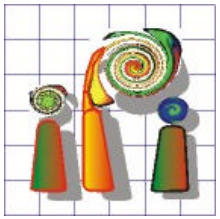
# *WAVESCAN* Automatic Recording and Modelling of Surf Zones based on Digital Image Sequences

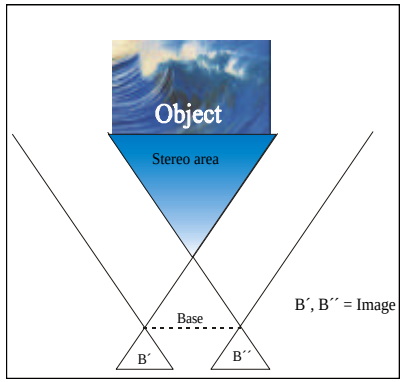
Institut für Strömungsmechanik u. Elektr. Rechnen im Bauwesen (ISEB), Universität Hannover, Appelstraße 9A, 30167 Hannover, Germany
Institut für Photogrammetrie u. Ingenieurvermessungen (IPI), Universität Hannover, Nienburger Straße 1, 30167 Hannover, Germany



## Introduction:

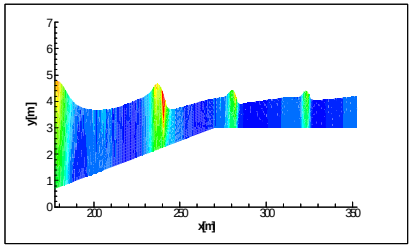
A class of models, termed Boussinesq-Wave-Models, has been developed in the past to provide time dependent (phase resolving) wave information for shallow and intermediate water depths. Recent extensions include wave breaking, runup and expansion into deeper water. There is a need for appropriate field data (spatial and time dependent) to steer and to validate the models. Aerial quasi continuous measurement techniques using high resolution digital cameras seem to be applicable for this purpose.

## Photogrammetric Model:

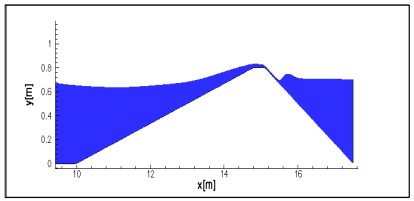



Wave analysis from image sequences using analytical photogrammetry is highly accurate, very complex and, therefore, expensive. For this reason, “classical” photogrammetry was replaced by other measurement techniques, e.g. radar or wave riders. The availability of high resolution digital cameras and sufficient image-sequencing allows the phase-resolving observation of waves. Present developments and research with regard to automated matching procedures and interpretation of digital images make it possible to replace the classical approach. These developments are important for wave analysis, considering the fact that photogrammetry was and still is the only highly accurate method with a continuous spatial and temporal data acquisition.

## Numerical Model:

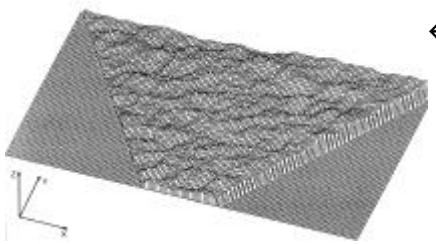



The wave field is calculated with the numerical model BOWAM2 that is based on an extended set of Boussinesq wave equations and that includes a more complex *Extended Eddy Viscosity Concept* in order to determine with a higher accuracy the wave breaking point, the decreasing wave height and the wave asymmetry in the surf zone.

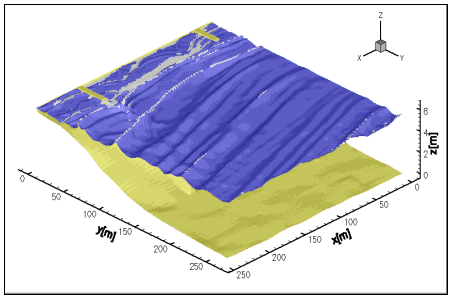



The *Wet Slope* is a special strategy that allows a determination of wave runup and the water volume associated with wave overtopping as an additional coastal enginnering parameter of a Boussinesq wave model. These surf zone concepts were developed by Strybny in 2000.

## Combination of both Models:



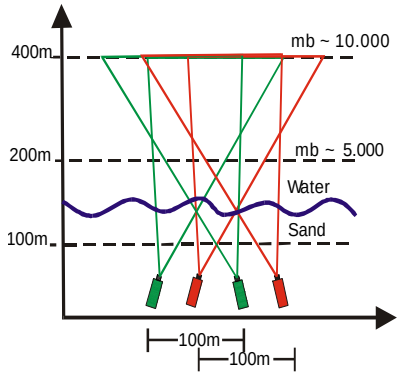
Digital surface model derived by photogrammetry




Surface calculated with the numerical model

BOWAM2 offers interfaces which can be used to **incorporate hydrographs, collected in the complete area,** at every grid point of the open boundary.

Procedures are being developed to **obtain additional information on special surf zone phenomena** such as the location of breaking waves and wave runup **from the digital sequences and for the automation of these methods.**




## Area under Observation:

Measurements are being taken over distances of a few hundred meters from the top of high rise buildings. The test area is a groyne field on the coast of the German North Sea on the island of Norderney. For the purpose of comparison, single point measurements are also being carried out with conventional instruments.