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AIRBORNE RADAR OBSERVATIONS OF HURRICANE GEORGES DURING LANDFALL OVER THE DOMINICAN REPUBLIC

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On 22 September 1998 hurricane Georges made landfall on the Dominican Republic (DR). Georges costed the DR at least 500 lives, made more than 155,000 people homeless and caused extensive damage to the country's main industries, tourism and agriculture. There was considerable wind damage, with wind gusts up to 58 m s^{-1} in Santa Domingo on the south coast, but most of the damage and deaths resulted from mudslides and the flooding of rivers. While this may have been the worst natural disaster to strike the DR, the sustained rapid storm movement saved the island from worse damage. Georges had previously affected several islands in the Lesser Antilles and Puerto Rico, but it had retained much of its circulation strength.

Forty raingauge stations across the DR measured rainfall totals from Georges between 0.7 and 41 cm, the latter at the capital Santo Domingo, located on the south coast. At Herrera the maximum 1h rainfall rate was 72 mm h^{-1}. It is suspected that much higher rain rates occurred in DR's mountainous interior.

Before landfall the eye was clearly evident in satellite imagery. When the eye moved over southeastern DR, it filled rapidly, and the cloud top height decreased in all storm sectors except in the southern inflow sector, where a long-lived MCS, with a diameter larger than that of the eyewall, slowly became enwrapped in the hurricane circulation. The eye closure was most rapid between 16-18 UTC, when the eyewall circulation felt the mountainous terrain of the Cordillera Central, which rises up to 3,093 m. The estimated central pressure increased from 962 hPa at 15 UTC to 986 hPa at 03Z on 23 Sept, and the maximum sustained surface wind speed decreased from 54 to 36 m s^{-1} during the same period. The island of Hispaniola has a cross-track width of about 250 km, much wider than the diameter of the eyewall anvil (about 100 km before landfall). So the event can truly be considered to be a landfalling case, even though Georges recovered after crossing Hispaniola, albeit never to the same strength.

Several reconnaissance and research aircraft examined Georges on 22 September. Two NOAA aircraft (the G-IV and the N43RF) flew a synoptic surveillance pattern and together they dropped 47 sondes. The NASA DC-8, equipped with a host of remote sensing instruments including a water vapour profiler, a clear-air wind retrieval system, and a weather Doppler radar, flew through the storm's eye at about 11 km and then examined the inflow to the south. Finally, the NASA ER-2 made 4 passes over the eye or its remnants between 20:00 and 23:00 UTC, at about 20 km above sea level. The ER-2 is equipped with visible, infrared and microwave imagers, a lightning detector, an interferometer (to retrieve temperature profiles), and a nadir- and forward looking Doppler radar. This radar (EDOP) is the focus of this presentation. EDOP radar data are used to measure the along-track reflectivity, linear polarization ratio, and air flow field at an unprecedented resolution of 100m in the horizontal and 37.5 m in the vertical.

Just after sunset (22:20 UTC), the ER-2 pilot reported spectacular purple lightning flashes, emanating above cloud top (but below flight level). EDOP data reveal deep clouds producing heavy yet stratiform precipitation. Occasionally the cloud tops overshot the prevailing anvil level, and clearly the tops were highly perturbed by intense upper-tropospheric vertical motion (with updrafts of 15 m s^{-1} or more). This deep convection was most spectacular over the Cordillera Central, and reflectivity values (uncorrected for attenuation) exceeded 40dB near the surface. Yet even in the absence of deep convection, the reflectivity at low levels, below the bright band, was high.

This talk will summarize satellite and ground observations of Georges as it passed the DR, and it will focus on EDOP data. In particular, we will try to estimate the rainfall rate over the mountainous terrain of the DR. And we will use detailed sounding data to explain the presence and characteristics of the massive MCS to the south, as well as the intense upper-level updrafts apparent over this MCS and over the mountains of the DR.