# CORRESPONDENCE

## Remarks on "Atmospheric salt particles and raindrops"

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In a recent paper in the JOURNAL, Woodcock[1] reported the results of a series of measurements of salt-particle sizes at various altitudes above and distances from the sea. The sampling techniques employed were successful in extending the range of collection upward to quite large particle sizes and in establishing that these large particles are carried up to cloud-base levels over and near the sea. In the same paper, Woodcock presents arguments supporting his view that the larger salt particles grow to raindrop size by condensation plus coalescence with smaller drops. I feel that there are two features of the argument which must be questioned.

The first and principal question concerns Woodcock's figs. 6 and 7. It will be seen that fig. 6 constitutes the one check between the salt-particle hypothesis and independent raindrop data, and that this figure depends in turn upon the content of fig. 7, which relates rainfall intensities to rain chlorinities. It seems to be implied that the hypothetical (solid) curves of fig. 6 were computed with use of chlorinities given by curve 1 of fig. 7, but the latter curve is by no means a close representation of the observational points plotted in fig. 7. Inasmuch as it seems improbable that curve 1 could have been obtained by any curve-fitting technique applied to the observed chlorinities of fig. 7, and is presumably not based upon any independent physical hypothesis (since none is mentioned), I am led to ask whether curve 1 was *computed* by starting with some particular points of the solid curves of fig. 6 (such as those at the ordinate of $10^2$ drops $m^{-3}$ $mm^{-1}$, where the solid and dashed curves cross)? If so, the pertinent test of Woodcock's hypothesis would be not the implied one of the agreement between solid and dashed curves of fig. 6, but rather the degree of fit between curve 1 of fig. 7 and the therein plotted points. The strong discrepancy between curve 1 and the datum points weighs heavily against accepting the hypothesis as presented.

A second feature of the argument which I find disturbing is the requirement that the accretional growth of the large salt particles involves coalescence with droplets of virtually zero salinity. Though there is, to be sure, present doubt as to whether sea-salt particles do comprise the primary source of condensation nuclei, it seems inconsistent to assume that the very rare, large salt particles grow readily while the far more numerous small salt particles do not, which is apparently implied by Woodcock. And if the intended implication is rather that the small particles, whose large numbers are so clearly shown by Woodcock's extensive measurements, do grow to cloud-drop size but are still outnumbered by other non-saline drops, it is quite indispensable to an appraisal of the hypothesis to have some estimate of the total weight of salt which might be added by coalescence with smaller saline drops, in order to be sure that the latter do not raise the chlorinity to values inconsistent with the hypothesis. The reason given for not making such an estimate is that one cannot be sure of the weights of salt particles comprising the nuclei in cloud drops, a view which seems incompatible with Mr. Woodcock's willingness to build a hypothesis upon just the upper end of the range of his own numerous salt-particle size measurements.

[1] A. H. Woodcock, "Atmospheric salt particles and raindrops," *J. Meteor.*, 9, 200–212, 1952.