COMPARISON OF CORONAL STRUCTURES 11.8.1999 ON THE LONG OBSERVATION BASE

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ABSTRACT

Observation of total solar eclipse obtained along the path of totality allows to study both fast and slow changes of white-light corona structures. These types of changes, as well as CME, slow moving of plasma, oscilations and so on reflect dynamics of photospheric and chromospheric activity caused by convection of magnetic fields. It is shown that structure changes in the individual formations, especially in coronal streamers could be occurred. By comparison of obtained pictures the speeds of moving of disturbances 100-200 km/s was found.

INTRODUCTION

The 1999 „European“ eclipse had a great opportunity to organize the multi-station observation of total solar eclipse along the entire totality band. After the last successful eclipse observations performed by Observatory Úpice we had an idea to employ this opportunity and organize two-station observation.

Moreover, plenty of Czech amateur astronomers, some Czech observatories and any other people asked us to coordinate "'99 eclipse Czech observational campaign", or to help them with preparing of their experiments. Then we decide to spread our program about their observation and make real multi-station observation. This circumstance allows collect the unique data obtained with the same or very similar telescopes, the same exposure times and the same types of films. These data make possibility to register some changes in solar corona during the time (approx. 120 min) of totality band crossing the Europe (Marková and Bělík, 1999).

EQUIPMENT AND OBSERVATIONS

In this paper the first results obtained from three observation places are presented. The first observation group was located in town Grandvilliers (France, 49,667N, 1,933E), the second one was near Balaton Lake (Hungary, 46,5N, 17,5E), the third one was in Pitesci (Romania, 45,5N, 24,47E). All three groups was equipped by the same, or similar telescopes (MTO1100/100, Rubinnar 1000/100, lens objective 300/4,5). All pictures were made on the same type of film (Kodak Royal 200 ASA) with the same exposures (1/1000 – 2s). All the films was developed at the same laboratory and at the same developer. Finally, the films were digitized at the same scanner with maximal resolution of 2000 DPI.

RESULTS

As Parker (1988) has suggested, the solar corona is heated by nanoflares. One may suppose that their responses should be observed as faint brightness excess in chosen coronal structures, especially in the thin extended streamers.

We have tried to find these faint brightness changes in the center axes of chosen streamers (fig. 1). The long helmet streamers were scanned along radial axes to find course of

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density downtrend. This process was repeated on different pictures and on gentle different "axes" of one and the same streamer to eliminate irregularities caused by impurities and faults on the pictures.

a) 345° streamer:

This streamer is situated in polar solar region, which shows only faint solar activity (Solar Data Analysis Center, 2000). On the west-side of this streamer the violent coronal hole is situated. We found possible "brightness candidates" in this streamer: 1,12 Ro on France snapshots (sign. F in the next), 1,45 Ro on Hungary pictures (H in the next) and 1,55 Ro, respectively 1,62 Ro on Romania pictures (R in the next). All radial scans are shown on fig. 2. The time diference is 1720 s (F-H) and 840 s (H-R). The corresponding speeds of irregularity moving along the streamer are 133 km/s (F-H) and 93 km/s, respectively 141 km/s (H-R).

b) 235° streamer:

This streamer is situated in region, which shows little enhanced activity. In this streamer only very faint brightness were found: 1,35 and 1,61 Ro (F), 1,54 and 1,71 Ro (H) and 1,5, 1,74 and 1,95 Ro (R). All radial scans are shown on fig. 3. It is very complicated to identify correlations between individual irregularities. We can only with very big insurance determine the speeds on 77 or 146 km/s (F-H) and 198 km/s (H-R).

c) 120° streamer:

This streamer is situated above active region No. 8665, which shows rather strong activity (Mees Solar Observatory, 2000). In this streamer we can detect brightness changes at 1,42 Ro (F), 1,85 Ro (H) and 2,07 Ro (R). All radial scans are shown on fig. 4. The speeds are 174 and 182 km/s.

d) 60° streamer:

This streamer is situated above arising active regions No. 8667 and 8668. In this streamer were found next possible events: 1,26 Ro (F), 1,33, 1,35 and 1,58 Ro (H) and 1,5, 1,72 and 1,95 Ro (R). All radial scans are shown on fig. 5. If we suppose the relations of events 1,26(F), 1,58(H) and 1,72(R) Ro, the corresponding speeds are 129 km/s (F-H) and 116 km/s (H-R).

