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USCRN气候基准站网布局理论在我国的应用

Application of USCRN Station Density Strategy to China Climate Reference Network

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摘要：

基于美国气候基准站网（USCRN，US Climate Reference Network）的均匀正三角网格布局模式，以站网对我国平均降水量和气温的方差解释量分别能够达到95%和98%为标准，利用我国2416个观测站的降水量和气温数据研究了我国气候观测站网的布局设计，得到能反映我国整体气候特征的站网最少台站数。结果表明：为显著减少全国尺度上的气候不确定性，需要新建边长为3°纬距的正三角均匀网格（103个站点）站网，并在全国范围内开展站址考察、总结评估和运行检验工作，才能得到新的气候基准站网；在已有气候观测系统基础上改进完善而不新建系统，则改进的气候基准站网为最接近边长为2°纬距的正三角网格分布（229个站点），其中199个预期位置或其附近已建有观测站点，没有对应实际站点的30个预期位置主要分布在青藏高原西南大部，这些地区将是未来建站的重点。

关键词：美国气候基准站网(USCRN) 方差解释 站网布局方法

Abstract:

The US Climate Reference Network (USCRN) consists of 114 stations developed, deployed, managed, and maintained by the National Oceanic and Atmospheric Administration (NOAA) in the continental United States for the express purpose of detecting the national signal of climate change, focusing solely on precipitation and temperature. The vision of the USCRN program is to reduce uncertainty and error range envelopes in producing the most precise in situ precipitation and temperature records possible, and to do it with the fewest possible stations located in areas of minimal human disturbance and with the least likelihood of human development over the coming 50—100 years. And the key goal of USCRN is to reduce climate uncertainty at the national level to a statistically insignificant level. That is, for precipitation climate uncertainty should be reduced by 95% and for temperature climate uncertainty at the national level should be reduced by 98%.China is in great need of a sustainable high quality and long term climate observation network, especially for areas without observations or with little information. Given the complexity of the network development, the overall structure of the climate network should be analyzed first. Therefore, the minimum number of sites and locations which are able to represent national climate characteristics of China are proposed, on the basis of the equilateral triangular mesh employed by the USCRN, in order to provide preliminary advice for adjustment and optimization of China Climate Reference Network. For the purpose of assessing the performance of the network in addressing this goal, the coefficient of determination (r 2) is used as the performance measure (PM). This PM is an assessment of how closely the current and past configuration of the network captures the true national temperature and precipitation signal as defined by an area averaged time series of annual temperature and precipitation derived from 2416 China observing stations scattered across the continental China. The result is an explained variance that measures how closely the network s time series follows the true time series.Employing the USCRN standard that coefficient of determination exceeds 98% for precipitation and exceeds 95% for temperature, the 2416 stations in the conterminous China are investigated over the period of 1966—1995. Results indicate that China Climate Observing System should consist of at least 103 quasi uniformly distributed stations on a 3.0° equilateral triangular grid in order to reproduce inter annual variability in temperature and precipitation all over China. And on this structure，the new network will be established after surveys, approval or disapproval assessment, test and evaluation periods for each site at each geographic location. On the other hand, China Climate Reference Network may be adjusted and improved on the basis of the existing observing systems. The optimized network consists of 229 quasi uniformly distributed stations on a 2.0° triangular grid, founded by the existing 199 stations and 30 new established stations. The expected new established stations are mainly located in the southwestern part of the Qinghai Tibet Plateau, where will be the key areas in the network establishment. Based on the actual history of USCRN establishment, the final climate observing network of China may be formed by less than 103 or 229 stations.

Keywords:US Climate Reference Network (USCRN) explained variance station density strategy

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