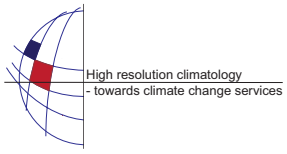
EMS Annual Meeting Abstracts
Vol. 7, EMS2010-744, 2010
10th EMS / 8th ECAC



Climate and anthropogenic impacts on forest vegetation derived from satellite data

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Vegetation and climate interact through a series of complex feedbacks, which are not very well understood. The patterns of forest vegetation are largely determined by temperature, precipitation, solar irradiance, soil conditions and CO2 concentration. Vegetation impacts climate directly through moisture, energy, and momentum exchanges with the atmosphere and indirectly through biogeochemical processes that alter atmospheric CO2 concentration. Changes in forest vegetation land cover/use alter the surface albedo and radiation fluxes, leading to a local temperature change and eventually a vegetation response. This albedo (energy) feedback is particularly important when forests mask snow cover. Forest vegetation-climate feedback regimes are designated based on the temporal correlations between the vegetation and the surface temperature and precipitation. The different feedback regimes are linked to the relative importance of vegetation and soil moisture in determining land-atmosphere interactions.
Forest vegetation phenology constitutes an efficient bio-indicator of impacts of climate and anthropogenic changes and a key parameter for understanding and modeling vegetation-climate interactions. Climate variability represents the ensemble of net radiation, precipitation, wind and temperature characteristic for a region in a certain time scale (e.g.monthly, seasonal annual). The temporal and/or spatial sensitivity of forest vegetation dynamics to climate variability is used to characterize the quantitative relationship between these two quantities in temporal and/or spatial scales. So, climate variability has a great impact on the forest vegetation dynamics. Satellite remote sensing is a very useful tool to assess the main phenological events based on tracking significant changes on temporal trajectories of Normalized Difference Vegetation Index (NDVIs), which requires NDVI time-series with good time resolution, over homogeneous area, cloud-free and not affected by atmospheric and geometric effects and variations in sensor characteristics (calibration, spectral responses). Spatio-temporal forest vegetation dynamics have been quantified as the total amount of vegetation (mean NDVI) and the seasonal difference (annual NDVI amplitude) by a time series analysis of NDVI satellite images over 1989 – 2009 period for a forest ecosystem placed in the North-Eastern part of Bucharest town, Romania, from IKONOS and LANDSAT TM and ETM satellite images and meteorological data. A climate indicator (CI) was created from meteorological data (precipitation over net radiation). The relationships between the vegetation dynamics and the CI have been determined spatially and temporally. The driest test regions prove to be the most sensitive to climate impact. The spatial and temporal patterns of the mean NDVI are the same, while they are partially different for the seasonal difference. For investigated test area, considerable NDVI decline was observed for drought events during 2003 and 2007 years. Under stress conditions, it is evident that environmental factors such as soil type, parent material, and topography are not correlated with NDVI dynamics. Specific aim of this paper was to assess, forecast, and mitigate the risks of climatic changes on forest systems and its biodiversity as well as on adjacent environment areas and to provide early warning strategies on the basis of spectral information derived from satellite data regarding atmospheric effects of forest biome degradation .