

# **Hierarchical spatio-temporal modeling of Arctic sea ice extent**

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## **Abstract**

Arctic sea ice extent has drawn considerable interest from geoscientists for the last two decades owing to its rapid decline. We propose a spatio-temporal hierarchical model for Arctic sea ice extent data, where a latent spatio-temporal Gaussian process is used to model the data dependence and linked to the observations, which here are binary. Both Bayesian hierarchical model (BHM) and empirical hierarchical model (EHM) are considered to obtain the predictive distribution of the latent process that governs the spatio-temporal changes of the Arctic sea ice. Through a simulation study, we investigate how parameter uncertainty in a complex hierarchical model can influence spatio-temporal prediction. These results inform how inference will proceed on Arctic sea ice extent over a period of more than twenty years. Covariates that are physically motivated are chosen through autologistic diagnostics. Finally, new summary statistics are proposed to detect the changing patterns of Arctic sea ice between successive time periods.