The many faces of oceanic whitecaps: A multi-instrument field campaign

- Whitecaps are surface expression of breaking wind waves
- Whitecap fraction $W$ quantifies the area covered with foam
- $W$ is suitable forcing variable to parameterize and predict various air-sea interaction processes

Whitecaps are surface expression of breaking wind waves. Whitecap fraction $W$ quantifies the area covered with foam and is suitable for parameterizing and predicting various air-sea interaction processes.

Goal of the field campaign: Collect experimental data to determine $W_A$ and $W_B$ independently from the Phillips concept for energy dissipation.

### Instruments:

- **Whitecaps**
  - Infrared Camera
  - Microwave radiometers (10 & 37 GHz)
  - Visible (video) cameras
- Underwater bubbles—acoustics array at 4 freqs
- Sea spray in the air—particle counter
- Auxiliary data
  - Meteorological data (meteo station)
  - Wave field (wave wires)
  - Water temperature profile (thermistor array)
  - Near-by buoys

### Experimental approach: $W_A$ using Infrared signature

- Distinctly different signatures of $W_A$ and $W_B$ in the IR region
- Different but weak signatures of $W_A$ and $W_B$ in the MW region
- Use the IR to gain insights for the MW

### Infrared

- Mid-wave infrared
- Visible

### Microwave

- 15 GHz
- 19 GHz

### Acoustics

- 19-54:06 UTC
- 19-55:32 UTC
- 19-57:07 UTC

Photographic and radiometric observations provide total $W$, including foam generated during active breaking of waves and residual foam left behind waves. The active phase of whitecaps is associated with dynamic air-sea processes in the upper ocean:

- Turbulent mixing
- Gas exchange
- Spray-mediated storm intensification
- Ambient noise

A database of $W_A$ separate from $W_B$ is needed.

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$W$ is obtained from photographs of sea state.

$W$ can also be measured from satellites using passive microwave (MW).

Extensive database of satellite-based $W$ is compiled with many additional variables.