

# 使用偏極化雷達觀測反演降雨動能的方法與應用

## Methodology and Application of Retrieving Rainfall Kinetic Energy with Polarimetric Radar Observations

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### 摘 要

前人研究指出，降雨動能為降雨侵蝕土壤能力的良好指標，與坡體崩塌機率以及輸砂量的正相關性，比降雨量更高。為了估計降雨區域內的降雨動能，傳統方法使用雨滴譜儀觀測擬合的降雨動能與降雨強度經驗關係式，配合都卜勒雷達觀測擬合的回波與降雨強度經驗關係式，便可從回波資料估計降雨動能。本研究研發新方法，使用偏極化雷達觀測所反演的雨滴粒徑分布，計算三維空間中的降雨動能，能避免上述兩經驗關係式的代表性誤差。此新方法以新北市瑞芳區猴硐台鐵邊坡崩塌事件進行測試，結果明顯修正傳統方法常見的降雨動能高估情形。目前防災科技中心已作業化此新方法，每10分鐘即時展示全台的10分鐘累積降雨動能，以及水保局定義34處大規模崩塌潛勢區的7天累積降雨動能歷線，並開放數據資料供大眾申請。

**關鍵字：**降雨動能、崩塌、輸砂、雨滴譜儀、偏極化雷達、雨滴粒徑分布

### Abstract

Previous studies pointed out that rainfall kinetic energy (RKE) is a good indicator of soil erodibility by rainfall. Compared with rainfall amounts, RKE has a higher positive correlation with landslide probability and sediment discharge. To estimate RKE in rainfall areas, a traditional method uses two empirical relations between RKE and rainfall intensity (fitted with disdrometer observations) and between reflectivity and rainfall intensity (fitted with Doppler radar observations), which yield RKE from reflectivity data. This study develops a new method, which calculates three-dimensional RKE utilizing the drop size distributions retrieved from polarimetric radar observations, to avoid representative errors existing in the aforementioned empirical relations. The new method is tested for a Taiwan Railway landslide event at Houtong, Ruifang District, New Taipei City, and the results significantly correct the common overestimation of RKE with the traditional method. The National Science and Technology Center for Disaster Reduction has now employed the new method in a real-time product that displays 10-minute accumulated RKE in Taiwan every 10 minutes as well as 7-day accumulated RKE in 34 potential large-scale landslide areas defined by the Soil and Water Conservation Bureau. The digital data are open to the public to apply for.

**Key words:** rainfall kinetic energy, landslide, sediment discharge, disdrometer, polarimetric radar, drop size distribution