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Using new airborne instruments to observe precipitation formation in clouds

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We describe recent progress in using two relatively new instruments for studying precipitation formation in clouds. Holodec II is an airborne in-line holographic camera, which allows about three holograms per second to be captured. Recent developments in automated holographic reconstruction of particle size and concentrations has allowed for direct comparisons between holographic imagery and traditional techniques for measuring hydrometeor size distributions, such as 2-D diode occultation. The main advantages of the holographic technique are: (a) the ability to resolve small hydrometeors (a few microns in size) as well as larger (mm-sized) ones, (b) a relatively large sample volume at the points where the holograms are taken (which is a critical issue for identifying precipitation formation), (c) identifying the position of particles in a three dimensional volume. The 3D distribution allows for flagging of particle shattering events when hydrometeors strike the tips of the instrument. The main disadvantages of the Holodec II are the data gaps between holograms and the large amount of computing resources needed to perform the reconstructions. Current development efforts include quantifying contamination from noise at the lower size limit and determining edge effects. The second instrument, SID II-H, a small ice detector, uses light scattering patterns to distinguish between water and ice. As with Holodec II, SID II-H measures both small ice and water droplets. SID II-H limitations are its small sample volume and in some cases contamination caused by splashing and shattering of large particles in precipitating clouds. SID II-H and Holodec II, due to the different ways they sample clouds, present a much different viewpoint for studying precipitation formation. We illustrate these differences by comparing data from both instruments during flight through mixed phase clouds.