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Can Salt on an Optical Rain Gauge Lens Affect Performance?

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The optical rain gauge (ORG) by ScTI is designed to be tolerant to reduction of infrared beam intensity due to a 'dirty' lens. The system electronics includes an automatic gain control circuit (agc) which compensates for dirty lens effects. So with reasonable care and in suitable operational conditions, data from the optical rain gauges do not require adjustment for variations in the beam strength.

Recently there is interest in long term use of optical gauges onboard buoys at sea. Because of logistics, these systems are serviced infrequently, i.e. every several months. Due to the proximity of the gauges to the sea surface, salt can be expected to be deposited on the lens. As inhabitants of northern climates who drive their cars in the winter months know, it is wishful thinking to expect that rain will effectively rinse the salt off. Thus although rain may help wash off the gauge optics, it can not be expected to keep the lens clean. In fact, inspection of gauges that have been deployed on buoys reveals some abnormal pitting of metallic surfaces. Salt is probably coating the optics too.

To obtain an indication of the potential for dirty lens to affect the ORG calibration, a simple experiment was conducted using a translucent piece of plastic. Although scientific assessment of the optical properties of the plastic mask were not obtained at the time of the experiments, copies were made on 'xerox' machines with the mask over a portion of text. On one machine the mask appeared as a slightly smudged area, but on the other machine the mask was not apparent. This test shows that whereas the optical properties of the mask are constant, the effect of the mask is dependent upon the particular system. So it is interesting to see what effect, if any, the mask has on an ORG. Two simple experiments were conducted.

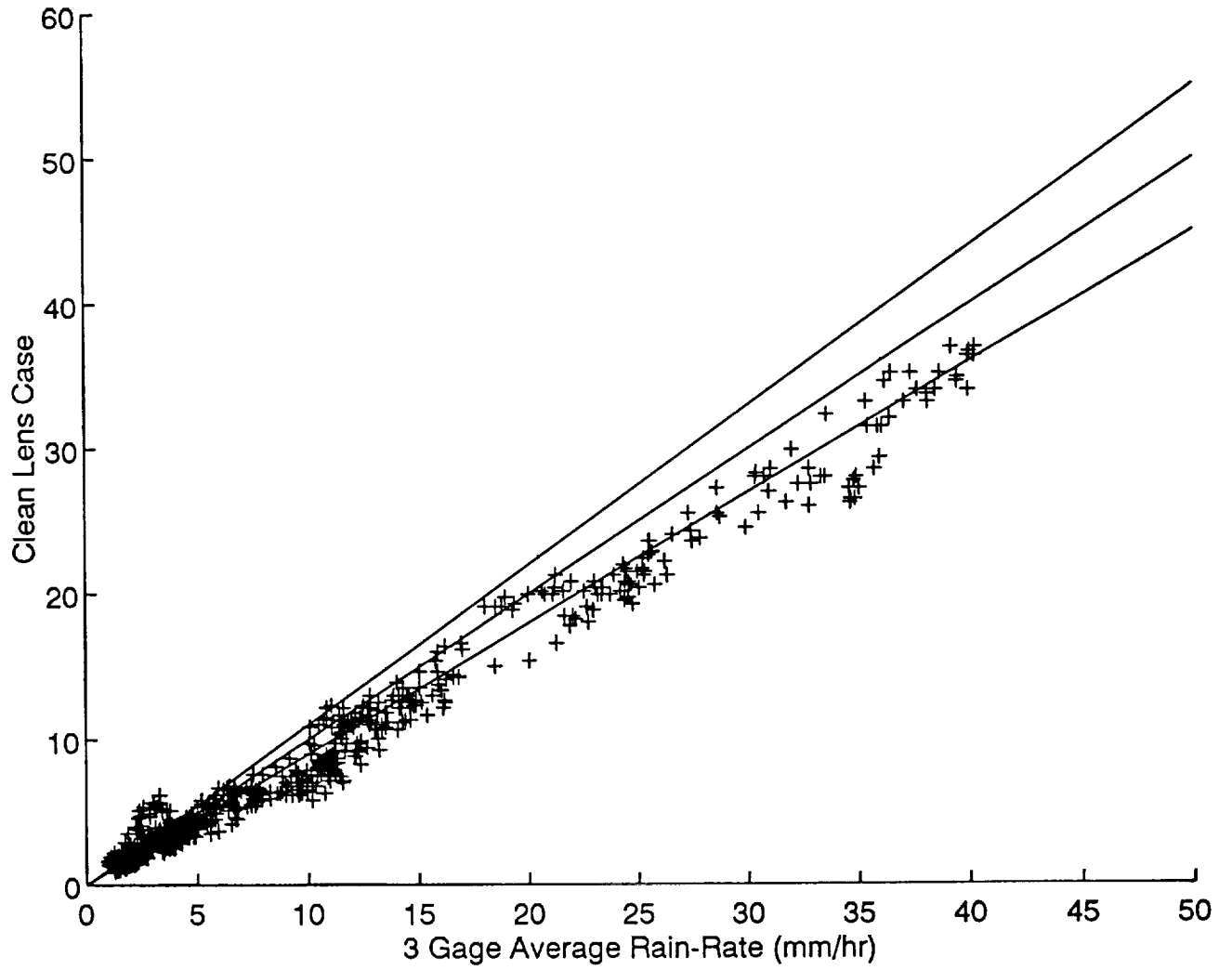
In the control experiment, a sample ORG was compared to three other ORGs during natural rain events. The results of that experiment are shown in Figure 1, which reveals that the

unperturbed gauge measurements fall within 10 % of the average from three other ORGs. Thus the sample ORG is within specifications when operated under normal conditions.

Next the mask was placed on the transmitter lens of the sample ORG and again data were collected under natural rain conditions. The data from the perturbed ORG are plotted in comparison with the three other ORGs in Figure 2, which shows that the mask reduced the gain of the perturbed ORG by about 30%. The perturbed ORG operated rather well in that the mask only causes a change in the gain and does not cause data drop out at low rain rates. However, the reduced gain would seriously impact an assessment of rain statistics.

The concern for buoy applications is sea salt - not plastic masks. In discussions with workshop participants, the need to study potential salt effects was recognized because no data are available on this topic and the effects of sea salt on ORG calibration are unknown. Hopefully this simple but inconclusive experiment will motivate potential users of ORG data from buoys deployed at sea to ensure that sea salt is not significantly contributing to errors. Because of the robust operation of the ORG with the plastic mask, it is likely that sea-salt is not a real concern for normal deployment. Studies with sea-salt are needed to confirm this intuitive feeling.

Unperturbed Gage Comparison



Simulation of Sea Salt on Rain Gage Lens

