

Contents

Volume 1. Precipitation Scavenging

CLOUD STUDIES

Airborne Measurements

| | |
|---|----|
| The Role of Cloud Dynamics in Redistributing Pollutants and the Implications for Scavenging Studies | 1 |
| <i>G.A. Isaac, J.W. Strapp, H.A. Wiebe, W.R. Leitch, J.B. Kerr, K.G. Anlauf, P.W. Summers and J.I. Macpherson</i> | |
| Cloudwater Acidity Measurements and Formation Mechanisms-- Experimental Design | 15 |
| <i>Stephen E. Schwartz, Peter H. Daum, Mark R. Hjelmfelt and Leonard Newman</i> | |
| Studies of the Gas- and Aqueous-Phase Composition of Stratiform Clouds | 31 |
| <i>Peter H. Daum, Stephen E. Schwartz and Leonard Newman</i> | |
| Measurements of Scavenging and Transformation of Aerosol Inside Cumulus | 53 |
| <i>W. R. Leitch, J.W. Strapp, H.A. Wiebe and G.A. Isaac</i> | |
| Preliminary Measurements of the Size Distribution of Cloud Interstitial Aerosol | 71 |
| <i>Lawrence F. Radke</i> | |
| Preliminary Measurements on the Scavenging of Sulfate and Nitrate by Clouds | 79 |
| <i>Dean A. Hegg and Peter V. Hobbs</i> | |
| In-Cloud Scavenging and Resuspension of Cloud Active Aerosols during Winter Storms over Lake Michigan | 91 |
| <i>V.K. Saxena and A.H. Hendier</i> | |

Surface Measurements

| | |
|--|-----|
| Cloud Water Chemistry at Whiteface Mountain | 103 |
| <i>John Kadlecek, Scott McLaren, Nancy Camarota, Volker Mohnen and Jerre Wilson</i> | |
| Characteristics of Non-Precipitating Stratiform Clouds | 115 |
| <i>Raymond A. Castillo and James E. Jiusto</i> | |
| Design and Calibration of a Rotating Arm Collector for Ambient Fog Sampling | 125 |
| <i>Daniel J. Jacob, Richard C. Flagan, Jed M. Waldman and Michael R. Hoffmann</i> | |
| Fogwater Composition in Southern California | 137 |
| <i>J.M. Waldman, J.W. Munger, D.J. Jacob, and M.R. Hoffmann</i> | |
| The Chemistry of Nighttime Urban Fog | 149 |
| <i>Daniel J. Jacob and Michael R. Hoffmann</i> | |
| Pollutant Deposition as a Result of Interception of Wind-Driven Cloud Measurements Made at a Site in Northern England | 161 |
| <i>G. J. Dollard and M.H. Unsworth</i> | |
| Cloud Water: An Important Vector of Atmospheric Deposition | 171 |
| <i>Gary M. Lovett and William A. Reiners</i> | |
| The Significance of Snow Crystal and Mountain-Surface Riming to the Removal of Atmospheric Trace Constituents from Cold Clouds | 181 |
| <i>Randolph D. Borys, Paul J. Demott, Edward E. Hindman, and Daxiong Feng</i> | |

