earth observation quarterly

meteorology — earthnet — remote sensing — solid earth — future programmes

N° 31 — September 1990

City Planning by means of Thermal Infrared Mapping
Urban climate analysis of the City of Graz

The city of Graz is located in the province of Styria in the southeast of Austria. Its main part lies in a basin surrounded by hills and low mountains of the Alpine Foothills. Towards the south the basin is open. Because of this specific topographic situation there is generally little wind and therefore reduced air circulation over the city. Nevertheless, some local wind systems exist which are mainly responsible for fresh air transportation towards the city. One of the most important local wind systems is triggered by cool air produced in small basins in the eastern hills during the nights. This fresh air flows gravitatively down the valleys into the city. Particularly during the winters there is a high possibility of smog. In recent years polluted air has caused several smog alarms. As an aid for a detailed urban climate analysis of Graz, a thermal-infrared mapping programme was carried out.

Advanced surface-temperature mapping

Using an AADS 1268 Daedalus multispectral scanner system belonging to the German Aerospace Establishment (DLR) during a late-night, an early-morning, and a solar-noon overflight on 2 and 3 October 1986, digitally derived data at a wavelength of 8.5 – 13 μm were obtained over the City of Graz and its immediate surroundings. In total 41 strips were flown. Vertical profiles of actual atmospheric parameters were measured, together with a net of other ground-truth data. The thermal-infrared data were radiometrically and geometrically rectified. Atmospheric correction was performed using the Lowtran-5 computer program. High accuracy in image rectification with a resampling to 5 m × 5 m pixels was achieved by means of an appropriate parametric restitution using a digital elevation model and approx. 1600 control points. The individual geocoded images were subsequently mosaicked to form complete scenes of the whole area of interest. Finally, the data were colour-coded with respect to their best visual discrimination of the (apparent) surface-temperature distribution. Three thermal maps were produced at a scale 1 : 25 000 which can be used efficiently by the user community. In addition to visual interpretation of the thermal data, it is possible to perform more complex analyses in a geographic information system (GIS).

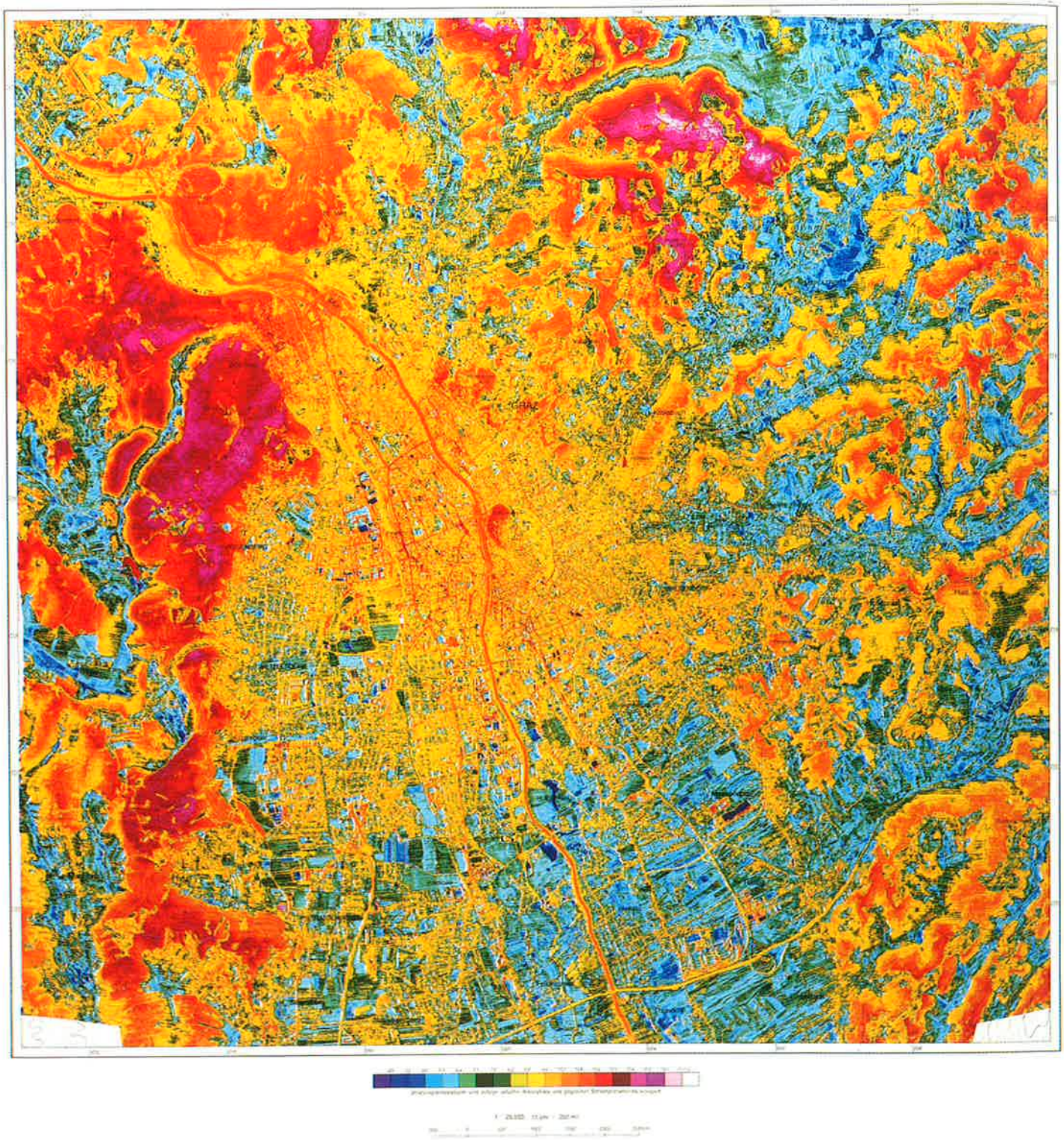
Detail of the centre of Graz with the Schloßberg and the river Mur on the left.

