# The many faces of oceanic whitecaps:

## A multi-instrument field campaign

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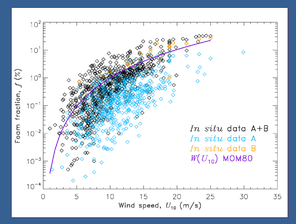
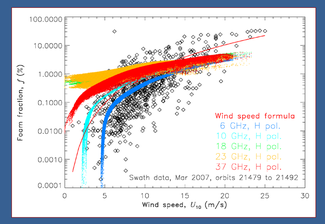
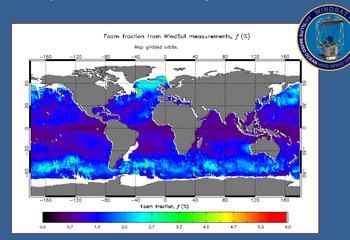
- Whitecaps are surface expression of breaking wind waves
- Whitecap fraction $W$ quantifies the area covered with foam
- $W$ is suitable forcing variable to parameterize and predict various air-sea interaction processes
- $W$ is obtained from photographs of sea state



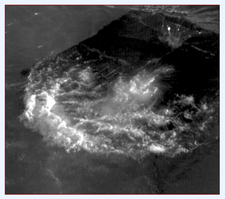

- $W$ can also be measured from satellites using passive microwave (MW)




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




- Photographic and radiometric observations provide total $W$ including foam generated during active breaking of waves and residual foam left behind waves
- 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 $W$ is needed

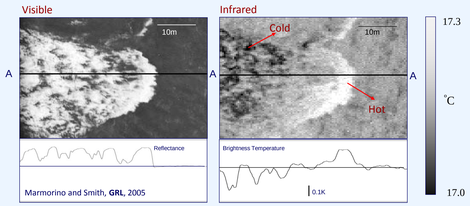


**Goal of the field campaign**: Collect experimental data to determine $W_A$ and $W$ independently from the Phillips concept for energy dissipation.

### Experimental approach:

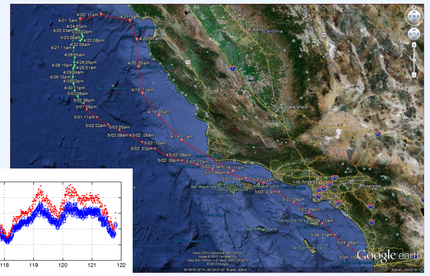
### $W_A$ using Infrared signature

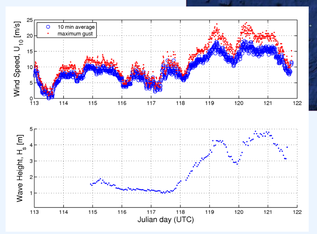
- Distinctly different signatures of $W_A$ and $W_B$ in the IR region
- Different but weak signatures of $W_A$ and $W_B$ in the MW region
- Use the IR to gain insights for the MW



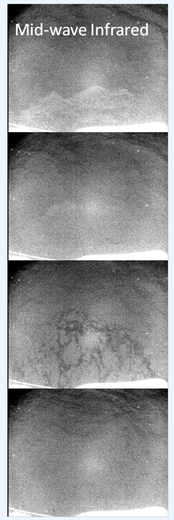

### Instruments:

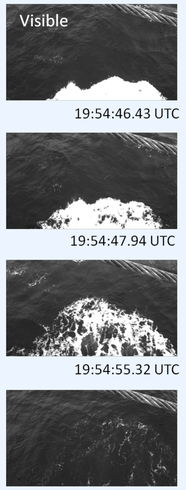
- Whitecaps
  - Infrared Camera
  - Microwave radiometers (10 & 37 GHz)
  - Visible (video) cameras
- Underwater bubbles—acoustics array at 4 freqs
- Sea spray in the air—particle counter
- Auxiliary data
  - Meteorological data (meteo station)
  - Wave field (wave wires)
  - Water temperature profile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



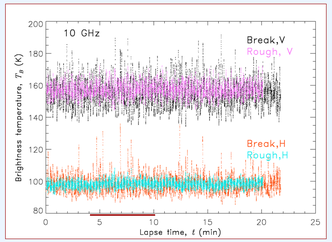



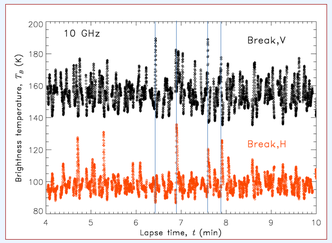

## Infrared




## Microwave




## Acoustics