FREQUENCY ANALYSIS OF REMOTE SENSING SCAN-SIGNALS AS A TOOL IN OCEANOGRAPHIC INVESTIGATIONS

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The Remote Sensing techniques are largerly employed in Earth Sciences in general. In Oceanography in particular a new and useful elaboration technique of the data has been perfected in order to study the superficial distribution of the water masses movements.

It is well known that the Remote Sensing observation techniques strongly contribute to the oceanographic knowledge for several reasons.

First of all the wideness of the investigated areas at a time (from aircraft or from spacecraft) allows the mapping of the geometrical distribution of some superficial parameters, such as the black-body temperature, spectral behaviour,turbidity, and so on, in an easy way.

Furthermore the repetition rate of the surveys (called temporal resolution) appears a good approach to investigate in the proper way the superficial dynamic of water masses using for instance the black body temperature as a tracer.

Finally the possible various elaborations of the electrical signals comingfrom the normally employed line scanners give us the possibility to investigate deeply some physical characteristics of the surveyed area.

In this communication we would like to stress the importance of the so called frequency analysis of a line-scan signal.

The simplest and normal way to utilize the information coming from a scanner (aiborne or spaceborne) is to slice the amplitude in several steps in order to achieve the geometrical distribution of the intensity of the parameter to be studied (temperature fields, colour spectrally analysed fields, and so on).

A more sophisticated technique - taking into account that the rotation speed of the scan-mirror is constant, as well as the velocity of the aircraft or spacecraft - involves the slicing along the time-axis or space-axis avoiding any consideration regarding the amplitude of the signal.

Practically speaking the signals are treated with a band-pass filter in such a manner that only the superficial variations contained within a selected time/space interval are considered, indipendently from their amplitude.

Obviously the frequency range has to be chosen in a suitable way for the problem to be studied and it is impossible to define 'a priori' in general which are the best frequency range.

The frequency range is a function of the geometrical resolution of the scanner, the rotation speed of the mirror, the altitude of the survey, and mainly of the accuracy requested for the solution of the problem.

So that if we handle a thermal infrared signal, for instance, it is possible to get the so called "thermal roughness" of the surface, which distribution depends on the winds direction, the current pattern, the dynamic of water masses, showing practically the whole water movements at the surface much better then using the normal slicing of the amplitude modulation of the signals.

In the figure 1 a typical example of the frequency analysis is shown: the area of Tiber estuary was surveyed with a thermal scanner from an altitude of 4.000 m.a.s.l.

It easy to distinguish the semi-circular distribution close to the discharge point and the rectilinear patterns due to the wind effect.

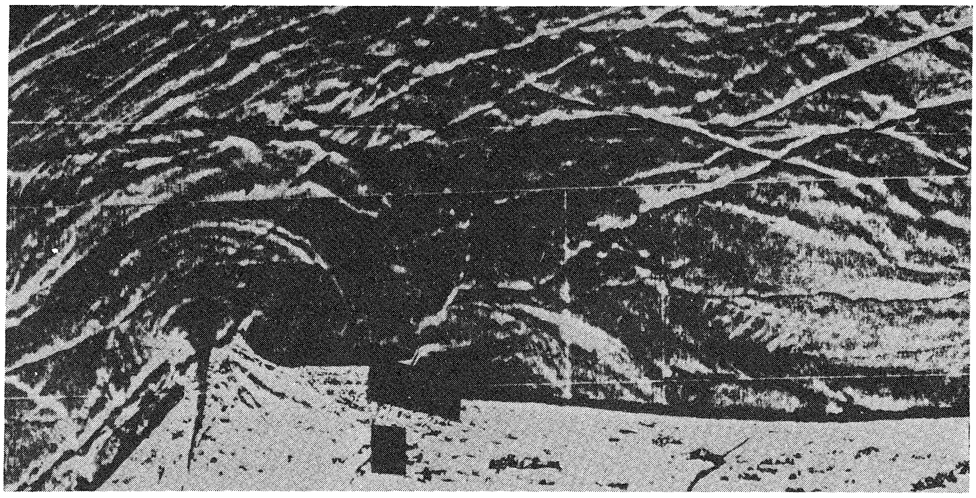

Fig. 1 18.6.1977 Frequency analysis of the electrical signals of the thermal scanner (100 kHz): the patterns of the surface temperature changes are clearly shown as well as some persistent boat trails where underlying water of different temperature had been brought to the surface by the vessels' passage.
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