Discussion

Optimal condition over total solar eclipses offers an opportunity to observe structural changes in the white-light corona (Zirker et al., 1992). Observations made at different sites along the eclipse path provide a possibility to study both the slow and fast changes in the solar corona. Photometric analysis shows that there could be another type of changes in the same type of coronal structure, especially in helmet streamers. These changes, preliminary called as "waves", have been detected in some helmet streamers during 1999 eclipse. Providing that these enhancements, detected at different heights in the streamer, are the same, we have estimated a speed of their propagation of 77-198 km/s. These values are in agreement with the our results obtained during the total solar eclipses on Oktober 24, 1995 and November 3, 1994 (Bělík et al., 1999).

Conclusion

We have tried to detect the possibility of small-scale manifestation, as result of nanoflares or other dynamic processes, in the brightness in coronal streamers observed during total solar eclipses. Koutchmy (1994) proposed that probably all white-light corona is in dynamic state at sub-arcsec resolution.

Irregularities in the brightness along the helmet streamers are very faint and they could by lightly interchanged with errors caused by digitize process, impurities, film inhomogenities and some more faults. As we sad earlier, this fault possibilities were minimized.

Nevertheless, we are in opinion that almost all detected events could be realistic and they could be an another type of phenomena showing that the white-light corona is in dynamic state.

REFERENCES

Bělík, M., Marková, E., Rušin, V., Šmelcer, L.: 1999, Manifestation Of ´Shock Waves´ In Coronal Streamers, Proc. 9th European Meeting on Solar Physics, ´Magnetic Fields and Solar Processes´, Florence, Italy, 12-18 September 1999 (ESA SP-448), **225**

Koutchmy, S.: 1994, Adv. Space Res., Vol. 14, No. 4, pp. (4)29-(4)39

Mees Solar Observatory, Haleakala, Hawaii http://www.solar.ifa.hawaii.edu/mees.htm

Parker, E.N.: 1988, Nanoflares and the Solar X-ray corona, Astroph. K., 330, **474**

Rušin, V., Minarovjech, M.: 1994, IAU Coll. 144 „Solar Coronal Structures", V. Rušin, P. Heinzel and J.-C. Vial (eds), VEDA Bratislava, pp. 487-490

Solar Data Analysis Center, NASA Goddard Space Flight Center, Greenbelt, Maryland USA, http://umbra.nascom.nasa.gov

