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Daily NDVI patterns: implications and opportunities for monitoring

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The MSG SEVIRI sensor provides images of Europe and Africa every 15 minutes, which gives the possibility of studying patterns of NDVI variation within a day. This study used the radiance values of the VIS 006 (red) and VIS 008 (infrared bands) of this sensor to calculate NDVI for a number of clear days in 2006 and 2007, including several extremely hot and dry days of the summer of 2006. Focus is on areas in the Netherlands with mainly vegetation, like grasslands, crop fields and forest.

Earlier research over the summer of 2006 indicated that on clear days the daily NDVI patterns of these different vegetation types are strikingly similar, with a sharp rise in NDVI at the start of the day, a gradual decline (about 0.05) over the day and a sharp decline as the sun sets. Current research confirms that these daily patterns can be found throughout the growing season. During very hot and dry days, the daily NDVI pattern had more of a saddle shape, with a shallow dip in the gradual decline, around midday. Possible explanation would be that the rise in NDVI at the start of day is a result of the start of photosynthesis, as the red light is absorbed and used while the infrared is reflected. Gradual decline of NDVI during the day or local shallow minima during hot, dry days could be attributed to limited photosynthesis as a result of water stress, when transpiration exceeds water uptake.

The research over the summer of 2006 showed also that the patterns were not due to daily atmospheric patterns, since analysis with reflectance values instead of radiance values (normalization of the influence of the atmosphere) gave similar results. No

significant relations were found between hourly air quality measurements and daily NDVI patterns. Although the influence of daily variations in air humidity could not be tested, evidence suggests that daily patterns in NDVI are indeed related to daily patterns in photosynthesis.

The current research expanded the series observations both in space and in time and focuses on better understanding of the relation between vegetation type, growing conditions and NDVI as reflected in daily NDVI patterns over different seasons, at different temperatures and under different growing conditions.

The implications of these findings are twofold: on the downside it is an additional source of error for NDVI mosaics originating from images acquired at different times of day. Better understanding of daily NDVI patterns should help to quantify and if possible correct for this error. On the positive side, the shape of the daily NDVI curve gives more detailed information on the photosynthesis and hence on the condition of the vegetation than only the daily (maximum) NDVI or the NDVI development over the season.