

INTEGRATED SPATIAL TREND ASSESSMENT USING STATION DATA AND GRIDDED CLIMATE NORMALS

INTEGRIERTE RÄUMLICHE TRENDBEWERTUNG UNTER VERWENDUNG VON STATIONSDATEN UND GERASTERTEN KLIMANORMALEN

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SUMMARY

A novel method of integrated spatial trend analysis (ISTA) is presented to represent spatial trends in more detail, by implementing point observations and a 30-year, gridded climate normal map. The gridded climate normal was adjusted annually (monthly) for each year (month) in the time period, and residual precipitation between observed and adjusted values were calculated. Interpolated residuals and the adjusted grid were summed to create spatial time series for statistical testing. The Mann-Kendall and Theil-Sen slope statistical tests were used to determine the significance and rate of change, as well as calculate the net volume of change in precipitation over an area.

The method was applied to the western side of the island of Hawai'i, USA as it has a unique rainfall pattern and complex topography over a small area. To assess changes in water entering the aquifer system, ISTA showed an annual decrease of $-8.42 \times 10^6 \text{ m}^3/\text{year}$ across the entire study area and a decrease of $-4.62 \times 10^6 \text{ m}^3/\text{year}$ when only significant areas are considered. Using inverse distance weighting (IDW) and ordinary kriging, the net annual decrease were similar, but much smaller for the significant areas. On a monthly basis, both the ISTA and IDW yield similar trends regarding an increase or decrease in the net volume entering the aquifer, however IDW underestimates the overall magnitude. The ISTA method provides an improved assessment of spatial trends that, while not limited to precipitation, can assist in broadening the limited knowledge of spatial precipitation trends across the globe.

Keywords: precipitation, spatial trend analysis, Hawai'i, climate change

ZUSAMMENFASSUNG

Eine neuartige integrierte räumliche Trendanalyse (IRTa) stellt räumliche Trends detaillierter dar. Es implementiert Punktbeobachtungen und eine 30-jährige, gerasterte Klimanor-