esa european space agency

THERMAL MAP GRAZ, AUSTRIA
1 : 25 000

2 October 1986

22:00 – 23:30 CET Night flight

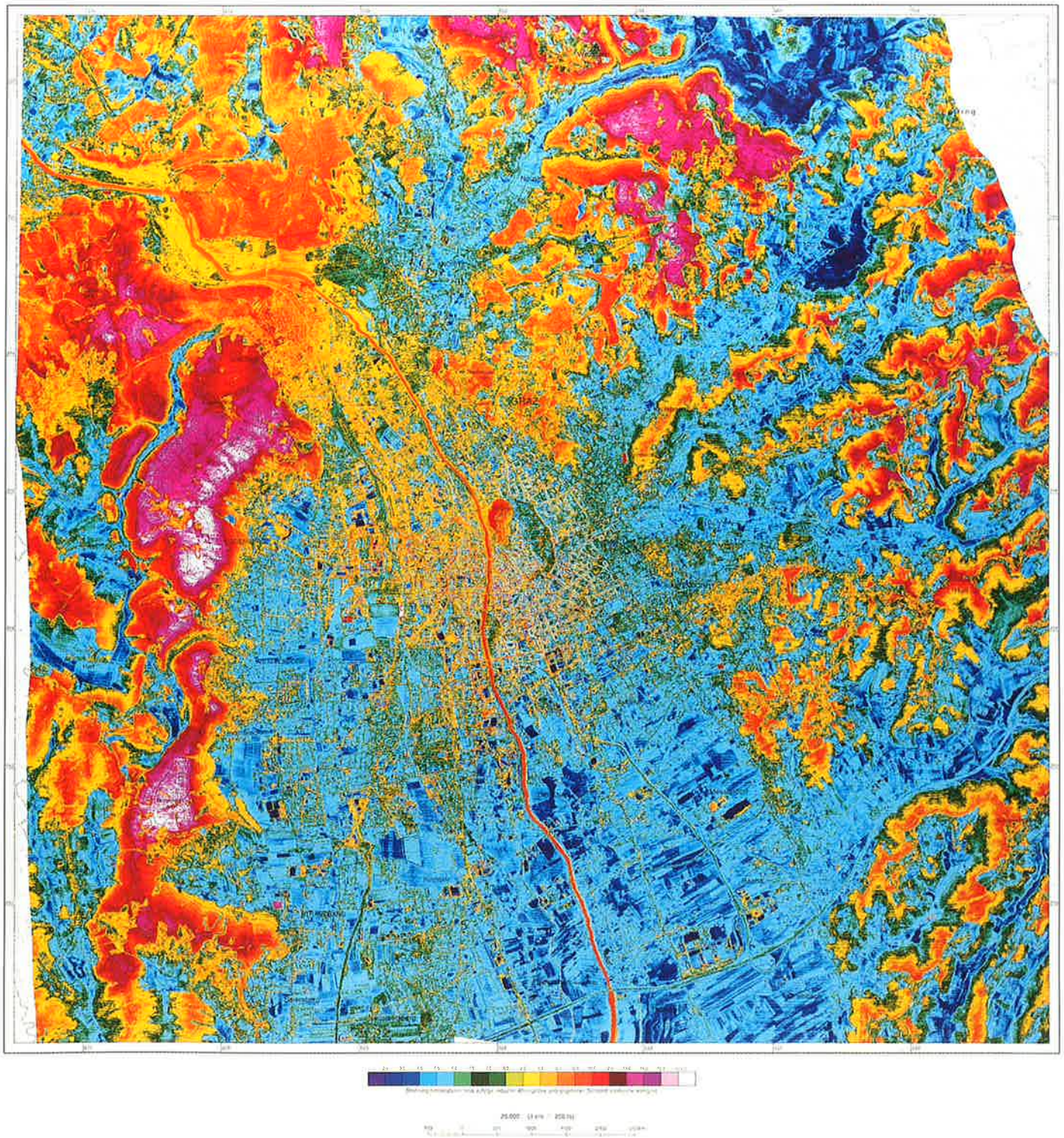


Conclusion

By using the thermal-infrared mapping results together with other collateral data (long-term atmospheric parameters, topography, urban physiognomy, industrial pollutants etc.), a detailed map of different microclimatic zones in and around the City of Graz was made. This has allowed new methods of city planning to be applied for the sake of a better environment.

THERMAL MAP GRAZ, AUSTRIA
1 : 25 000

3 October 1986 5:06 – 6:26 CET Morning flight



The very helpful cooperation of the German Aerospace Establishment (DLR) is greatly appreciated. Prof. G. Brandstätter (Graz University of Technology) kindly provided manpower to help us with the image data-processing tasks.

Authors: V. Kaufmann & M.F Buchroithner
Institute for Image Processing & Computer Graphics, Wastiangasse 6
A-8010 Graz, Austria
Tel. 43/316-8021. Fax: 43/316 - 8021/20