# Preparing for the ADM-Aeolus mission: measuring wind profiles from space; ocean albedo effects on surface wind calibration

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**The upcoming ADM-Aeolus polar orbiting satellite mission will provide accurate wind profiles with global coverage. Preparations include development of simulators and processors, and simulations of calibration procedures. The launch of ADM-Aeolus is expected in 2012.**

## 1. Introduction

ADM-Aeolus will be the first direct detection high spectral resolution Doppler Wind Lidar in space. It will be able to measure wind profiles from space, from the surface up to about 30 km altitude.

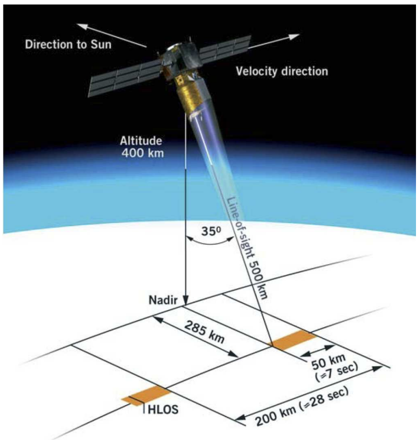


*Figure A. Overview of the measurement geometry and horizontal sampling of ADM-Aeolus.*

Properties:

- 355 nm laser pulsed at 100 Hz
- separate spectrometer for Rayleigh scattering by the air molecules (Fabry-Perot) and Mie scattering by aerosol and cloud particles (Fizeau)
- surface reflections are needed for calibration of zero wind
- knowledge of temperature and pressure profiles is needed during processing of the spectral data to allow retrieval of good wind information

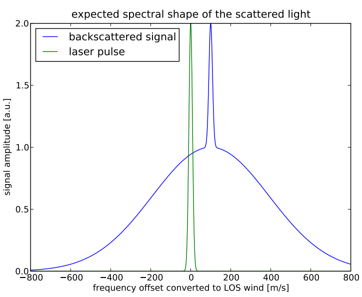


*Figure B. Expected spectrum of the backscattered light*

## 2. Ground Wind Calibration

Uncertainties in instrument pointing may cause a fraction of the satellite velocity to be projected into the line of sight (LOS). To obtain good results this must be corrected for by measuring surface reflections.

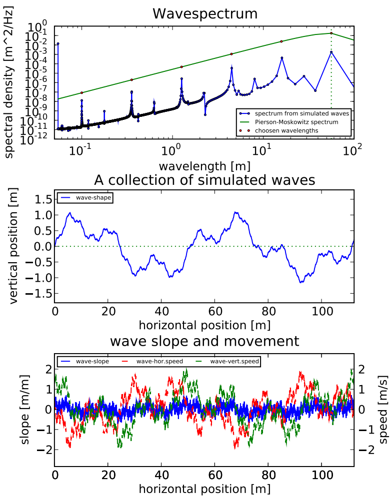


*Figure C. Example of wave properties used in the simulation for a windspeed of 8 m/s.*

This will allow to find the spectrometer frequency that corresponds to zero surface wind.

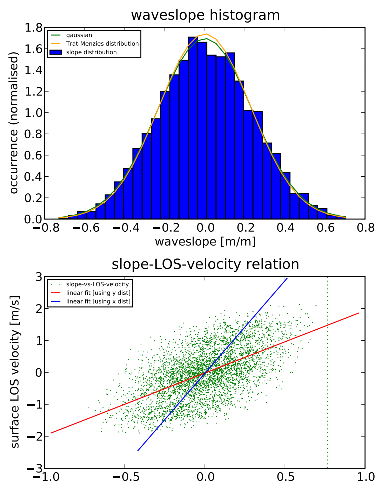


*Figure D. Illustration of the relation between the local water surface slope and the LOS water velocity as seen by the lidar for a windspeed of 8 m/s. The reflection calculation uses the simplified linear fitted relation indicated by the blue line.*

Surfaces with sufficient albedo include desert, snow/ice and ocean.

*Figure E. Waves at larger surface wind speeds form white-caps which dominate the off-nadir reflection (left photo: beach view, right photo: airplane view).*

### 2.1 Ocean surface reflection:

There is a risk that calibration on the ocean surface will give a biased result. To study this possibility, a simple model was constructed which includes:

- wave shape and motion for given local wind
- surface reflection for given local wind (both specular and white caps)
- to be added later: sub-surface reflection, to be combined with sub-surface water movement

The model tries to correlate these properties, to retrieve an average LOS water surface motion as will be seen by the lidar.

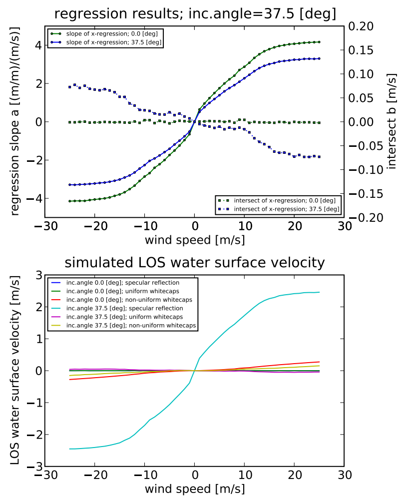


*Figure F. Slope relation used to calculate LOS water surface movement for different wind speeds.*

## 3. Conclusion

**The phase-relation between white-caps and waves is still an unknown. Depending on what is assumed for this relation a non-zero water movement may be observed by the lidar instrument, leading to biases in the observed wind profile. Also sub-surface reflections may alter the results when included in the simulation.**

*References*

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www.esa.int/esaLP/LPadmaeolus.html

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NAC-10 Veldhoven, 22-23 April 2010.

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