Effects of spring land cover change on early Indian summer monsoon variability

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Abstract. Effects of land cover change over the Indian subcontinent during the preceding March through May (MAM) on early Indian summer monsoon (ISM) rainfall were examined using the Normalized Difference Vegetation Index (NDVI) and Global Precipitation Climatology Project precipitation for the period of 1982~2003. MAM NDVI anomalies have increased significantly in western and northern India. NDVI anomalies are correlated with the decreasing trend of early ISM rainfall. Decreasing rainfall originates from the decreased land-sea thermal contrast, which is due to the decreasing trend of July sensible heat flux in central and northern India. This is related to the increase in the preceding MAM NDVI anomalies because early ISM rainfall is significantly and negatively correlated with the standardized principal component of the first leading empirical orthogonal function for the preceding MAM NDVI anomalies. Also, composite differences of early ISM rainfall for the five years of highest and of lowest MAM NDVI anomalies demonstrate that early ISM rainfall is significantly less for the years of highest MAM NDVI anomalies. Composite differences of wind vectors and divergence in the upper level also support the conclusion that the weak early Indian summer monsoonal circulation is due to the increase in land cover during the preceding spring, which would promote an increase in latent heat flux and a decrease in sensible heat flux thereby favoring a reduced horizontal temperature gradient.

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