**Seminar on Physics and Chemistry
of the Atmosphere
11.01.2019, WiSe 2018 - 2019, IUP Bremen**

# Deectometry and non-ideal LCDs; Glyoxal inversions using TM5

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## Abstract

The talk will be divided in two parts, introducing my scientific background and the future plans for my PhD.

In the first part, I want to shortly present the topic and results of my master thesis, titled "Assessment of active pattern generation with displays of non-ideal physical properties". The aim was to improve "deflectometry", which is an established measurement technique for specular surfaces, with theoretical precision limits similar to interferometry. The idea is to infer the surface's shape by observing how a known pattern is distorted after reflection on the surface. The current bottleneck for the precision of deflectometric measurements is the insufficient description of the exact properties of the patterns once generated in the real world, i.e. by means of a computer LCDs. For my thesis I took measurements on different LCDs and based on that modeled several properties of interest in a newly developed ray tracer simulation. This allowed me to estimate the magnitude and structure of the errors introduced by each non-ideal property of the LCDs. In turn, this information can now be used to improve the calibration procedure depending on the required precision.

The second part will revolve around my planned PhD-thesis, titled "Inversion of short lived pollutants in the global atmosphere using remote sensing data". The idea is to extend the capabilities of the TM5-4DVAR model to the inversion of (multiple) short lived species. First, this must be achieved for a single tracer. As of now, even on the highest spatial resolution of $1°x1°$, only very minimal transport is assumed for short lives species, which is why no reasonable inversions can be done. Therefore, the zooming capabilities of the model must be extended, for example, by splitting each grid cell in even finer sub-grids. This way, the resolution can be increased to i.e. $0.5° x 0.5°$, were meaningful transport can occur and local sources and sinks can be resolved, even for short lived species. Such inversions require very high resolution satellite data, which is given, for example, with the S5P data available in-house. An interesting case to investigate could be the CHOCHO and $NO_2$ observed over the tropical oceans. The results of the 4DVAR inversion, which optimizes in both space and time, can then be compared to 3DVAR data assimilation results using ie CTDAS (Carbon Tracker Data Assimilation Shell), which only does spatial, but no temporal optimization. If successful, the 3DVAR assimilation would yield a much less computationally expensive alternative. Once the inversion of a single short lived species is done, the second step is to extend the scheme to a true multi-tracer

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inversion. This implies the non-trivial task of a simultaneous inversion of at least two species, e.g. CHOCHO and $NO_2$, which have separate sources and sinks but influence the chemistry of one another.