Solar Geophysical Data, Part 1, Part 2, 1999, NOAA Boulder USA

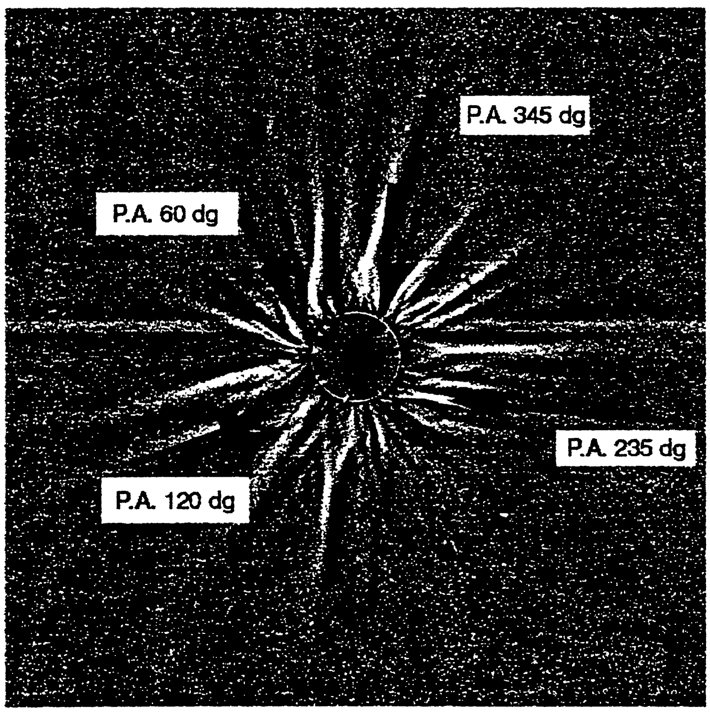

Fig.1: Position of