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Statistical atmospheric downscaling for rainfall estimation in Kyushu Island, Japan

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Abstract. The present paper develops linear regression models based on singular value decomposition (SVD) with the aim of downscaling atmospheric variables statistically to estimate average rainfall in the Chikugo River Basin, Kyushu Island, southern Japan, on a 12-hour basis. Models were designed to take only significantly correlated areas into account in the downscaling procedure. By using particularly precipitable water in combination with wind speeds at 850 hPa, correlation coefficients between observed and estimated precipitation exceeding 0.8 were reached. The correlations exhibited a seasonal variation with higher values during autumn and winter than during spring and summer. The SVD analysis preceding the model development highlighted three important features of the rainfall regime in southern Japan: (1) the so-called Bai-u front which is responsible for the majority of summer rainfall, (2) the strong circulation pattern associated with autumn rainfall, and (3) the strong influence of orographic lifting creating a pronounced east-west gradient across Kyushu Island. Results confirm the feasibility of establishing meaningful statistical relationships between atmospheric state and basin rainfall even at time scales of less than one day.

Keywords: atmospheric downscaling, precipitation, rainfall, singular value decomposition, southern Japan

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