Scientists working on technique to use lasers to force rain

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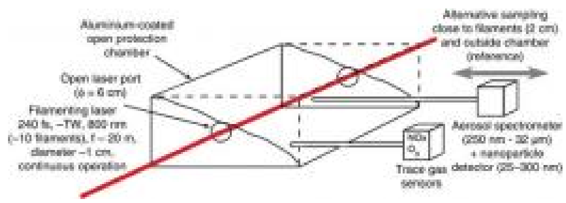

Experimental setup. Image: NPG, doi:10.1038/ncomms1462

(PhysOrg.com) -- As with many of man's most basic ancient desires; to be able to fly, to become invisible etc. making it rain on command (or by prayer) has always been high on the list, and up to now, has proved more elusive than other advances in the sciences. Now however, physicists in Switzerland might have finally made a breakthrough. In their paper published in *Nature Communications*, they describe a method whereby a laser is used to create nitric acid particles in the air to which moisture will gravitate forming droplets.

To test their theory, the researchers, led by Jérôme Kasparian, physicist at the University of Geneva, hauled their laser, called the Teramobile mobile femtosecond-Terawatt laser system, to a an area near the Rhône river and commenced to firing it into the sky (on a very humid day - over 70%) for 113 hours. To ensure their results were constrained to one area, wind shields were used. They then sampled the aerosols alternatively at 2 cm distances in the areas where they expected to see nitric acid particles form. In so doing they found that their efforts did indeed result in the creation of nitric acid particles which caused water droplets to form on the order of a few microns in size.

While the water droplets formed were clearly not nearly large or heavy enough to fall as rain, the results are encouraging because up to now, the best hope for forcing nature's hand has been to seed clouds with silver nitrate or dry ice, neither of which has so far been proven to actually work.

Unfortunately, despite the initial success of the project, it appears the idea of using lasers to control rain is still largely theoretical due to the uncertainty of whether the same technique can be used to make larger drops, and whether or not it would then be possible to use the technique in a big enough way to create a meaningful amount of rainfall (or whether there is a risk that larger drops might actually fall as nitric acid rain). Also, would the laser technique be useful in areas that need it most because of droughts, etc? And if so, what would that mean for the environment; if such rainmakers were activated all over the planet for example, would the resultant additional cloud cover serve to reduce global temperatures as they reflect back some of the sun's heat as suggested by other studies? Would it cause wars over rain rights as is now the case with water rights?

Clearly the development of such technology would create a situation where there would be more at stake than simple matters of physics.

More information: Field measurements suggest the mechanism of laser-assisted water condensation, *Nature Communications* 2, Article number: 456 doi:10.1038/ncomms1462

Abstract

Because of the potential impact on agriculture and other key human

activities, efforts have been dedicated to the local control of precipitation. The most common approach consists of dispersing small particles of dry ice, silver iodide, or other salts in the atmosphere. Here we show, using field experiments conducted under various atmospheric conditions, that laser filaments can induce water condensation and fast droplet growth up to several μm in diameter in the atmosphere as soon as the relative humidity exceeds 70%. We propose that this effect relies mainly on photochemical formation of p.p.m.-range concentrations of hygroscopic HNO3, allowing efficient binary HNO3–H2O condensation in the laser filaments. Thermodynamic, as well as kinetic, numerical modelling based on this scenario semiquantitatively reproduces the experimental results, suggesting that particle stabilization by HNO3 has a substantial role in the laser-induced condensation.