chosen helmet streamers

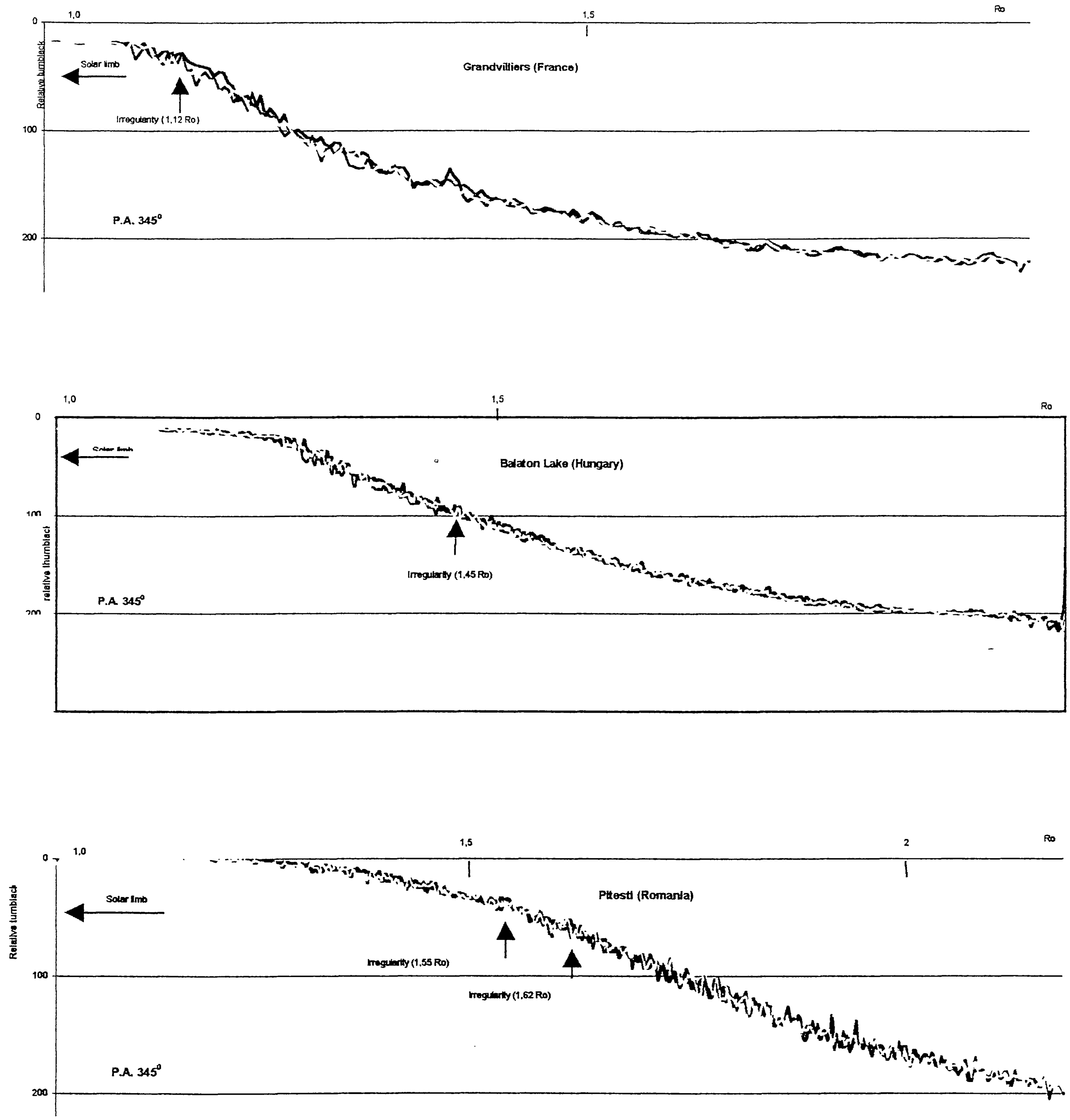

Fig. 2: Radial scan along streamer at P.A. 345°

