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Cloud modification

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**[Project Gulf Q a Study of Maritime Cumulus Modification.](#)** Dec 1970 30 pages

Authors: [W. C. White](#); [R. S. Clark](#); [J. R. Ennis](#); [H. E. Cronin](#); [NAVAL WEAPONS CENTER CHINA LAKE CA](#)

... through 28 May 1969 at Brownsville, Tex. The objective was to study the **modification** of warm tropical cumulus clouds by seeding them with hygroscopic solutions that had exhibited considerable warm **cloud modification** potential. These solutions were sprayed from aircraft on all of the 16 tests completed during the project ... attributable to this treatment were observed in all tests. When **cloud** growth occurred after seeding, there were frequently ... content and turbulence, especially in the upper half of the target **cloud**. On five tests the seeded clouds completely dissipated within 5 ...

**Full Text**

**[Development of 2-Dimensional Cloud Rise Model to Analyze Initial Nuclear Cloud Rise](#)** Mar 2005 109 pages

Authors: [Karson A. Sandman](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF ENGINEERING AND MANAGEMENT](#)

... rise model that could be used instead of the current 1-D **cloud** rise model in the Defense Land Fallout Interpretive Code ( ... more detailed definition of the physical properties within the mushroom **cloud** than the 1-D DELFIC option. This is particularly useful in ... , and particle location within the rising/risen **cloud**. The analysis model created for this study is the result of modifications to a convective **cloud** simulation. The primary **modification** to the convective **cloud** model is the incorporation of initial conditions for a nuclear **cloud** similar to those used in DELFIC's initial conditions module.

**Full Text**

**[Estimates for the Probabilities of Surface-to-Air Cloud-Free Lines-of- Sight and Low Cloud Statistics from Ship Observations. Part 1. Fifteen Marine Locations](#)** Nov 24, 1980 169 pages

Authors: [B. S. Katz](#); [F. C. DeBold](#); [J. J. Perez-Esandi](#); [NAVAL SURFACE WEAPONS CENTER SILVER SPRING MD](#)

... (PCFLOS) were calculated for a set of nine angles using a **modification** of Lund and Shanklin's universal method from lower **cloud** weather data taken at fifteen marine locations. The data ... (1964-1971) and provides statistics for seasonal variations of lower **cloud** base heights and cover and low **cloud** type ... degrees above the horizontal and for the heights for which lower **cloud** base data were available. The main assumption of the ... method can be applied successfully to the statistics for individual low **cloud** base height recording cells. Intermediate computational results corresponding ...

**Full Text**

**[Experimental and Modeling Studies of Interactions of Marine Aerosols and Clouds](#)** May 31, 1997 8 pages

Authors: [Sonia M. Kreidenweis](#); [COLORADO STATE UNIV FORT COLLINS](#)

... following key questions regarding marine aerosol/ **cloud** interactions: (1) What factors control the abundance and ... model description of aerosol evolution and aerosol / **cloud** interaction that can be applied to a variety of marine ... model for prediction of the effects of aerosol characteristics on **cloud** formation and evolution, and, in turn, ... effects of **cloud** processes on the marine aerosol. The models built in this project can be used to study the role of aerosol in **cloud modification**, including ship tracks and ... aimed at elucidating some important aerosol / **cloud** interactions, and to adapt and use ...

**Full Text**

**[The Behavior of Cloud Droplets in an Acoustic Field: A Numerical Investigation](#)** Aug 1985 107 pages

Authors: [Michael P. Foster](#); [ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND WSMR NM ATMOSPHERIC SCIENCES LAB](#)

... the study of atmospheric phenomena may provide insight to the effect of thunder on **cloud** and precipitation processes as well as providing the basis for a new technology in weather **modification**. In this thesis the theory of acoustic agglomeration is described and a one-droplet model is developed to study the effects of acoustic waves on **cloud** droplets. A stochastic model used to predict changes in **cloud** droplet ... sedimentation is modified to simulate the application of acoustic energy to various **cloud** volumes. The results are discussed and suggestions are made for further ...

