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Study on the aerosol radiative forcing in the inter-annual radiative balance modulation

M. Caian, E. Savin

National Meteorological Administration, Bucharest, Romania

This paper presents a study on the aerosol radiative forcing in the inter-annual radiative balance modulation across Bucharest.

The 1964-1990 global radiation data across Bucharest show a decrease over 1970-1980. A reason could be that, over this period, an intense industrializing activity went on leading to lower solar radiation (SW) due to aerosols emissions in the atmosphere. The sudden, major increase after 1985 would be caused on the one hand by the measures to decrease pollutant emissions and by the long wave (LW) radiation's contribution due to greenhouse gases, long-lasting in the medium and high atmosphere.

Inter-annual distribution of these variations supports to some extent the two contributions, the 70s cooling being more intensely marked as a process over the spring-summer season (lighter wind in lower troposphere NH, favoring the persistence of aerosol radiative forcing). The 80s radiative increase over Bucharest shows a quasi-annual periodicity triggered in autumn. Both decennial energetic modifications show nevertheless, over this series of 30 years, the same dynamic mechanism triggering major energetic changes: shifting of the October-December season in both cases so as to induce over the rest of the interval (annually and up to a high periodicity, quasi-decennial) the mentioned energetic changes, a sign of the physico-dynamic way of interaction between climatic subsystems with different time responses to climatic forcing. This mechanism is also visible in the monthly relative anomalies field, which, in addition, shows the plain effect of the winter variability increase.

Aerosol radiative forcing still remains an important element particularly in the inter-annual radiative balance modulation, a high frequency of the long-term, multi-annual

tendency.

Numerical simulations to quantify aerosols' effect show on a short-medium term that total forcing is a balance between two contributions greater than total contribution, between the direct effect induced by aerosols and the indirect one.