

第5回気象電気シンポジウム (IV)

雷雲中における電荷分離の機構 (つづき)

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引用文献

- Banerji, S.K., 1938: Does Thunderstorm Rain play Any Part in the Replenishment of the Earth's Negative Charge?, *Quart. J.R. Met. Soc.*, 64, 293~299.
- Barnard, V., 1951: The Approximate Mean Height of the Thundercloud Charges taking part in a Flash to Ground, *J. Geophys. Res.*, 56, 33.
- Brook, M., 1958: Laboratory Studies of Charge Separation during Ice-Ice Contact, *Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity*, 383~389.
- Byers, H. R. and Braham, R. R., 1949: The Thunderstorm.
- Chalmers, J. A., 1943: The Separation of Electricity in Clouds, *Phil. Mag.*, 34, 63~67.
- Chalmers, J.A., 1947: The Capture of Ions by Ice Particles, *Quart. J.R. Met. Soc.*, 73, 324~334.
- Chalmers, J.A., 1955: The Charging of Rain by Splashing, *Quart. J.R. Met. Soc.*, 81, 618.
- Chalmers, J.A., 1956: Atmospheric Electricity.
- Chalmers, J.A., 1958: The Electricity of Nimbostratus Clouds, *Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity*, 309~315.
- Chalmers, J.A. and Little, E.W.R., 1940: The Electricity on Continuous Rain. *Terr. Mag. and Atm. Elec.*, 45, 451~462.
- Chapman, S., 1952: Thundercloud Electrification Studies II. Report No. VC-603-P-1 to U.S. Office of Naval Research.
- Chapman, S., 1953: Thundercloud Electrification in Relation to Rain and Snowparticles, *Thunderstorm Electricity*, 207~230.
- Dinger, J.E. and Gunn, R., 1946: Electrical Effects associated with a Change of State of Water, *Terr. Mag. and Atm. Elec.*, 51, 477~494.
- Elster, J. and Geitel, H., 1885: Über die Elektrizitätsentwicklung bei der Regenbildung, *Ann. Phys. Chem.*, 25, 121~131.
- Elster, J. and Geitel, H., 1888: Über eine Methode, die elektrische Natur der atmosphärischen Niederschläge zu bestimmen, *Met. Z.*, 5, 95~100.
- Elster, J. and Geitel H., 1913: Zur Influenztheorie der Niederschlags-electricität, *Phys Z.*, 14, 1287~1292.
- Findeisen, W., 1940: Über die Entstehung der Gewitterelektrizität, *Met. Z.*, 57, 201~215.
- Findeisen, W., and Findeisen, E., 1943: Untersuchungen über die Eissplitterbildung an Reif-Schichten, *Met. Z.*, 60, 145~154.
- Fitzgerald, D.R. and Byers, H.R., 1958: Aircraft Observations of Convective Cloud Electrification, *Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity*, 245~268.
- Frenkel, Y.I., 1944: A Theory of the Fundamental Phenomena of Atmospheric Electricity, *J. Phys. Moscow*, 8, 285~304.
- Frenkel, Y.I., 1946: Influence of Water Drops on the Ionization and Electrification of Air, *J. Phys., Moscow*, 10, 151~158.
- Frenkel, Y.I., 1947: Atmospheric Electricity and Lightning, *J. Franklin Inst.*, 243, 287~307.
- Gish, O.H. and Wait, G.R., 1950: Thunderstorm and the Earth's General Electrification, *J. Geophys Res.*, 55, 473~484.
- Grenet, G., 1947: Essai d'explication de la charge électrique des nuages d'orages, *Ann. Géophys.*, 3, 306~307.
- Gunn, R., 1935: The Electricity of Rain and Thunderstorms, *Terr. Mag. and Atm. Elec.*, 40, 79~106.
- Gunn, R., 1948: Electric Field Intensity inside of Natural Clouds, *J. Appl. Phys.*, 19, 481~484.
- Gunn, R., 1950: Free Electrical Charge on Precipitation inside an Active Thunderstorm, *J. Geophys. Res.*, 55, 171~178.
- Gunn, R., 1954a: Electric Field Regeneration in Thunderstorms. *J. Met.*, 11, 130~138.
- Gunn, R., 1954b: Diffusion Charging of Atmospheric Droplets by Ions, and the resulting Combination Coefficients, *J. Met.*, 11, 339~347.