**Full Text**

**[A Comprehensive Report on Nineteen Condensation Nuclei. Part 2](#)** Jan 1971 279 pages

Authors: [Richard D. H. Low](#); [ARMY ELECTRONICS COMMAND WHITE SANDS MISSILE RANGE NM ATMOSPHERIC SCIENCES LAB](#)

... single parameter to denote the hygroscopicity of the nucleus and which includes an additional term to reflect

[Full Text](#) the inefficiency of the condensation process. This volume and its predecessor serve as a valuable reference for the experimental **cloud** physicist in his study of the growth behaviors of condensation nuclei and for the field **cloud** physicist in his selection of the proper artificial nuclei for warm fog or **cloud modification**.

[Project Foggy Cloud I.](#) Aug 1970 85 pages  
 Authors: [E. Alex Blometh](#); [R. S. Clark](#); [H. E. Cronin](#); [J. R. Ennis](#); [R. L. Lininger](#); [NAVAL WEAPONS CENTER CHINA LAKE CA](#)

[Full Text](#) Foggy **Cloud I** was a series of experiments in observation, **modification**, and treatment of fog and stratus clouds conducted at or near the Arcata-Eureka airport, Humboldt County, Calif., from late March through mid-November 1968. A ... enough identifiable effects to indicate promise were investigated in detail and improved upon. Observations were made of fog characteristics, visual effects, changes in **cloud** physics parameters, and of the fallout from the fog. Hygroscopic smokes were found useful for intensifying, stabilizing, and forming fog and stratus. Hygroscopic powders, ...

[Analysis of Shiptrack Persistence With Insitu Cloud Measurements and Satellite Retrieved Reflectance](#) Mar 1996 96 pages  
 Authors: [Scott A. Tessmer](#); [NAVAL POSTGRADUATE SCHOOL MONTEREY CA](#)

[Full Text](#) ... than expected. A simple model of physical processes is developed to correlate the ship injected aerosols to the subsequent effects on **cloud** condensation nuclei, droplet distribution, effective radius, and albedo. The theoretical dispersion model is tested using measured values ... in the observed down-track fractional change of droplet concentration disputes the decreasing fractional changes of droplets predicted by dispersion associated with track widening. The results indicate downtrack **modification of cloud** and droplet concentrations able to maintain track brightness and track detection life.

[Step Potential Modification by the Lightning Electromagnetic Environment](#) Sep 1996 13 pages  
 Authors: [John M. Tobias](#); [ARMY COMMUNICATIONS-ELECTRONICS COMMAND FORT MONMOUTH NJ](#)

[Full Text](#) ... This step potential examination considers the space charge region developed in the earth as a consequence of the charge present in a thunderstorm **cloud**. It is theorized that, under certain conditions, the step potential may be significantly higher than previous theoretical estimates, or empirical results obtained under fine weather electric field conditions. The objective of this report is to present the theory of the influence of the **cloud** charge on current distribution and, hence, step potential by citing recent qualitative observations of rocket-triggered lightning studies. ...

[Experimental and Modeling Studies of Interactions of Marine Aerosols and Clouds](#) May 31, 1995 13 pages  
 Authors: [Sonia M. Kreidenweis](#); [COLORADO STATE UNIV FORT COLLINS](#)

[Full Text](#) ... objectives of the modeling component are to develop models of the marine boundary layer, including models that predict **cloud** formation and evolution and the effects of such processes on the marine aerosol (and vice versa). It is anticipated that the modeling techniques built in this project can be used to study the role of aerosol in **cloud modification**, including ship tracks. The objectives of the experimental component are to evaluate new techniques for aerosol characterization and adapt these for field (shipboard and ground) deployment, particularly ...

[Delivery and Development of a Day/Night Whole Sky Imager with Enhanced Angular Alignment for Full 24 Hour Cloud Distribution Assessment](#) Mar 1997 19 pages  
 Authors: [Janet E. Shields](#); [Richard W. Johnson](#); [Monette E. Karr](#); [Richard A. Weymouth](#); [David S. Sauer](#); [SCRIPPS INSTITUTION OF OCEANOGRAPHY LA JOLLA CA MARINE PHYSICAL LAB](#)

[Full Text](#) The Whole Sky Imager is a ground-based digital imaging system for assessment of **cloud** cover over the full upper hemisphere. Using a fisheye lens and a slow scan CCD sensor, it acquires imagery under daylight, moonlight and starlight conditions. This contract funding enabled Marine Physical Lab ... Sky Imager to the Air Force, with several enhancements. The primary enhancements funded under this contract included more accurate alignment with respect to the sky field, detailed documentation, and enhancement of the software to allow interactive **modification** of the data acquisition from remote sites.

