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SPRING STRATOSPHERIC CIRCULATION TRANSITION AND MID-LATITUDE SPORADIC E-LAYER

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ABSTRACT

Using ionospheric data from a 32-year period for 8 mid-latitude stations within the European part of Russia, the dependence of intensity of an sporadic-E layer during the summer period on the start date of the spring seasonal transition of zonal circulation in the stratosphere was investigated. In those years with an early circulation transition, the sporadic-E layer intensity was increased by a factor of 1.5 compared with years with a late circulation transition.

INTRODUCTION

The behavior of a sporadic-E layer is largely controlled by features of the wind profile in the lower thermosphere (Akchurin *et al.*, 1995), which are largely generated by phenomena in the stratosphere and troposphere. At all times of the year, the sporadic-E layer intensity increases when the tropospheric zonal westerlies are distorted from their mean flow. In summer, the occurrence of intense sporadic-E layer is favoured when tropospheric wind circulation patterns are dominated by tropospheric blocking patterns. This includes stationary anticyclones and associated cyclones (Akchurin *et al.*, 1995). Blocking patterns are often observed over northwest Europe in summer during the odd cycle of the quasi-biennial oscillation (QBO), while these are replaced by intense westerlies during the even QBO cycle (Davis, 1967). The dependence of intensity and form of the summer troposphere circulation on the date of the spring transition to a stratospheric anticyclone was revealed by Ugryumov (1971). Therefore the start date of the seasonal circulation transitions of the lower mesosphere and stratosphere is frequently used in the long-term forecasts of weather. We describe our investigation into the relationship between the start date of the spring circulation transition in the stratosphere on the intensity of ionospheric sporadic-E layers during the summer period.

INITIAL EXPERIMENTAL DATA

The spring stratospheric circulation transition occurs with the change of a cyclonic circumpolar vortex to an anticyclonic flow. Thus the intense westerly winter circulation decreases to zero at the transition, after which an easterly summer circulation develops. For an objective determination of the spring date of stratospheric transition of circulation, the Katz index of zonal circulation (Ugryumov, 1971) may be used. In this work, we use a long-term data base of the start date of the spring zonal circulation transition (d - number of days from beginning of the year) for the extra-tropical latitudes of the northern hemisphere at the 10 mbar surface (30 - 31 km), for the period 1958-1989 (Ugryumov, 1971, Minyushina, 1992).