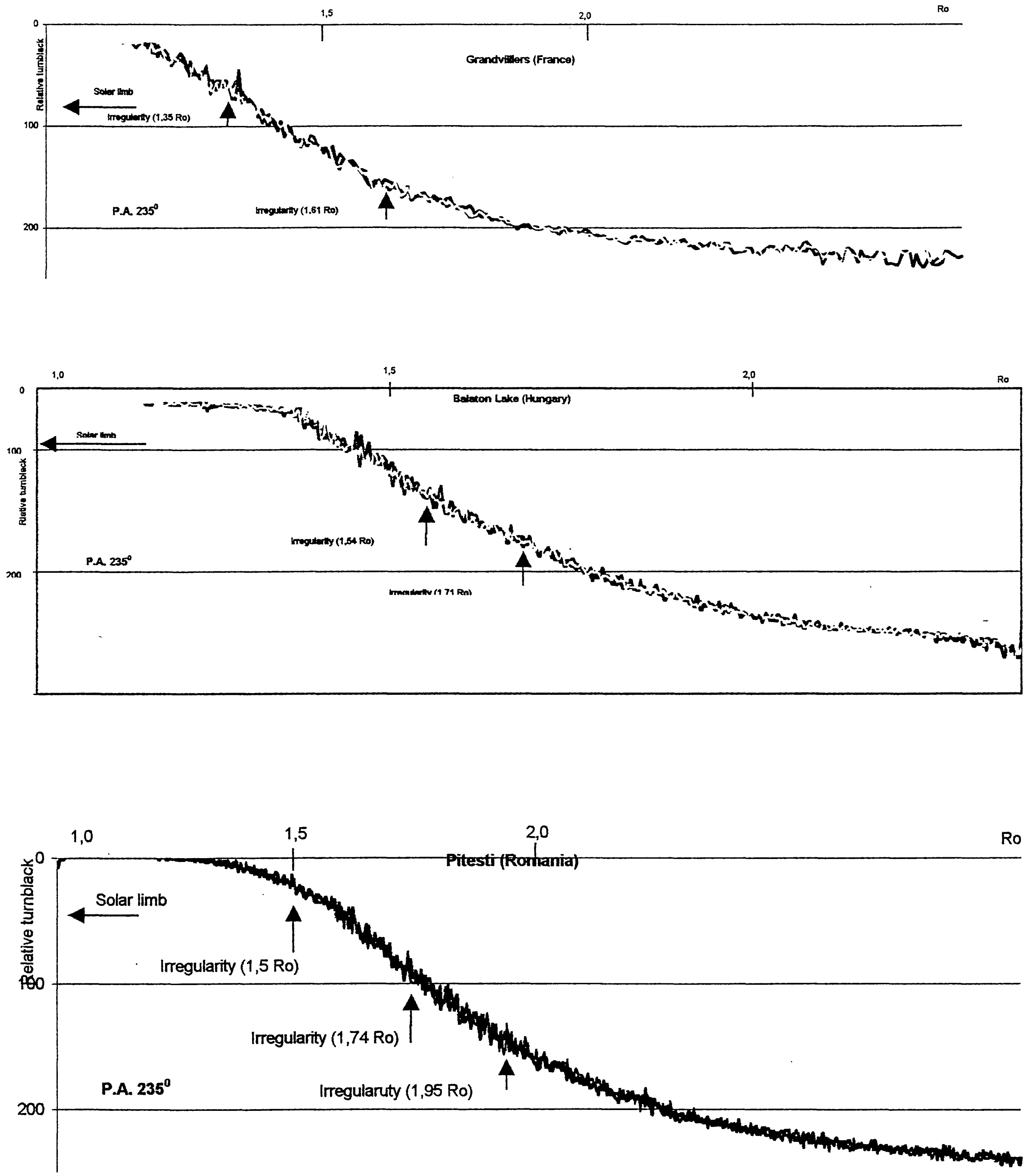

Fig. 3: Radial scan along streamer at P.A. 235°

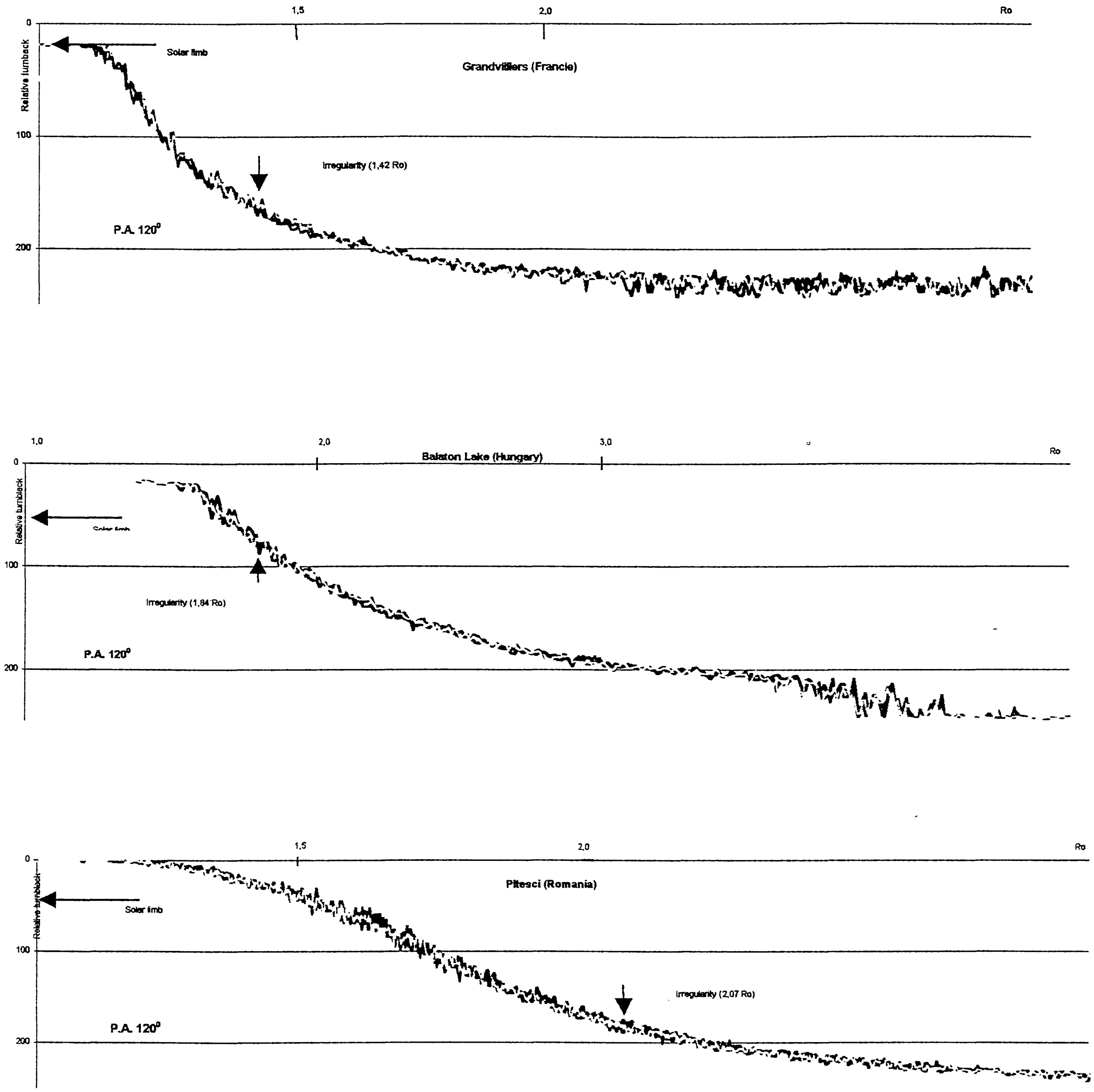

