AMS Rossby (1-10-2018, Austin, Texas)

Mr. President and my AMS colleagues:

I was both surprised and thrilled to hear the news from my colleague President Roger Wakimoto, UCLA Vice Chancellor for Research, who insisted on coming to my office for a meeting and then informed me that I received the 2018 AMS Carl-Gustaf Rossby Research Medal. Indeed, it is a great pleasure and distinct honor to be on the roster of previous outstanding awardees. I would like to thank Wilf Brutsaert, Mike Wallace, Robert Dickinson, and Peggy Lemone for their support and encouragement in my pursuit of academic and research excellence, and to extend my appreciation to the Rossby Medal Selection Committee for recognizing my contributions to radiative transfer, cloud physics, and climate and remote sensing application. Radiation is the prime driver in the Earth's energy budget, and clouds, the largest feedback in weather and climate systems, are fundamental to our understanding of climate dynamics and atmosphere-surface interactions.

Radiative transfer is an interdisciplinary subject that was initially studied by astrophysicists and later by planetary scientists and meteorologists for atmospheric applications. It is also an important field in optics and various engineering disciplines. The concept of radiative forcing, proposed by Bob Dickinson and Dennis Hartmann, requires radiative transfer analysis to determine the impacts of anthropogenic greenhouse gases and aerosols and cloud feedback, on global warming and climate change. Development of remote sensing techniques to infer atmospheric compositions and surface properties must follow the principle of radiative transfer.

Early in my career, I had the opportunity to study Chandrasekhar's book "Radiative Transfer" written in 1950, which led me to develop simplified solutions for the transfer of solar and thermal infrared radiation in atmospheres containing clouds and aerosols, and later for three-dimensional inhomogeneous mountain and snow topography. My exposure to Born and Wolf's book "Principles of Optics," first published in 1959, guided me to initiate the geometric optics approach to understand the scattering, absorption, and polarization processes of irregular ice crystals and aggregated soot aerosols. I realized that exact solutions for light absorption and scattering by these intricate and complicated particles, widely variable in size and morphology, could not be derived from conventional wave equations and boundary conditions.

Seminal books by Richard Goody in 1966 and Henk van de Hulst in 1957 inspired me to seek approximations based on the first principles. A number of graduate students and I have been able to develop improved geometric optics approximations based on a number of fundamental electromagnetic theories to cover different size ranges and morphologies. Since joining UCLA in 1997, I have had some success incorporating simplified radiative transfer and ice cloud solutions, in forms of spectral radiation parameterization, into general circulation models for climate studies, specifically involving high-level clouds and aerosols.

My expertise in radiative transfer also led me to work with a group of graduate students on remote sensing challenges, including differentiation of ice crystals and water droplets based on the backscattering depolarization approach, determination of cirrus cloud composition, understanding of aerosol-cloud interactions, and retrieval of heating rates and surface fluxes from space.

Indeed, over the last 30 years, I have had the privilege of working with a number of bright and talented graduate students at the University of Utah and UCLA who complemented my strengths in research. They deserve to share, in equal measure, any recognition I have received, including this great honor from AMS. It is in this spirit that I accept the Carl-Gustaf Rossby Research Medal. Thank you very much indeed.