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AUTHOR: Tverskoy, N. P.

TITLE: The problem of coagulation of fog droplets by sonic oscillations

SOURCE: Leningrad. Glavnaya geofizicheskaya observatoriya. Trudy*, no. 145, 1963. Voprosy* fiziki oblakov i aktivny*kh vozdeystviy, 36-48

TOPIC TAGS: meteorology, fog, droplet coagulation, sonic oscillation, fog dispersal, weather modification

ABSTRACT: The mechanism of coagulation of fog droplets under the influence of sonic oscillations is reviewed. The orthokinetic theory cannot explain this mechanism. The difference in the amplitudes of oscillation of droplets of various sizes cannot be responsible for the fusion of droplets because the distance between droplets at a liquid water content $w = 0.1\ g/m^3$ is greater than the difference in the amplitudes of oscillation. This theory applies only when droplets already have regrouped under the influence of sonic oscillations and converge to distances comparable to the amplitude of oscillation under the influence of other processes. According to the hydrodynamic theory, droplet coagulation increases with an increase in the dimension of droplets and increases with an increase of

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the frequency of sonic oscillations (to a certain limit). With an increase of sonic intensity the effect increases, but to a lesser degree than according to the orthokinetic theory; coagulation proceeds most intensively when the droplet density is high. Hydrodynamic forces of interaction, considered together with oscillatory motions of fog droplets in a high-frequency sound field, can exert a substantial influence on coagulation of fog droplets greater than 1 micron in diameter. Formulas describing the coagulation of droplets under the influence of sonic pressure are cited and the effect of intense sonic waves on a fog described. The enlargement and falling of droplets is described as follows. In a field of intense sonic oscillations the droplets come into complex oscillatory motion. Under the influence of a shock wave they break up into finer droplets. Some evaporate in the sonic field due to thermal heating and others move perpendicular to the sonic wave front. Near the sonic source the droplets are being blown away or evaporated continuously. The sonic wave front changes as it moves and harmonics appear in the propagating frequency which are caused by the presence of "broken" droplets in the medium. At a great distance from the source the droplets, still with oscillatory motion, will regroup into denser complexes. Depending on the oscillatory frequency these complexes will have different groupings and distances and the droplets in the complex will begin to fuse and enlarge and then fall under the influence of gravity. Hydrodynamic and radiation forces

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also induce a shortening of the distance between droplets and their coagulation. These processes are most effective at frequencies of the order of several thousand cycles per second. Low frequencies are best for dense fogs. However, because droplets of various sizes are present the frequency of the sonic oscillations must be varied within certain limits and certain optimum value must be selected due to the increase of attenuation with increase of sonic frequency; the recommended range is 1500 to 5000 cps. Sonic oscillations having an intensity at point of effect of 0.5 watt/cm^2 in the indicated frequency range can disperse a fog in seconds. Orig. art. has: 29 formulas, 3 figures and 2 tables.

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