[STUDIES OF EFFECTS OF BOUNDARY MODIFICATION IN PROBLEMS OF SMALL AREA METEOROLOGY](#) Apr 1969 187 pages  
 Authors: [Heinz H. Lettau](#); [Charles R. Stearns](#); [WISCONSIN UNIV-MADISON DEPT OF METEOROLOGY](#)

[Full Text](#) Contents: Evapotranspiration climatology; Estimates of vorticity, divergence, and vertical velocity in a surface layer; Thermal response of a plant canopy to drifting **cloud** shadows; Thermal response of a concrete slab to controlled daytime and nighttime cycles of radiation; Topographic influence on tornado tracks and frequencies in Wisconsin and Arkansas; The theory of variangular wind spirals; The determination of the surface roughness from wind speed and air temperature profiles in the surface layer; Thermo-tidal winds in an equivalent barotropic boundary layer; Note on aerodynamic ...

[A Maritime and Continental Aerosol-Cloud Interaction Study From ASTEX '92](#) Dec 1992 114 pages  
 Authors: [Karen M. Ruppe](#); [NAVAL POSTGRADUATE SCHOOL MONTEREY CA](#)

[Full Text](#) ... by particle size index, optical depth, and low **cloud** analysis at visible and 3.7 micrometers wavelengths. Use of ... to resolve aerosol type and distribution prove useful in determining implications of **cloud** reflectance changes due to **modification** by aerosol particles. Air masses were clearly defined and showed distinctive signatures in aerosol characteristics and **cloud** reflectances at 3.7 micrometers wavelengths. Air mass characteristic sources consisted ... Europe and desert dust from the Sahara Desert.... Satellite **cloud** analysis, **Cloud** distribution, Aerosol distribution, Aerosol classification.

[STATBIC - A Method for Inclusion of Fractal Statistics in Obscurant Transport](#)

Apr 1998

34 pages

[Models](#)Authors: [Sean G. O'Brien](#); [Donald W. Hoock](#); [ARMY RESEARCH LAB WHITE SANDS MISSILE RANGE NM](#)

A generic texture routine was developed for upgrading smooth obscurant **cloud** models by introduction of time and space dependent fluctuations in line ... for mean or average aerosol concentration contributions in the obscurant **cloud**. Atmospheric turbulence and eddy structures are the underlying ... algorithms that provide either two-dimensional propagation overlays for image **modification** or three-dimensional volume fluctuations. Path integrated concentration, LOS propagation fluctuations, and realistic **cloud** imaging are then simulated by multiplication of pseudorandom fluctuation outputs with ...

[Full Text](#)[Simulating Wet Deposition of Radiocesium from the Chernobyl Accident](#)

Mar 2001

124 pages

Authors: [Aaron M. Kinser](#); [AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF ENGINEERING AND MANAGEMENT](#)

... of the airborne Chernobyl cesium was wet deposited, either via interception by falling raindrops or via absorption into **cloud** droplets destined to become raindrops. The Hybrid Single- Particle Lagrangian rated Transport (HYSPLIT) model, developed at Air Resources Laboratory, is used to simulate the transport and deposition of Chernobyl cesium-137. A **cloud** base parameterization **modification** is tested and appears to slightly improve the accuracy of one HYSPLIT simulation of daily Chernobyl cesium-137 deposition over the course of the accident ...

[Full Text](#)[Research in Numerical Analysis Techniques for Fog Model Simulation.](#)

Nov 15, 1971

48 pages

Authors: [Russell C. Serbagi](#); [DIGITAL PROGRAMMING SERVICES INC WALTHAM MASS](#)

... transport and condensation processes of clouds. The models considered include two dimensional warm fog seeding, one dimensional cumulus **cloud** formation, and three dimensional warm fog **modification** by external heat sources. The finite difference techniques used and the stability criteria are discussed. A series of computer ... The meteorological data collected is reduced into a usable form such that computer studies relative to the growth, structure, and **modification** techniques of convective clouds can be made. (Author)

[Full Text](#)[Urban Influences on Convection and Lightning Over Houston](#)

2006

185 pages

Authors: [Michael L. Gauthier](#); [ALABAMA UNIV IN HUNTSVILLE SCHOOL OF GRADUATE STUDIES AND RESEARCH](#)

... anthropogenic, influences on convection as it relates to lightning production and precipitation structure. In general, inadvertent weather **modification** hypotheses offered to explain lightning and rainfall anomalies rely on either or both perturbations in the spatial distribution and intensity of convection (from whence warm-season rainfall and lightning emanate), or **modification** to convective **cloud** microphysics through aerosol loading over and downwind of polluted cities such as Houston. Using eight independent datasets, causative mechanisms to explain ...

