Introduction

To be efficient, remote-fire monitoring requires a reliable method by estimating the danger. For large remote forested areas, such as found in Russia, where a dense network of local weather stations is not available, the danger displayed should be a criterion gradient. However, remote-sensing using atmospheric data of several satellites allows for obtaining a number of parameters describing surface conditions of the Earth (e.g., radiative surface temperatures, vegetation indexes, etc.). In addition, the vertical sounding system (NOAA/TOVS) collects data on characteristics for the near-surface atmospheric layer (e.g., dew point temperature, wind parameters, pressure distribution, etc.).

The technology of fire-danger map generation consists of three interdependent stages. The first stage involving preliminary data processing includes acquisition and recording of the satellite signal, radiometric data collection, and selection of a specific analysis channel combination. This stage also allows for a correction to the fire-danger index based on precipitation information obtained from local weather stations.

Software development

The second stage is where software was developed to allow all the data to be projected as one image in a given coordinate projection, which results in a daily updated fire-danger map. Radiometric parameters for the underlying surface obtained with the help of remote-sensing methods are used instead of actual meteorological parameters to estimate specific atmospheric bottom layers parameters. During the research the development of a fire-danger index using remote-sensing technology has been accomplished.

The advanced equipment contained on the NOAA-14 satellite gathers supplementary data giving an opportunity for estimation of visible surface moisture. This allows for the correction of a computation factor of that affects both the vegetation index (AVHRR channels 1 and 2 data) and the quantitative estimation of surface moisture (AVHRR/NDVI channel 2 data).

Unfortunately, darkness is not transparent to the AVHRR infrared wavelength. Thus radiometric data over regions covered by clouds is not available for any computations. A solution to this situation is a proposal to use NOAA/AVHRR instrument data. Unlike the infrared channels of AVHRR, the microwave range of TOVS data allows for obtaining of daily updated fire-danger index maps. Radiometric parameters for the underlying surface obtained with the help of remote-sensing methods can be used instead of actual meteorological parameters to estimate atmospheric bottom layer parameters. During the research the development of a fire-danger index using remote-sensing technology has been accomplished.

The third stage takes advantage of Geographical Information Systems (GIS) technology to produce a final product. This stage is accompanied with the help of ARCINFO 3.4.2 and ArcView 3.2 software packages. The classes of fire danger are selected according to the ranges of actual fire-danger index values. Further processing using GIS technology could combine the fire-danger maps produced here with forest fuel information to produce maps showing potential levels of fire behavior and fuel consumption. Such products would be useful in fire suppression efforts and for projecting carbon emissions from fires in Russia.

Additional literature