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Tropical cyclone Pam field survey in Vanuatu

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Severe tropical cyclone Pam (Cat. 5, SSHS) crossed the Vanuatu archipelago with sustained winds of 270 km/h on March 13 and 14, 2015 and made landfall on Erromango. Pam is the most intense tropical cyclone to make landfall on Vanuatu since the advent of satellite imagery based intensity estimates in the 1970s. Pam caused one of the worst natural disaster in Vanuatu's recorded history. Eleven fatalities were directly attributed to cyclone Pam and mostly due to lack of shelter from airborne debris. On March 6 Pam formed east of the Santa Cruz Islands causing coastal inundation on Tuvalu's Vaitupu Island located some 1100 km east of the cyclone center. Pam intensified while tracking southward along Vanuatu severely affecting the Shefa and Tafea Provinces. An international storm surge reconnaissance team was deployed to Vanuatu from June 3 to 17, 2015 to complement earlier local surveys. Cyclone Pam struck a remote island archipelago particularly vulnerable to the combined cyclonic multi-hazards encompassing extreme wind gusts, massive rainfall and coastal flooding due to a combination of storm surge and storm wave impacts. The team surveyed coastal villages on Epi, the Shepherd Islands (Tongoa and Mataso), Efate (including Lelepa), Erromango, and Tanna. The survey spanned 320 km parallel to the cyclone track between Epi and Tanna encompassing more than 45 sites including the hardest hit settlements. Coastal flooding profiles were surveyed from the shoreline to the limit of inundation. Maximum coastal flood elevations and overland flow depths were measured based on water marks on buildings, scars on trees, rafted debris and corroborated with eyewitness accounts. We surveyed 91 high water marks with characteristic coastal flood levels in the 3 to 7 m range and composed of storm surge with superimposed storm waves. Inundation distances were mostly limited to a few hundred meters but reached 800 m on Epi Island. Wrack lines containing pumice perfectly delineated the inundation at many sites and were mapped as line features. Coral boulders of more than 1 m diameter were measured on Erromango. Along each island that was sampled, Cyclone Pam deposited a 1 – 20 cm thick sedimentary layer consisting of foraminfera-bearing sand and pumice cobbles. Infrastructure damage on traditional and modern structures was assessed. Eyewitnesses were interviewed at most sites to document the chronology of the wind and coastal flooding events, survival strategies, cyclone and tsunami awareness, evacuation procedures, shelter locations and ancestral knowledge. Field observations were compared with surveyed eyewitness accounts of historic events such as severe tropical cyclone Uma in 1987. The measured cyclone Pam high water marks will facilitate the interpretation of the collected sedimentary evidence and serve as benchmarks for modeling studies.