Tracking cloud patterns by METEOSAT rapid scan imagery in complex terrain

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Abstract
During the field phase of the Mesoscale Alpine Programme (MAP) in autumn 1999 Meteosat-6 performed 5-minute rapid scans of a region centred over the Alpine area. This dataset was used to implement a tracking technique based on the standard pattern correlation technique for tracking cloud patterns. Sensitivity studies with respect to the size of the tracked cloud regions, their textural characteristics and persistence were carried out. The big advantage of satellite imagery of high temporal resolution for tracking purposes is demonstrated. The rapid scans favour a continuous tracking of smaller-sized geographical windows (e.g. 15 x 15 pixels) with a high tracking quality expressed in terms of correlation. This is true for rapidly developing convective cells or weakly-textured stratiform cloud areas. Besides the temporal resolution of the images the tracking results are dependent on the size of the initially defined target pattern and the rate of development.

1 Introduction

During the Special Observing Period (SOP) of the Mesoscale Alpine Programme (MAP) (BOUGEAULT et al., 2001) EUMETSAT provided 5-minute rapid scan imagery from the geostationary spacecraft Meteosat-6 located at 9° W. Meteosat-6 performed a total of 480 hours of rapid scan imagery of a region centred over the Alpine area (HANSON et al., 2000). The increase of the spacecraft’s temporal resolution from the operational 30-minute interval to the rapid scanning 5-minute interval favours a tracking of cloud systems. In the present paper, this high-resolution satellite data is used to expedite tracking sensitivity studies with the standard correlation tracking technique. According to Hodges (1998), the current techniques to perform cloud tracking and calculating the cloud motion vectors (CMVs) are predominantly based on correlation techniques which are perfectly adequate for these purposes. SCHMETZ et al. (1993) described the operational correlation technique for deriving CMVs from infrared images of Meteosat and pointed out, that the CMVs calculated from satellite imagery may represent a layer mean flow rather than a wind vector at a specific height. SZANTAI et al. (2001) used ground measurements from lidar and radiosonde data to determine the height of an extended cirrus cloud they tracked with the correlation method. They computed CMVs with a correlation window of 32 x 32 pixels and were able to track elements of the large cirrus cloud for more than 64 hours with 30-minute interval imagery from Meteosat-4. BOLLIGER (2002) implemented the correlation tracking technique to track cloud systems over the Alps with rapid scan data of Meteosat-6 with the aim to infer the convective and stratiform character of cloud areas from the intensity of cloud development. It was concluded, that the correlation technique combined with high temporal resolution imagery leads to reasonable results in complex terrain even with small tracking areas (size: 15 x 15 pixels). The present tracking studies are based on investigations of BOLLIGER (2002). The tracking applied to rapid scan data from Meteosat-6 was not performed to derive cloud motion.