable radio frequency energy from the discharge. Another electrostatic generator is the classical Wimshurst machine, which readily generates large voltages in a few seconds. This has also been used in a classroom demonstration context with a group of students. With the addition of an optically-isolated voltmeter, the breakdown strength of air can be estimated. Taken together, these two educational approaches provide illustrations of charge transfer on water drops, and the electrical breakdown of air. This adds an experiential element to education about atmospheric electricity that can be explained at a variety of technical levels, from school children to the general public to final year undergraduate students.