Deltas in Depth scientific sessions		
Deltas in Depth Theme 3. Fresh water management		
DD 3.2 Salinity, drinking water, adaptation practices		
Chair	Holly Michael, University of Delaware, USA	
Presentations	•	Mahmoud Abdel Wahed, Lappeenranta University of Technology, Laboratory of Green Chemistry, Finland
	•	Rob Uittenbogaard, Deltares, Netherlands
	•	Yann Friocourt, Deltares, Netherlands
	•	Joachim Hunink, Deltares, Netherlands

Holly Michael (University of Delaware, USA) points out the importance of fresh water research and monitoring. With the words "What lessons are learned and what is still need to know?" she opens the session.

Mahmoud Abdel Wahed, Lappeenranta University of Technology, Finland, Water quality of Fayoum surface water, Fayoum Province, Egypt

One of the biggest issues in Egypt is water quality. Due to sea level rise the most fertile lands in Egypt will inundate and groundwater will be contaminated with salt. Huge populations live there and will have to migrate and reclaim new land elsewhere.

Abdel Wahed examined the drinking and irrigation water quality of the Fayoum Province. He shows some pictures of irrigation canals filled with garbage and waste of animals, and tells that he collected 43 water samples from irrigation canals, drains and Lake Qarun. He tested the samples on their electrical conductivity, oxygen and heavy metals. The results show that these surface waters contain high microbiological contaminations from human excrements. Therefore there is a high risk for people drinking it. This is a problem while many inhabitants don't have access to tap water.

Lake Qarun is a reservoir filled with drain water, but contains a relatively low level of heavy metals. compared to the other water samples. The sediments at the bottom of the lake seem to have absorbed the metal elements. He ends his talk with an urge for awareness among locals and laws for environmental protection: Egypt needs every drop of clean water!

Rob Uittenbogaard, Deltares, the Netherlands, Water-air bubble screens reduce salt intrusion through ship locks

Ship locks are important in deltas, but they import salt water into the fresh water system. This troubles the demand for more and longer storage of fresh water in times of low discharge. Therefore bubble screens were invented in the 1960's. And it works as follows: on the sea side of a ship lock a perforated pipe releases a thick curtain of air bubbles and, due to the buoyancy effect, these bubbles prevent salt water from entering the system.

Deltares tried to improve this bubble screen. They made air regulators to ameliorate the screen and added a fresh water screen adjacent and parallel to the bubble screen. They tested both screens in a ship lock in the north of the Netherlands, in which oil tankers pass, and measured salinity, density and depth. The water-air bubble screen yields the lowest salt-leak ratio of 0-15%, in comparison to the 50% salt-leak radio of the traditional bubble screen from the 1960's.

Yann Friocourt, Deltares, the Netherlands, Air bubbles against salt intrusion, promises and misconceptions

In the 1960's experiments were done in estuaries to reduce salt intrusions. But 175 m^3 per second of air was needed for a reduction of salt water intrusion of 1,5 km length. That was not cost-effective enough, so the plan was abandoned," he starts. Deltares tries to find out if water-air bubble screens are the answer to prevent salt intrusions in the Rhine River. After testing the new water-air bubble screen in scale models, experimental tanks and real shipping locks, they measured they only need 30% of the air that was needed in the 1960's.

But still, it's unlikely that the screens will be implemented in the Rhine. Because it is not effective in all conditions and it is still very costly due to the power needed to get the acquired air pressure.

Joachim Hunink, Deltares, the Netherlands, Upscaling detailed process study to regional effectiveness on water supply: Bubble plumes in the Rotterdam Waterway

Why coping with droughts and water scarcity in such a water rich country like the Netherlands? How come we have a water shortage? The problem is to get water of the right quality, at right place, at right time. In the Netherlands there are two resources of fresh water: water from the rivers Rhine and Meuse and precipitation. The main bottlenecks for water supply are: 1) enough water in the IJssel Lake, a lake in which fresh water is stored, 2) low river discharge, 3) salt water intrusion from the sea and groundwater, 4) low ground water level, and 5) a combination of factors 3 en 4.

To keep the Netherlands safe, the government started the Dutch Delta programme five years ago. The Delta Programme investigates how the fresh water supply can be safeguarded. As part of this programme, Deltares has been investigating whether bubble plumes could effectively be used to limit salt intrusion in the Rhine and Meuse estuary during times of low river discharge, and how they can improve regional water supply. Therefore Deltares compared different bubble-plumes. They conclude that small bubble plumes are not effective, but the big variant diminishes a fresh water shortage. This research will be followed by cost-benefit analysis.