[Full Text](#)[Preliminary Design for Dredged Material Placement Physical Modeling Facilities](#)

Dec 1992

57 pages

Authors: [Mills Soldate](#); [James R. Pagenkopf](#); [Michael R. Morton](#); [TETRA TECH INC ARLINGTON VA](#)

The feasibility of performing laboratory experiments to aid in the **modification** and enhancement of existing numerical models for predicting the physical fate of dredged material discharged into open water is addressed. First, appropriate ... determine the general design requirements of the test facility. These requirements include the types of equipment and measurement techniques required to monitor rates of **cloud** entrainment, rates of spreading on the bottom, disposal material properties, suspended sediment concentrations, and other parameters of interest. Typical testing scenarios for various ...

[Full Text](#)[Symposium on Turbulence \(13th\) Held at Rolla, Missouri on September 21- 23, 1992](#)

Sep 1992

574 pages

Authors: [X. B. Reed](#); [Gary K. Patterson](#); [Jacques L. Zakin](#); [MISSOURI UNIV-ROLLA DEPT OF CHEMICAL ENGINEERING](#)

... effects in turbulent flows; laser-Doppler, hot wire, and hot film anemometry; novel measurement techniques; flow visualization, holography, image analysis; boundary layer **modification** and control; interactions of turbulence with wave structures; wind-generated waves and other oceanographic applications; atmospheric boundary layers and turbulence; implications of turbulence in the environment (including pollution, estuarial and tidal channel flows, plumes, **cloud** physics); industrial, aeronautical, and astronautical applications.

[Full Text](#)[Applications of Spectral Microwave Radiometry to Sensing of Sea Ice and the Ocean Surface](#)

May 1993

106 pages

Authors: [Karen M. St Germain](#); [MASSACHUSETTS UNIV AMHERST DEPT OF ELECTRICAL AND COMPUTER ENGINEERING](#)

... examined with regard to the 19, 22, 37, and 85 GHz channels of the SSM/I system. The atmospheric vapor and **cloud** liquid water attenuation was empirically modeled with respect to frequency and atmospheric temperature. The mean atmospheric temperature was empirically linked to ... speed. With the significant environmental variables parameterized, two algorithms for analysis of polar SSM/I data were developed. The first is a simple **modification** that adds the capability of determining ice temperature to an existing algorithm. The second is a weather correcting algorithm significantly more complex than ...

[Full Text](#)[Multiple Instrument Studies of Chemical Releases and Heating at Arecibo](#)

Mar 1994

44 pages

Authors: [R. C. Livingston](#); [C. J. Heinselman](#); [J. F. Vickrey](#); [R. T. Tsunoda](#); [SRI INTERNATIONAL MENLO PARK CA](#)

... the dawn F region -- two into the natural ionosphere and one into an ionosphere modified by HF heating.

Extended periods of HF **modification** prior to the rocket launches also provided an opportunity to study heating effects, per se. This report reviews some preliminary results from three participating instruments: (1) ion-line mapping made by the Arecibo incoherent scatter radar, (2) HF backscatter characterization and tracking of the barium **cloud**, and (3) transionospheric propagation diagnosis of large and medium scale structure produced by heating and the barium releases. The data that are ...

[Full Text](#)

#### [Survey of the Thermal Threat of Nuclear Weapons](#)

May 1964

357 pages

Authors: [Jack C. Rogers](#); [T. Miller](#); [STANFORD RESEARCH INST MENLO PARK CA](#)

... the enemy, warhead types and yields, altitude of detonation, timing, and warning) in determining the characteristics of thermal radiation and the susceptibility of targets to thermal damage; **Modification** of the thermal radiation by the atmosphere, intervening **cloud** layers or other meteorological features, and target elements, such as trees and topography; Interaction of blast, radioactivity, and thermal radiation phenomena; Response of target elements ...

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