PRECIPITATION CHEMISTRY

| | |
|--|-----|
| Characterization of the Inorganic Chemistry of the Precipitation of North America | 191 |
| <i>Richard G. Semonin and Van C. Bowersox</i> | |
| The Dependence of Sulphate Scavenging Ratios on Meteorological Variables | 203 |
| <i>Len Barrie and Jacob Neustadter</i> | |
| Scavenging Ratios for Exceptional Wet SO_4^{2-} Episodes in Eastern North America from Three Event Networks | 217 |
| <i>Brand L. Niemann</i> | |
| Correlation of Intrastorm Sequential Precipitation Chemistry with Storm Meteorology | 229 |
| <i>Jerre Wilson, Richard Graham, and John Robertson</i> | |
| Tracking the Source Regions for Wet Deposition in the Netherlands by a Combination of Cluster Analysis and Meteorological Interpretation | 239 |
| <i>J. Slanina and W.A.H. Asman</i> | |
| Differential Rain and Snow Scavenging Efficiency Implied by Ionic Concentration Differences in Winter Precipitation | 249 |
| <i>Gilbert S. Raynor and Janet V. Hayes</i> | |
| Interpretation of Sequential Rain Sampling Results | 265 |
| <i>Willem A.H. Asman, Piet Jonker, Jakob Slanina, and Jan H. Baard</i> | |
| Vertical Variability and Short-Term Temporal Trends in Precipitation Chemistry | 275 |
| <i>J.W. Munger, J.M. Waldman, D.J. Jacob and M.R. Hoffmann</i> | |
| Nitrate in Precipitation: How Are the Observed Concentrations Explained? | 283 |
| <i>Elmar R. Altwicker</i> | |
| The Scavenging of Nitric Acid Vapor by Snow | 293 |
| <i>Barry J. Huebert, F.C. Fehsenfeld, R.B. Norton and D. Albritton</i> | |
| Precipitation Scavenging of Submicron Particles Released by Rockets into Convective Clouds | 303 |
| <i>J.P. Lacaux and J.A. Warburton</i> | |
| Rate and Chemistry of Wet Deposition Derived from Time Series of Natural Radioactivity | 315 |
| <i>W. Weiss, C.H. Wagner, P. Schlosser, H. Stockburger, H. Sartorius, J. Volpp, R. Ditschmann, D. Wagenback and K.O. Münnick</i> | |
| Case Study of Aerosol Size Distribution and Chemistry during Passages of a Cold and a Warm Front | 323 |
| <i>C.M. Sheih, S.A. Johnson, and F.T. Depaul</i> | |
| PLUME STUDIES | |
| Scavenging Measurements near Large Point Sources: A Review and Evaluation | 335 |
| <i>M. Terry Dana and A.A.N. Patrinos</i> | |
| Estimation of Wet Deposition from a Plume of A Powerplant and of the Corresponding Background Concentration | 349 |
| <i>J. Slanina, F.G. Romer and W.A.H. Asman</i> | |
| Oxygen-18 Estimation of Primary Sulfate in Total Sulfate Scavenged by Rain from A Power Plant Plume | 357 |
| <i>Ben D. Holt, Eugene Nielsen and Romesh Kumar</i> | |

