

A study on the Relationship between Water Temperature and Ripple size: flume experiments.

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Wavy topographies, such as ripples and dunes, are common features in both terrestrial and extraterrestrial landscapes, reflecting the interaction between fluid flow and sediment transport. Due to their correlation with hydraulic processes and widespread distribution, engineers and geologists have extensively utilized bedform morphology to predict hydraulic conditions and interpret both modern and paleo-sedimentary environments on Earth and extraterrestrial planets. Previous studies have established a universal relationship for ripple wavelengths; however, this relationship does not clearly account for the influence of water temperature. Moreover, a single equation does not allow for the inference of both flow strength and viscosity, leading to the temperature effect being overlooked. This study examines the effect of water temperature on ripple morphology through flume experiments with sediment grains of 0.95 mm, conducted at temperatures ranging from 15°C to 45°C. Additionally, existing ripple scaling theories are revisited using a new dataset that explicitly includes temperature effects. The results show that natural variations in river water temperature can induce measurable changes in ripple dimensions. A modified equation for ripple wavelength and a new scaling relationship for ripple height are established, both of which demonstrate strong consistency with previous experimental and theoretical studies. Our analysis indicates that the equation for ripple wavelength may need to be applied depending on the specific scenario, and that the equation for ripple height operates independently of wavelength. Furthermore, the results confirm that the Ripple Index (RI), defined as the ratio of wavelength to height, is not influenced by water temperature. These findings enhance the accuracy of flow reconstructions in natural river systems and promote the use of ripple dimensions as indicators of both flow intensity and temperature in paleo-environmental studies.