D6

Surface waves and suspended particles

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Objectives: Experimental work

Waves and currents

- Determination of the wave field characteristics in the littoral (littoral garden additional sites)
- Continuous observation of the current field

Suspended particles

- Observation of the spread of turbid water and identification of wave induced resuspension
- Comparison of the frequency of turbidity and temperature driven density currents.
- Estimation of the effect of suspended particle distribution on the light climate

Experimental techniques

Waves and currents

- Acoustic current meters in combination with pressure sensors as wave meters (ADV, ADCP)
- 1D wave meter
- 2 additional ADCPs to measure current profiles and near bottom currents

Suspended particles

- Profiles of acoustic backscatter signal (ADCP's)
- Light trasmission (attached to a CTD-probe)
- Light backscatter signal (turbidity meter of project C2)
- Transparency (video project C2)
- Water sample analysis (organic-anorganic particulate material; particle size distribution by project D7)

Temperature regime

- Vertical profiling along transects (CTD)
- Moored thermistors along the bottom slope and near the water surface

Light regime

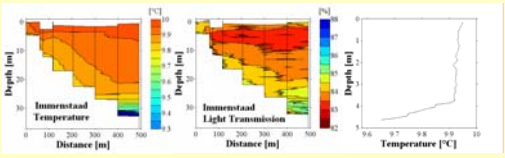
- Chain of PAR sensors recording at a high sampling frequency (EAWAG)

Objectives: Modelling work

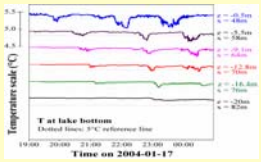
- Adaptation of the existing wave model to the shallow water zone of the littoral garden and additional sites
- Calibration and validation of the existing wind wave model
- Comparison of the simulated and observed transformation of the wave spectra from deep to shallow water
- Calculation of shear stress from simulated wave parameters and provision of critical time periods and depth zones for resuspension
- Generalization of the findings to other time periods and locations by numerical experiments

Observations of density currents generated in the littoral zone

Density plumes caused by temperature gradients

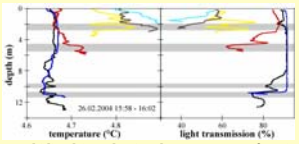


Density plume caused by temperature gradients due to differential cooling: Transect of vertical profiles of temperature and light transmission.

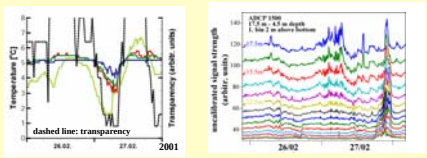


Moored thermistors indicating a density plume propagating along the bottom slope.

Turbidity gradients and density plumes

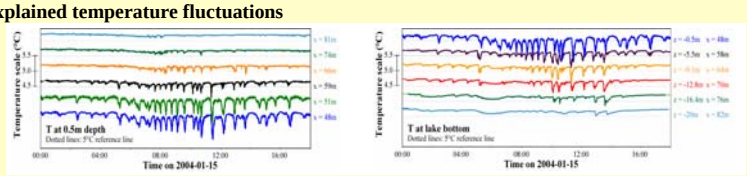


Turbidity driven density plume: Transect of vertical profiles of temperature and light transmission.



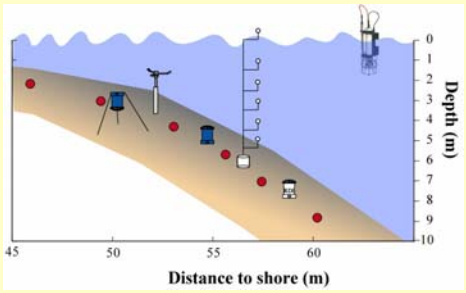
Density plume driven by temperature and turbidity. Left: data from thermistors and viedo camera. Right: ADCP backscattering signal from different depths.

Unexplained temperature fluctuations

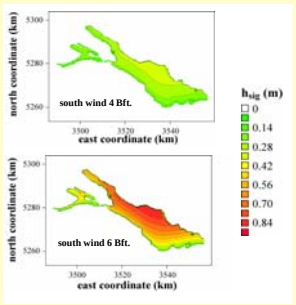


Rapid temperature fluctuations possibly related to the thermal bar.

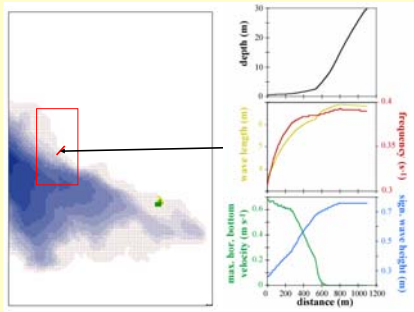
Experimental design in the littoral garden



- Thermistor: continuous temperature measurements
- Nortek ADCP: profiles of currents and acoustic backscattering signal.
- RDI ADCP: directional wave spectra; profiles of currents and acoustic backscattering signal.
- Nortek ADV: directional wave spectra; local currents.
- PAR sensor: continuous PAR measurement at high temporal resolution.
- CTD-probe: vertical profiles of light transmission, temperature, conductivity and fluorescence.



Simulation of significant wave height as function of wind speed (by Thomas Wolf, ISF)



Simulation of wave characteristics in the shallow water zone (by Thomas Wolf, ISF)

Links within the SFB

Benefits from joint experiments:

- Particle size distribution in suspension (D7)
- Horizontal distribution of turbidity (D3)
- Turbulence and turbulent transport in the littoral (D8)
- Optical backscatter and video transparency measurements (C2)
- Intercalibration of different techniques to measure turbidity (D3, D7, C2)
- Water quality parameters in relation to resuspension (D7, B1)

Contribution to other projects

- Information of typical characteristics of the wave field (wave tank experiments C2, zoobenthos diversity and calibration of devices A1)
- Field data on the light climate in the littoral (biofilm growth B10)
- Long term data on wave field and currents (D8)
- Field observations on the varaition of the load of suspended particles (B1)
- Frequency of resuspension events (D7)
- Potentially: Identification of sites and depths zones specifically affected by wave action (constrains of macrophyte growth by physical processes, A4)