| | |
|---|-----|
| Scavenging Rates of Sulfur and Trace Metals from a Smelter Plume | 369 |
| <i>M.A. Lusic, W.H. Chan, A.J.S. Tang and N.D. Johnson</i> | |
| Precipitation Scavenging and Dry Deposition of Pollutants from the INCO Nickel-Smelter in Sudbury | 383 |
| <i>W.H. Chan, C.U. Ro, R.J. Vet, A.J.S. Tang and M.A. Lusic</i> | |
| GAS SCAVENGING | |
| Distribution of Polycyclic Aromatic Hydrocarbons in Precipitation . . . | 395 |
| <i>Hans-Walter Georgii and Günther Schmitt</i> | |
| Organic Compounds in Los Angeles and Portland Rain: Identities, Concentrations, and Operative Scavenging Mechanisms | 403 |
| <i>James F. Pankow, Lorne M. Isabelle, William E. Asher, Toni J. Kristensen and Mary E. Peterson</i> | |
| Effects of Organic Surface Films on the Scavenging of Atmospheric Gases by Raindrops and Aerosol Particles | 417 |
| <i>T.E. Graedel, P.S. Gill and C.J. Weschler</i> | |
| The Coupled Gas-Phase/Aqueous Phase Free Radical Chemistry of a Cloud | 431 |
| <i>William L. Chameides and Douglas D. Davis</i> | |
| A Theoretical and Experimental Study of SO ₂ Scavenging by Cloud and Rain Drops | 445 |
| <i>C. Walcek, S. Mitra, J. Topalian and H.R. Pruppacher</i> | |
| Kinetics of Oxidation of Aqueous Sulfur(IV) by Nitrogen Dioxide | 453 |
| <i>Yin-Nan Lee and Stephen E. Schwartz</i> | |
| MICROPHYSICS | |
| Laboratory Measurements of Aerosol Activity Spectra Enhanced by the Aqueous Phase Oxidation of SO ₂ | 471 |
| <i>Dennis Lamb, Alan Gertler, Norm Robinson, Ulrich Katz and David Miller</i> | |
| Solubility Measurements of Aerosols in the "Greenfield Gap" to Determine Efficiency of In-Cloud Scavenging by Nucleation | 483 |
| <i>D.J. Alofs and M.B. Trueblood</i> | |
| Deposition of Submicron Particulates on Model Scavengers | 493 |
| <i>Josef Podzimek and Jon J. Martin</i> | |
| The Scavenging of Submicron Particles in Mixed Clouds: Physical Mechanisms - Laboratory Experiments | 505 |
| <i>Franco Prodi</i> | |
| Particle Scavenging by Evaporating Cloud Drops | 517 |
| <i>K.V. Beard, Harry T. Ochs, III, and K.H. Leong</i> | |
| A Comparison of In-Cloud Scavenging by Brownian Diffusion and Thermo and Diffusio-Phoresis | 529 |
| <i>John C. Carstens and Jon J. Martin</i> | |
| An Experimental Study of Electrostatic Effect on Aerosol Scavenging by Snow Crystals | 541 |
| <i>Masataka Murakami and Choji Magono</i> | |
| A Laboratory Study of the Scavenging of Sub-Micron Aerosol by Charged Raindrops | 551 |
| <i>A.K. Barlow and J. Latham</i> | |
| Effect of Electric Charges on the Efficiency with which Columnar Ice Crystal Scavenge Aerosol Particles | 561 |
| <i>P.K. Wang and C.H. Chuang</i> | |
| Electrical Aspects of Rainout | 573 |
| <i>Carl E. Rosenkilde and Franklin J.D. Serduke</i> | |

| | |
|--|-----|
| A Theoretical Study of the Effect of Atmospheric Turbulent Motions on the Scavenging of Aerosol Particles by Cloud and Rain Drops | 583 |
| <i>S. Grover and H.R. Pruppacher</i> | |
| Turbulent Aspects of Rainout | 589 |
| <i>Carl E. Rosenkilde and Franklin J.D. Serduke</i> | |
| MODELS | |
| A Scavenging Model for Stratified Precipitation | 597 |
| <i>Charles R. Molenkamp</i> | |
| Numerical Simulation of Aerosol Capture and Deposition by a Precipitating Convective Cloud | 609 |
| <i>Francis W. Murray</i> | |
| Distribution of Acidity in Convective Clouds due to the Aqueous Phase Oxidation of Sulfur Dioxide by Ozone - A Numerical Simulation | 617 |
| <i>R. Ananthakrishna Sarma</i> | |
| A Three-Dimensional Mesoscale Numerical Simulation of Atmospheric Cleansing during the 1982 Boulder Upslope Cloud Observation Experiment (BUCOE) | 627 |
| <i>Nadine Chaumerliac, Everett Nickerson and Robert Rosset</i> | |
| Interpretations of the OSCAR Data for Reactive Gas Scavenging | 649 |
| <i>R.C. Easter and J.M. Hales</i> | |
| An Intercomparison of the Washout of $\text{SO}_4^=$ from a Single-Layer Regional Transport Model with a Multilayer Vertical-Motion Regional Transport Model | 663 |
| <i>W.E. Davis</i> | |
| The Effects of In-Cloud Scavenging on the Transport and Gas Phase Reactions of SO_x , NO_x , HC_x , H_2O_y , and O_3 Compounds | 675 |
| <i>Gregory R. Carmichael, Toshihiro Kidada and Leonard K. Peters</i> | |
| Precipitation Scavenging of Highly Soluble Gases | 687 |
| <i>G.A. Dawson and Peter Brimblecombe</i> | |
| The Statistics of Wet Deposition | 697 |
| <i>M.B. Baker, G. Egbert, K.B. Erickson, and H. Harrison</i> | |
| The Spatial Inhomogeneity of Aerosols within an Air Parcel and Some Implications for the Modelling of Particle Scavenging by Convective Clouds | 707 |
| <i>Edward Lozowski</i> | |
| Precipitation Scavenging and Tropospheric Mixing | 719 |
| <i>Henning Rodhe</i> | |
| Volume 2. Dry Deposition and Resuspension | |
| KEYNOTE ADDRESS | |
| Deposition and Resuspension | 731 |
| <i>A.C. Chamberlain</i> | |
| DRY DEPOSITION OF GASES | |
| Dry Deposition of Nitrogen Dioxide to Scots Pine Needles | 753 |
| <i>Peringe Grennfelt, Curt Bengtson and Lena Skärby</i> | |
| Dry Deposition of SO_2 onto a Scots Pine Forest | 763 |
| <i>David Fowler and J. Neil Cape</i> | |
| Dry Deposition on Coniferous Forest of SO_2 at PPB Levels | 775 |
| <i>Christer Johansson, Andreas Richter and Lennart Granat</i> | |

