

AtSc 252 Applied Weather Modification Study Guide: Spring 2022 - Exam 3

Section I

Weather Modification Projects and Aircraft Research Experience

- North Dakota Cloud Modification Project Location, Flight Hours, and Partners
- Aircraft Seeding Equipment and Activities
- Types of Aircraft Flight Activities
- Research Aircraft Projects, Activities and Objectives

Weather Modification History and Critical Thinking

- Weather Modification Pioneers
- First Test: Results and Experiments
- Operational Programs Locations
- Analyze to Formulate Conclusions/Opinions

Legal, Environmental and Sociological

- Licenses/Permits, Laws, and Liability
- Water Rights
- Cloud Seeding Environmental Impacts
- Effect of Silver Iodide (AgI)
- Public Awareness, Concerns and Fears

Economics and Inadvertent Modification

- Costs and Benefits
- North Dakota Economic Impacts
- Scale of Possible Effects
- Possible Mechanisms for Inadvertent Effects
- Urban and Rural Impacts

Evaluation of Weather Modification Projects

- Black Box and Physical
- Operational Evaluations Issue
- Distribution, Hypothesis Testing and P-values
- Statistical Evaluation Methods
- Evaluation of North Dakota Cloud Modification Projects

Aerosols, Water and Nucleation

- Aerosol, Cloud Condensation Nuclei (CCN) and Ice Nucle (IN) Concentrations and Sizes
- Atmospheric Aerosols Vertical, Horizontal and Temporal Distribution
- Sources, Sinks and Composition
- Energy and Phases of Water
- Saturation and Changes
- Equilibrium of Water
- Mechanisms of Ice Crystal Nucleation
- Ice Nucleation Activity as a Function of Temperature

Section II

Droplet Growth and Ice Nuclei Activation

- Solute and Curvature Effects
- Köhler (Koehler) Curve
- Growing Droplets and Cloud Formation
- Effectiveness of Ice Nuclei
- Activation of Ice Nuclei

Ice Crystal Growth

- Equilibrium Vapor Pressure
- Mixed Phase Clouds

Basic Clouds

- Convective Clouds
- Ice Clouds

Cloud Dynamics

- Cold Rain Process
- Warm Rain Process

Conceptual Models

- Updraft Speed

Precipitation Models

- Microphysical Seeding
- Dynamic Seeding
- Over-seeding
- Orographic Precipitation Enhancement

Hail Suppression Conceptual Models

- Hail Growth
- Precipitation Augmentation
- Types of Hail Suppression Conceptual Models
- National Hail Research Experiments

North Dakota Cloud Modification Project (NDCMP) Conceptual Model

- Natural Hail Process
- Cloud Seeding Hypothesis
- Feeder and Mature Cells
- Multi-cell Storms

Section III

Fog Abatement

- Types of Fog

- How to modify different types of fog?

Lightning Suppression

- Fair Weather Charge Field

- Cloud Charging Mechanisms

- Lightning Modification Concepts

Hurricane Modification

- Hurricane Characteristics

- Project Stormfury Results

- Possible Modification Theories

Seeding Materials

- Types of Cloud Seeding Materials

- Types of Cloud Seeding Equipment

- Cloud Seeding Efficiency, Activity, Activation, Deactivation

Dry Ice as Seeding Agent

- History of Dry Ice Seeding

- How does Dry Ice work?

- Where and When to Use Dry Ice

- Using Dry Ice

Seeding Agent Dispersal

- Release of Cooling Agents

- Release of Ice Nuclei

Seeding Equipment and Methods

- Airborne and Ground based Seeding

- Cloud Top and Cloud Base Seeding

- Pyrotechnic Methods

- Reaction Times of Seeding Agents

Radar for Weather Modification

- Radar Measurements and Detection

- Radar Measurements from Aircraft

- Components of a Radar System

- Types of Radar Displays

- Characteristics of Electromagnetic Radiation

- Radar Terms and Types

- Dependence of Radar Echos

- Levels of Radar Reflectivity

- Height of Radar Beams

- Radar Attenuation

- Radar Beam Characteristics

- Doppler Radar

Record-keeping (PARS System)

Components and Cost of Seeding Solution

Reason for Record-keeping

Pilot/Co-pilot Typical Roles and Employment

Peak Aircraft Launch Times for NDCMP