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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 43997.1-2024

**Surface temperature retrieval from thermal infrared remote
sensing data - Part 1: Single channel method**

地表温度热红外遥感反演 第1部分：单通道法

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Foreword

This document is in accordance with the provisions of GB/T 1:1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents"

Drafting: This document is Part 1 of GB/T 43997 "Thermal Infrared Remote Sensing Inversion of Land Surface Temperature": GB/T 43997 has been published as follows part:

--- Part 1: Single channel method;

--- Part 2: Split window method: Please note that some of the contents of this document may involve patents: The issuing organization of this document does not assume the responsibility for identifying patents: This document was proposed by the Chinese Academy of Sciences: This document is under the jurisdiction of the National Technical Committee on Remote Sensing Technology Standardization (SAC/TC327): This document was drafted by: Institute of Agricultural Resources and Regional Planning, Chinese Academy of Agricultural Sciences, University of Electronic Science and Technology of China, Kunming University of Science and Technology, Suzhou Zhongke Tianqi Remote Sensing Technology Co., Ltd., Chengdu Institute of Mountain Hazards and Environment, Chinese Academy of Sciences and Ministry of Water Resources, Hebei University of Geosciences, Guilin University of Technology University, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, University of Chinese Academy of Sciences, Beijing Normal University, Peking University, Institute of Space and Astronomy, Chinese Academy of Sciences Information Innovation Research Institute, Dalian Maritime University, Southwest University, Shanxi University, National Satellite Meteorological Center, China Resources Satellite Application Center, China Science and Technology STAR CHARTS LIMITED: The main drafters of this document are: Li Zhaoliang, Duan Sibao, Wu Hua, Tang Bohui, Zhou Chenghu, Leng Pei, Zhao Wei, Shang Guobei, Chen Kunshan, Tang Ronglin, Jiang Xiaoguang, Yan Guangjian, Ren Huazhong, Liu Xiangyang, Ma Lingling, Qian Yonggang, Qiu Shi, Gao Maofang, Zhang Xia, Qin Zhihao, Zhao Enyu, Yu Wenping, Gao Caixia, Huang Cheng, Zhang Xiaoyu, Liu Zhaoyan, Wang Xinhong, Liu Meng, Ouyang Xiaoying, Fan

Jinlong, Han Qijin, and Cai Wenwen:

GB/T 43997 "Surface Temperature Inversion by Thermal Infrared Remote Sensing" aims to provide the inversion of surface temperature using aerospace or aviation thermal infrared remote sensing data: GB/T 43997 is planned to consist of four parts:

--- Part 1: Single channel method: The purpose is to clarify the process and steps of using a single thermal infrared channel for remote sensing inversion of surface temperature and uncertainty:

--- Part 2: Split Window Method: The purpose is to clarify the process and steps of using two thermal infrared channels for remote sensing inversion of surface temperature: and uncertainty:

--- Part 3: TES separation method: The purpose is to clarify the use of three or more thermal infrared channels to analyze the surface temperature and emission The process, steps and uncertainty of rate co-inversion:

--- Part 4: Day-night method: The purpose is to clarify the use of multiple thermal infrared channels in the day-night dual-phase for remote sensing inversion of land surface temperature: Processes, steps and uncertainties: Thermal infrared remote sensing inversion of land surface temperature Part 1: Single channel method

1 Scope

GB/T 43997.1-2024 is Part 1 of the Chinese series on retrieving land surface temperature from thermal infrared remote sensing, and covers the single channel method. Land surface temperature is a primary input to drought monitoring, urban heat island work, evapotranspiration and climate records, and the satellite does not measure it: it measures radiance at the top of the atmosphere, from which the temperature has to be recovered by removing the atmospheric absorption and emission and dividing out the surface emissivity. With a single thermal channel there is no way to solve for the atmosphere from the data itself, so the method depends on external atmospheric profiles and is sensitive to how good they are. The standard sets the principle of the method and the conditions under which it applies, the retrieval workflow and its steps, and the uncertainty analysis, with a normative annex on the relationship between channel radiance and temperature and an annex working through the combined standard uncertainty and its contributions from the model, the atmospheric parameters and the emissivity. It took effect on 1 November 2024.

This document describes the principle and applicable conditions of the single-channel method for inverting land surface temperature using thermal infrared remote sensing data, the inversion process and steps, and and uncertainty analysis: This document applies to the inversion of land surface temperature using one channel data in the thermal infrared atmospheric window region:

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document: For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document:

GB/T 41534-2022 Authenticity verification of land surface temperature remote sensing products

GB/T 41538-2022 Authenticity verification of surface emissivity remote sensing products

GB/T 41541-2022 Basic terms of thermal infrared remote sensing

3 Terms and definitions

The terms and definitions defined in GB/T 41534-2022, GB/T 41538-2022, GB/T 41541-2022 and the following terms and definitions apply This document: 3:

1 Earth's surface temperature Characterizes the integrated temperature of the Earth's surface with a thickness equal to the penetration depth (range 0:1 to 10 times the wavelength):

Note: The surface temperature obtained by remote sensing data inversion is the surface anisotropy after eliminating the influence of atmosphere and emissivity based on the brightness temperature obtained by the sensor: The equivalent temperature of the hybrid pixel (i.e., directional radiometer temperature), including land surface temperature and sea surface temperature, is in Kelvin (K): [Source: GB/T 41534-2022, 3:2] 3:2 [spectral] emissivity [Spectrum] emissivity The ratio of the thermal radiator's own spectral radiance to the spectral radiance of a black body at the same temperature and wavelength: [Source: GB/T 41538-2022, 3:1] 3:3 at-sensor[spectral]radiance satellite[spectral]radiance In a given direction, the spectral radiance of the surface above the ground is received by the satellite sensor after being affected by the atmosphere: [Source: GB/T 41541-2022, 3:26]