| | |
|--|-----|
| Measurements of the Dry-Deposition Flux of Nitric Acid Vapor to Grasslands and Forest | 785 |
| <i>B.J. Huebert</i> | |
| Dry Deposition of Sulphur Dioxide onto Grass in Rural Eastern England (With Some Comparisons with Other Forms of Sulphur Deposition) | 795 |
| <i>T.D. Davies and J.R. Mitchell</i> | |
| Experimental Constraints in Micrometeorological Gaseous Pollutant Fluxes | 807 |
| <i>J.G. Droppo and J.C. Doran</i> | |
| Development of an Instrument Package for the Measurement of Dry Deposition Fluxes by Eddy Correlation | 817 |
| <i>G.C. Edwards and G.L. Ogram</i> | |
| <u>DRY DEPOSITION OF PARTICLES</u> | |
| <u>To Vegetation</u> | |
| Deposition of Atmospheric Trace Constituents onto Different Natural Surfaces | 825 |
| <i>K.D. Höfken, F.X. Meixner and D.H. Ehhalt</i> | |
| Application of Surrogate Surface and Leaf Extraction Methods to Estimation of Dry Deposition to Plant Canopies | 837 |
| <i>Steven E. Lindberg and Gary M. Lovett</i> | |
| Dry Deposition of Small Particles to Grass in Field Conditions | 849 |
| <i>J.A. Garland</i> | |
| Dry Deposition Model Sensitivity | 859 |
| <i>W.S. Lewellen, A.K. Varma and Y.P. Shenq</i> | |
| <u>To Other Surfaces</u> | |
| Dry Deposition of Trace Elements in Olympic National Park | 871 |
| <i>Cliff I. Davidson, William D. Gould and G. Bruce Wiersma</i> | |
| A Comparison of Surrogate Surfaces for Dry Deposition Collection | 883 |
| <i>Jean Muhlbaier Dasch</i> | |
| Relationship between Dry Deposition as Measured via Collection with a Dry Bucket vs. Ambient Air Concentrations | 903 |
| <i>Arland H. Johannes and Elmar R. Altwicker</i> | |
| Accumulation Rates of Ionic Substances on Indoor Surfaces | 913 |
| <i>J.D. Sinclair, L.A. Psota-Kelty and G.B. Munier</i> | |
| <u>By Eddy-Flux Methods</u> | |
| An Experimental Study of Sulfur Deposition to Grassland | 933 |
| <i>B.B. Hicks, M.L. Wesely, R.L. Coulter, R.L. Hart, J.L. Durham, R.E. Speer and D.H. Stedman</i> | |
| Eddy-Correlation Measurements of the Dry Deposition of Particulate Sulfur and Submicron Particles | 943 |
| <i>M.L. Wesely, D.R. Cook, R.L. Hart, B.B. Hicks, J.L. Durham, R.E. Speer, D.H. Stedman and R.J. Tropp</i> | |
| Size-Resolved Measurements by Eddy-Correlation of the Dry Deposition Velocity of Atmospheric Aerosol Particles | 953 |
| <i>Paul C. Katen and John M. Hubbe</i> | |
| Eddy Flux and Profile Measurements of Small-Particle Dry-Deposition Velocity at the Boulder Atmospheric Observatory (BAO) | 963 |
| <i>Herman Sievering</i> | |

