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Illposed inverse problems in assimilating radiances for numerical weather prediction

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Using radiance-data from satellites within the numerical weather prediction (NWP) system we inherently expose ourselves to the difficulties of an illposed inverse problem. The complexity of an entire atmosphere can not be described very well with a single measurement.

On the other hand radiance-data from satellite provide a unique chance to access information about the atmosphere in a regular and well distributed manner. This is an advantage in areas that traditionally have little or no other sources of observational data. Together with the increasing availability of satellite-data (recall the launch of MetOp-B late last year) this has been the reason for a strong interest in assimilating this information into the NWP-systems around the world within the last years.

Apart from these practical aspects we highlight the underlying mathematical description of the problem. Singular value decomposition can shed a new light onto the limits and chances that satellite-data has within the numerical weather prediction.