

Radiometric measurements on profiling floats

Currently we typically measure:

1. $E_d(\text{PAR})$
2. $E_d(\lambda)$, typically with a 10nm bandwidth

On sophisticated prototypical platforms we also measure: $L_u(\lambda)$

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Typical applications:

1. Photosynthesis: several $E_0(\lambda, z)$ or $E_0(\text{PAR}, z)$
2. Heating: several $E_0(\lambda, z)$ or $E_0(\text{shortwave}, z)$
3. Photo-oxidation: $E_0(\text{UV}, z)$.
4. Chlorophyll and CDOM: several $E_d(\lambda, z)$ in UV<->green part of Vis spectrum.

Relevant time scale: varies from instantaneous (Chl, CDOM) to daily (all others).

Example data from Organelli et al., 2016:

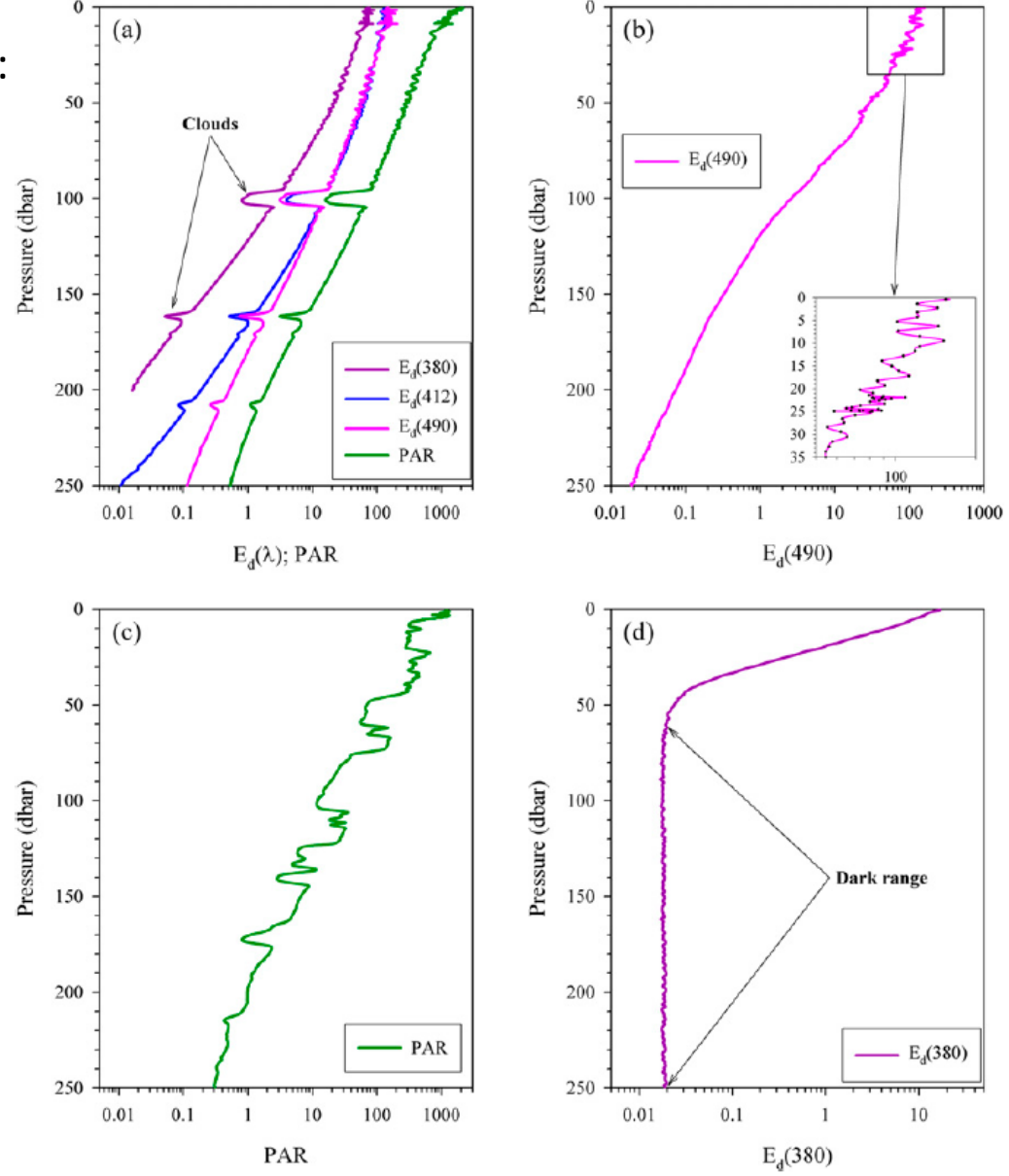


FIG. 3. Examples of (a) atmospheric cloud occurrence along profiles acquired by Bio-Argo floats (float WMO 6901439), (b) wave focusing in the surface layer (float WMO 6901655), (c) profile acquired in very unstable sky and sea conditions (float WMO 6901439), and (d) dark occurrence along the profile (float WMO 6901486). Values of $E_d(\lambda)$ at 380, 412, and 490 nm are expressed as $\mu\text{W cm}^{-2} \text{nm}^{-1}$. PAR values are expressed as $\mu\text{mol quantum m}^{-2} \text{s}^{-1}$. Depth is expressed in units of pressure.