- Gunn, R., 1955: The Systematic Electrification of Mist and Light Rain in the Lower Atmosphere, *J. Geophys. Res.*, 60, 23~27.
- Hacking, C.A., 1954: Observations on the Negatively Charged Column in Thunderclouds, *J. Geophys. Res.*, 59, 449~453.
- 島山久尚, 1946: 昭和16年夏前橋附近における雷雨の際の空中電気の測観, 気象技術官養成所研究報告, 1, 33.
- Hatakeyama, H., 1958: The Distribution of the Sudden Change of Electric Field on the Earth's Surface due to Lightning Discharge, Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity, 289~298.
- Hutchinson, W.C.A., 1960: Ice-crystal Contact Electrification, *Quart. J.R. Met. Soc.*, 86, 406~407.
- Israël, H. and Lahmeyer, G., 1948: Das Auswahlprinzip des Luftelektrische 'ungestörten Tage,' *Terr. Mag. and Atm. Elec.*, 53, 373~386.
- Kano, M., 1954: A Note on the Workman-Reynolds' Theory of Thunderstorm Charge Generation, *Pap. Met. Geophys.*, 5, 47~53.
- Kitagawa, N. and Kobayashi, M., 1958: Distribution of Negative Charge in the Cloud taking part in a Flash to Ground, *Pap. Met. Geophys.*, 9, 99~105.
- Kuettner, J., 1950: The Electrical and Meteorological Conditions inside Thunderclouds, *J. Met.*, 7, 322~332.
- Kuettner, J. and Lavoie, R., 1958: Studies of Charge Generation during Riming in Natural Super-cooled Clouds, Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity, 391~397.
- Kumm, A., 1951: Über die Entstehung von Elektrischen Ladungen bei Vorgängen in der Kristallinien Eisphase, *Arch. Met. Geophys. Biokl.*, A, 3, 382~407.
- Lenard, P., 1892: Über der Elektrizität der Wasserfälle, *Ann. Phys.*, 46, 584~636.
- Lueder, H., 1951a: Ein Neuer Elektrische Effekt bei der Eisbildung durch Vergraupelung in Natürlichen Unterkühlten Nebeln, *Z. Angew. Phys.*, 3, 247~287.
- Lueder, H., 1951b: Vergraupelungselektrisierung als eine Ursache der Gewitterelektrizität, *Z. Angew. Phys.*, 3, 288.
- Malen, D.J., 1952: Les décharge de l'air et la charge inférieure positive d'un nuage orageux, *Ann. Géophys.*, 8, 385~401.
- Malan, D. J., 1954: Les décharges orageuses intermittentes et continues de la colonne de charge negative, *Ann. Géophys.*, 10, 271~281.
- Malan, D.J. and Schonland, B.F.J., 1951: The Distribution of Electricity in Thunderclouds, *Proc. Roy. Soc., A*, 209, 158~177.
- Mason, B.J., 1953a: On the Generation of Charge associated with Graupel Formation in Thunderclouds, *Quart. J.R. Met. Soc.*, 79, 501~509.
- Mason, B.J., 1953b: A Critical Examination of Theories of Charge Generation in Thunderstorms, *Tellus*, 5, 446~460.
- Mason, B.J. and Maybank, J., 1960: The Fragmentation and Electrification on Freezing Water Drops, *Quart. J.R. Met. Soc.*, 86, 176~185.
- Meinhold, H., 1951: Die Elektrische Ladung eines Fluzeuges bei Vereisung in Quellwolken, *Geofis. pur. appl.*, 19, 176~178.
- Müller-Hillebrand, D., 1954: Charge Generation in Thunderstorm by Collision of Ice Crystal with Graupel, falling through a Vertical Electric Field, *Tellus*, 4, 367~381.
- Norinder, H. and Pucher, W., 1954: Field Intensities and Charge Densities in Thunderstorms, *Ark. Geofys.*, 2, 97~107.
- Norinder, H. and Salka, O., 1951: Mechanism of Positive Spark Discharges with Long Gaps in Air at Atmospheric Pressure, *Ark. Geofys.*, 3, 347~386.
- Phillips, B.B. and Gunn, R., 1954: Measurements of the Electrification of Spheres by moving Ionized Air, *J. Met.*, 11, 384~351.
- Pierce, E.T., 1955a: Electrostatic Field-Changes due to Lightning Discharges, *Quart. J.R. Met. Soc.*, 81, 211~228.
- Pierce, E.T., 1955b: The Development of Lightning Discharges, *Quart. J.R. Met. Soc.*, 81, 229~239.
- Reynolds, S.E., 1953: Thunderstorm Precipitation Growth and Electrical Charge Generation, *Bull. Amer. Met. Soc.*, 34, 117~123.
- Reynolds, S.E., 1954: Compendium of Thunderstorm Electricity.
- Reynolds, S.E., Brook, M. and Gourley, M.F., 1957: Thunderstorm Charge Separation, *J. Met.*, 14, 426~436.
- Reynolds, S.E. and Neill, H.W., 1955: The Distribution and Discharge of Thunderstorm Charge Centres, *J. Met.*, 12, 1~12.
- Rossmann, F., 1948: Vom Ursprung der Gewitterelektrizität, *Met. Rdsch.*, 1, 193~195.
- Rossmann, F., 1950: Luftelektrische Messung mittels Segelflugzeugen, *Ber. Dtsch. Wetterdienstes U.S. Zone*, No. 15.