By Other Methods

| | |
|--|------|
| Comparison of Several Techniques for Determining Dry Deposition Flux | 979 |
| <i>J.E. Sickles, II, W.D. Bach, L.L. Spiller</i> | |
| Estimation of Dry Deposition Velocities of Sulfur over Canada and United States East of the Rocky Mountains | 1991 |
| <i>C. Masse and E.C. Voldner</i> | |
| Profiles of Elements in the Surface Boundary Layer | 1003 |
| <i>J.C. Doran and J.G. Droppo</i> | |
| Particle Dry Deposition Measurements with Dual Tracers in Field Experiments | 1013 |
| <i>George A. Sehmel</i> | |
| Dual Tracer Measurements of Plume Depletion | 1027 |
| <i>T.W. Horst, J.C. Doran and P.W. Nickola</i> | |
| Inland Transport, Mixing, and Dry Deposition of Sea-Salt Particles | 1037 |
| <i>W.G.N. Slinn, L.F. Radke and P.C. Katen</i> | |

WIND EROSION

| | |
|--|------|
| Threshold Velocities for Wind Erosion on Natural Terrestrial Arid Surfaces (A Summary) | 1047 |
| <i>Dale A. Gillette</i> | |
| The Concept of Resuspension Rates Applied to Problems of Fugitive Dust Emissions and Wind Erosion | 1059 |
| <i>Dale A. Gillette and Chatten Cowherd</i> | |
| Resuspension Rates from Aged Inert-Tracer Sources | 1073 |
| <i>George A. Sehmel</i> | |
| Some Recent Studies of the Resuspension of Deposited Material from Soil and Grass | 1087 |
| <i>J.A. Garland</i> | |
| Quantitative Comparison of Five Suspension Models | 1099 |
| <i>W.J. Smith, II, and F.W. Whicker</i> | |
| A Universal Model for Entrainment Processes | 1111 |
| <i>Kyaw Tha Paw U</i> | |

PLUTONIUM DEPOSITION AND RESUSPENSION

| | |
|--|------|
| Comparison of Simulated to Actual Plutonium at the Savannah River Plant | 1121 |
| <i>D. Clifton Carlson, Alfred J. Garratt, Don D. Gay and Charles E. Murphy</i> | |
| Plutonium Aerosol Fluxes and Pulmonary Exposure Rates during Resuspension from Bare Soils near a Chemical Separation Facility . . . | 1131 |
| <i>Joseph H. Shinn, Donald N. Homan and Don D. Gay</i> | |
| Characteristics of Airborne Plutonium Resuspended from Near- Background Aged Surface-Sources | 1145 |
| <i>George A. Sehmel</i> | |
| Activity, Size, and Flux of Resuspended Particles from Rocky Flats Soil | 1161 |
| <i>Gerhard Langer</i> | |
| Mechanical Resuspension of ²³⁹ Pu from Unpaved Roads | 1175 |
| <i>C. Reed Hodgkin</i> | |
| Near-Surface Meteorological Conditions Associated with Active Resuspension of Dust by Wind Erosion | 1185 |
| <i>C. Reed Hodgkin</i> | |