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Basic QC:

1. Are the values we measure reasonable?

Day: Higher near surface going to zero at great depth, with a near exponential decay.

Surface values can be compared to surface irradiance products and to models (e.g. Greg and Carder, 1990), noting the need to take clouds into account.

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Basic QC:

During day: passage of clouds obscuring some sky and sun light, wave focusing, and fluorescence can result in non-monotonically decreasing profiles of irradiance with depth.

Night: expect signal to be nearly zero (except for moon). Can be used to establish if blanks (dark) are appropriate.

Drift: observe values at depth and near surface.

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Advanced QC (Organelli et al., 2016):

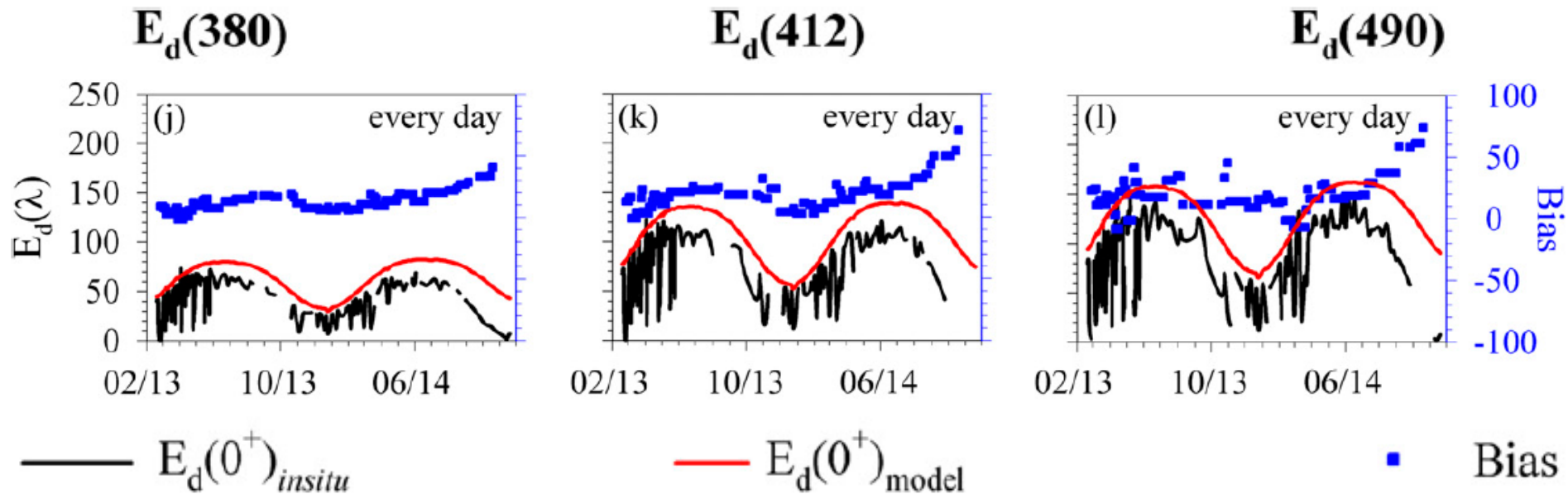
Dark values can be diagnosed from the part of the water column where the radiance distribution becomes normal.

If there is a need to remove spikes and clouds (e.g. to compute chl and CDOM) procedures need to be applied.

There is indication that $\text{dark} = \text{dark}(T)$. Diagnose and correct accordingly.

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Example of model data comparison:



Organelli et al., 2016