- Sartor, D., 1954: A Laboratory Investigation of Collision Efficiencies, Coalescence and Electrical Charging of Simulated Cloud Droplets, *J. Met.*, 11, 91~103.
- Schonland, B.F.J., 1928: The Polarity of Thunderclouds, *Proc. Roy. Soc.*, A1 118, 233~251.
- Schonland, B.F.J. and Malan, D.J., 1951: The Distribution of Electricity in Thunderclouds, *Arch. Met. Geophys. Biokl.*, A, 3, 64~69.
- Simpson, G.C., 1909: On the Electricity of Rain and its Origin in Thunderstorms, *Phil. Trans.*, A, 209, 379~413.
- Simpson, G.C., 1919: *Brit. Antarc. Exped.* 1910~1913, *Meteorology*, 1, 302~312.
- Simpson, G.C., 1927: The Mechanism of a Thunderstorm, *Proc. Roy. Soc.*, A, 114, 376~401.
- Simpson, G.C., 1942: The Electricity of Cloud and Rain, *Quart. J.R. Met. Soc.*, 68, 1~34.
- Simpson, G.C., 1956: The Charging of Rain by Splashing, *Quart. J.R. Met. Soc.*, 82, 103.
- Simpson, G. C. and Robinson, G. D., 1941: The Distribution of Electricity in Thunderclouds. II. *Proc. Roy. Soc.*, A, 177, 281~329.
- Simpson, G. C. and Scrase, F. J., 1937: The Distribution of Electricity in Thunderclouds, *Proc. Roy. Soc.*, A, 161, 309~352.
- Smith, L.G., 1951: Rain Electricity.
- Smith, L. G., 1955: The Electric Charge of Raindrops, *Quart. J.R. Met. Soc.*, 81, 23~47.
- 田村雄一, 1940: 雷雲内の雲気分布について, *地球物理* 4, 181.
- 田村雄一, 1943: 雷雲の電気について, *地球物理*, 7, 81.
- Tamura, Y., 1958: Investigations on the Electrical Structure of Thunderstorms, Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity, 269~276.
- Twomey, S., 1957: Electric Charge Separation in Subfreezing Cumuli, *Tellus*, 9, 384~393.
- Vonnegut, B., 1955: Possible Mechanism for the Formation of Thunderstorm Electricity, *Wentworth Conference*, 169~181.
- Vonnegut, B. and Moore, C.B., 1958: Preliminary Attempts to Influence Convective Electrification in Cumulus Clouds by the Introduction of Space Charge into the Lower Atmosphere, Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity, 317~331.
- Wall, E., 1948: Das Gewitter, *Wett. u. Klima*. 1, 8~21, 65~74, 193~204, 321~326.
- Weickmann, H.K. and Aufm Kampe, H.J., 1950: Preliminary Experimental Result concerning Charge Generation in Thunderstorms concurrent with the Formation of Hailstones, *J. Met.*, 7, 404~405.
- Wichmann, H., 1948: Grundprobleme der Physik des Gewitters.
- Wichmann, H., 1950: Das Gewitter,
- Wichmann, H., 1952: Zur Theorie des Gewitters, *Arch. Met. Geophys. Biokl.*, A, 5, 187~230.
- Wilson, C.T.R., 1916: On Some Determinations of the Sign and Magnitude of Electric Discharges in Lightning Flashes, *Proc. Roy. Soc.*, A, 92, 555~574.
- Wilson, C.T.R., 1920: Investigations on Lightning Discharges and on the Electric Field of Thunderstorms, *Phil. Trans.*, A, 221, 73~115.
- Wilson, C. T. R., 1929: Some Thundercloud Problems, *J. Franklin Inst.*, 208, 1~12.
- Wilson, C. T. R., 1956: A Theory of Thunder Cloud Electrification, *Proc. Roy. Soc.*, A, 236, 297~317.
- Williams, J.C., 1958: Some Properties of the Lower Positive Charge in Thunderclouds, Recent Advances in Atmospheric Electricity, II. Thunderstorm Electricity, 425~429.
- Workman, E.J., 1948, New Electrical Phenomena associated with the Freezing of Weak Solutions, *Signal Corps Research, Final Report*.
- Workman, E. J. and Holzer, R. E., 1942: A Preliminary Investigation of the Electrical Structure of Thunderstorm, *Tech. Notes N.A.C.*, No. 850.
- Workman, E.J., Holzer, R.E. and Pelsor, G.T., 1942: The Electrical Structure of Thunderstorms, *Tech. Notes N.A.C.*, No. 864.
- Workman, E.J. and Reynolds, S.E., 1948: A Suggested Mechanism for the Generation of Thunderstorm Electricity, *Phys. Rev.*, 74, 709.
- Workman, E.J. and Reynolds, S.E., 1950: Electrical Phenomena occurring during the Freezing of Dilute Aqueous Solutions and Their Possible Relationship to Thunderstorm Electricity, *Phys. Rev.*, 78, 254~259.
- Workman, E.J. and Reynolds, S.E., 1953: Structure and Electrification, Thunderstorm Electricity, 139~149.
- Wormell, T.W., 1939: The Effect of Thunderstorms and Lightning Discharges on the Earth's Electric Field, *Phil. Trans.*, A, 238, 249~303.
- Wormell, T.W., 1953: Atmospheric Electricity; Some Recent Trends and Problems, *Quart. J.R. Met. Soc.*, 79, 3~50.
- 吉田順吾, 1944: 氷の摩擦破壊によって生ずる電気並びに雷の電気の発生機構, *低温科学* 1, 149.