| | |
|--|------|
| A Receptor-Based Technique for Determining Impacts of Wind-Suspended Particulates | 1195 |
| <i>C. Reed Hodgkin</i> | |
| A Correction to the Gaussian Source-Depletion Model | 1205 |
| <i>Thomas W. Horst</i> | |
| AIR-SEA EXCHANGE | |
| Estimates of Dry and Wet Deposition and Resuspension Fluxes of Several Trace Metals in the Southern Bight of the North Sea | 1219 |
| <i>H.L. Dedeurwaerder, F.A. Dehairs, G.G. Decadt and W.F. Baeyens</i> | |
| Influence of Relative Humidity and Sea Salt Nuclei on the Eddy Flux Determination of Small Particle Dry Deposition over the Sea | 1233 |
| <i>Jill Schmidt, John Eastman and Herman Sievering</i> | |
| Estimation of the Dry Deposition Velocity and Scavenging Ratio for Organic Chemicals | 1243 |
| <i>William A. Tucker, Warren J. Lyman, and Alan L. Preston</i> | |
| Size Distribution and Mineralogy of Aluminosilicate Dust Particles in Tropical Pacific Air and Rain | 1259 |
| <i>Patrick Baut-Menard, Ullah Ezat and Annie Gaudichet</i> | |
| TROPICAL AND POLAR | |
| Scavenging Ratios and Dry Deposition Velocities of Radioactive Particles in the Tropical Regions of India | 1271 |
| <i>C. Rangarajan and C. D. Eapen</i> | |
| Snow Crystal Riming and Arctic Snowpack Chemical Composition | 1281 |
| <i>Randolph D. Borys</i> | |
| Atmosphere to Snow Transfers in Antarctica | 1289 |
| <i>Gerard Lambert, Benedicte Ardouin and Ashraf Mesbah-Bendezu</i> | |
| Trace Gases in Snow and Rain | 1301 |
| <i>R.A. Rasmussen, M.A.K. Khalil and S.D. Hoyt</i> | |
| GLOBAL SCALE | |
| ²¹⁰ Pb as a Tracer of the Deposition of Sub-Micrometer Aerosols | 1315 |
| <i>William C. Graustein and Karl K. Turekian</i> | |
| Size Distribution of Atmospheric Pb and ²¹⁰ Pb in Rural New Jersey: Implications for Wet and Dry Deposition | 1325 |
| <i>Ronald H. Knuth, Earl O. Knutson, Herbert W. Feely and Herbert L. Volchok</i> | |
| The Global Cycle of Particulate Elemental Carbon: A Theoretical Assessment | 1337 |
| <i>R.P. Turco, O.B. Toon, R.C. Whitten, J.B. Pollack and P. Hamill</i> | |
| Mean Residence Time of the Submicrometer Aerosols in the Global Troposphere | 1353 |
| <i>Gerard Lambert, Joseph Sanak and Georges Polian</i> | |
| A Potpourri of Deposition and Resuspension Questions | 1361 |
| <i>W.G.N. Slinn</i> | |
| FUTURE STUDIES | |
| Suggestions for Further Research | 1417 |
| <i>Hans-Walter Georgii</i> | |
| Comments about Precipitation Scavenging Research | 1421 |
| <i>Henning Rodhe</i> | |

| | |
|--|------|
| Some Comments, and Suggestions for Future Research and Monitoring, Related to Precipitation Scavenging Modeling | 1425 |
| <i>Peter W. Summers</i> | |
| Overview and Suggestions for Future Research on Dry Deposition | 1429 |
| <i>B.B. Hicks and J.A. Garland</i> | |
| Resuspension and Dry Deposition Research Needs | 1435 |
| <i>George A. Sehmel</i> | |
| Future Research in Resuspension | 1443 |
| <i>Dale A. Gillette</i> | |
| A Few Comments on Future Direction | 1447 |
| <i>Rudolf J. Engelmann</i> | |
| Authors and Conference Attendees | 1451 |