Fig. 4: Radial scan along streamer at P.A. 120°

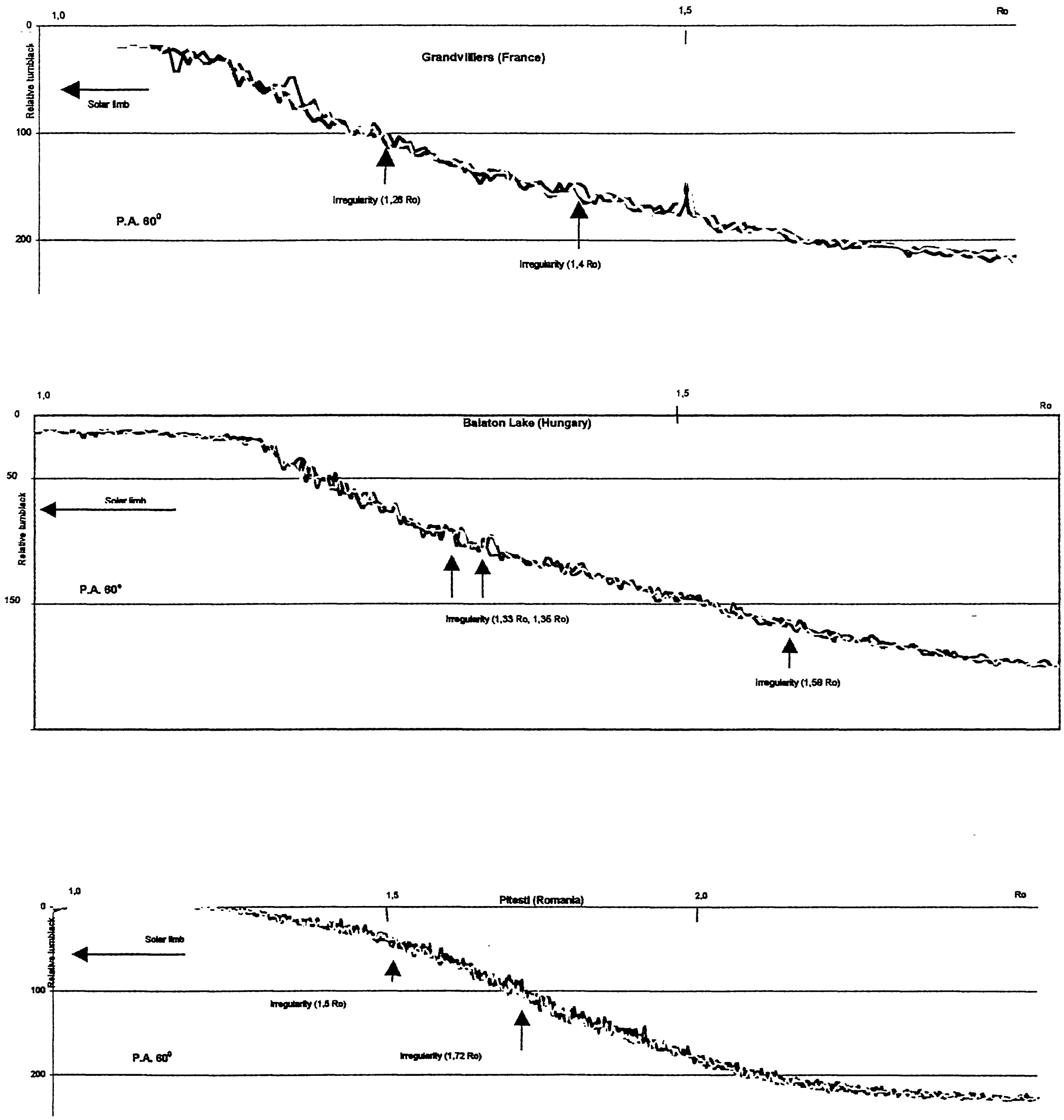

Fig. 5: Radial scan along streamer at P.A. 60°