

Chapter 5

THESIS GOALS

5.1 Scientific Objectives

The review of the background oceanographic knowledge (Chapter 3) demonstrates that bubble clouds are important for the investigation of upper ocean dynamics and acoustics, and air-sea gas transfer. A few studies have reported on this topic. They had established the most significant bubble cloud parameters. The wide discrepancies in void fraction values, obtained in different experiments, speak for the inconclusiveness of this issue. The solving of the inverse problem – finding the bubble population from the void fraction measured – may overcome the instrumental difficulties in measuring the initial bubble population. The first step for parameterization the bubble clouds was done by Kalvoda (1992) for wind speed of 16 m s^{-1} . The continuation of this investigation comes naturally. Thus, systematic parameterization of the bubble cloud characteristics under various well-controlled conditions is necessary and pertinent. In fulfilling this scientific task, a

laboratory study on bubble clouds produced by breaking waves under various wind velocities in both fresh and salt waters and at different temperatures is considered. Parameters of interest are: the spatial and temporal evolution of cloud shape, penetration depth, and void fraction. Their behavior at different wind velocities, temperatures, and in fresh and salt waters should be compared. Video imaging technique is employed.

The results expected of this study are:

1) Tracking the spatial and temporal evolution of the bubble cloud. Cloud dimensions – length, width, depth of penetration – are to be parameterized and scaled with the corresponding wave parameters.

2) Wind dependency of these parameters are to be established.

3) Water temperature influence on these parameters to be determined.

4) Water salinity influence on these parameters to be obtained.

5) Void fraction of the cloud to be derived: at different wind velocities; in fresh and salt waters.

6) Size distributions of large-bubble population to be calculated and compared with the directly obtained bubble population.

5.2 Experimental Plan

The experiments necessary to achieve these goals were scheduled as follows:

1) An experiment in fresh water at fetch 26 m under wind 9 - 16 m s⁻¹.

Measurements with: one camera with a big side view for imaging the bubble clouds; and second camera with a small side view for obtaining bubble size distribution within the clouds; wave gauge for extracting the wave characteristics.

2) An experiment in fresh water at fetch 26 m under wind 9 - 16 m s⁻¹.

Measurements with: one camera for top view; wave gauge.

3) As experiments 1) and 2) but at higher and lower temperatures.

4) Salinity experiment in fresh, distilled and sea water.