Dolfi 37 – Raw - Comparison « Pinkster » solver with « Keuning 2006 »

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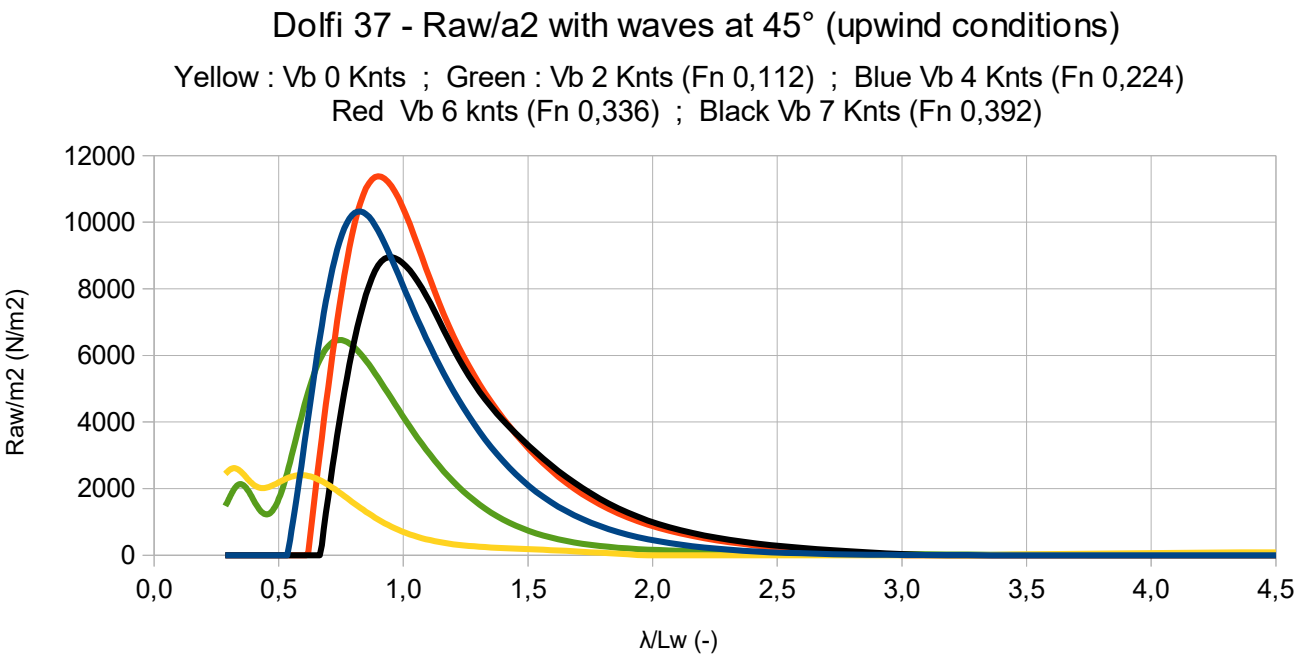
1. The Raw/a2 computed with « Pinkster » solver

I put the Raw/a2 computed with the « Pinkster » solver for the Dolfi 37 with waves at 45° (upwind condistions), with using λ/Lw in abscissa and for 0, 2, 4 , 6 and 7 Knots, i.e. Fn 0, 0,112, 0,224 , 0,336 and 0,392 :



One can see that for Fn 0,392, the (black) curve is lower than the one for 0,336 (in red), which is not logic neither relevant : Pinkster solver losses its relevance from such Froude number. Fortunately, most of the sailboats are limited at Fn ~ 0,35 upwind on calm water, and actually 0,30 to 0,35 upwind on waves, so the Fn 0,392 case is of no use in the VPP process.

One can see also that on the left side, for Fn > 0,2 and λ/Lw < 0,7, the curves are going to zero and even negative (negative drag = thrust) which also is not logic : we erase these values to zero before the integration with S(ω).

2. The Raw/a2 with « Keuning 2006 » and comparison

I completed the coefficients file with waves direction a = 135° , computed in proportion of a=120 and a =140, and then I add a sheet wich can computed the coefficients for any Fn (between 0,2 and 0,45) and Kyy/Lw (between 0,2 and 0,3) for this a = 135°. So, one can fit at the best with the Dolfi 37 conditions for the comparison :

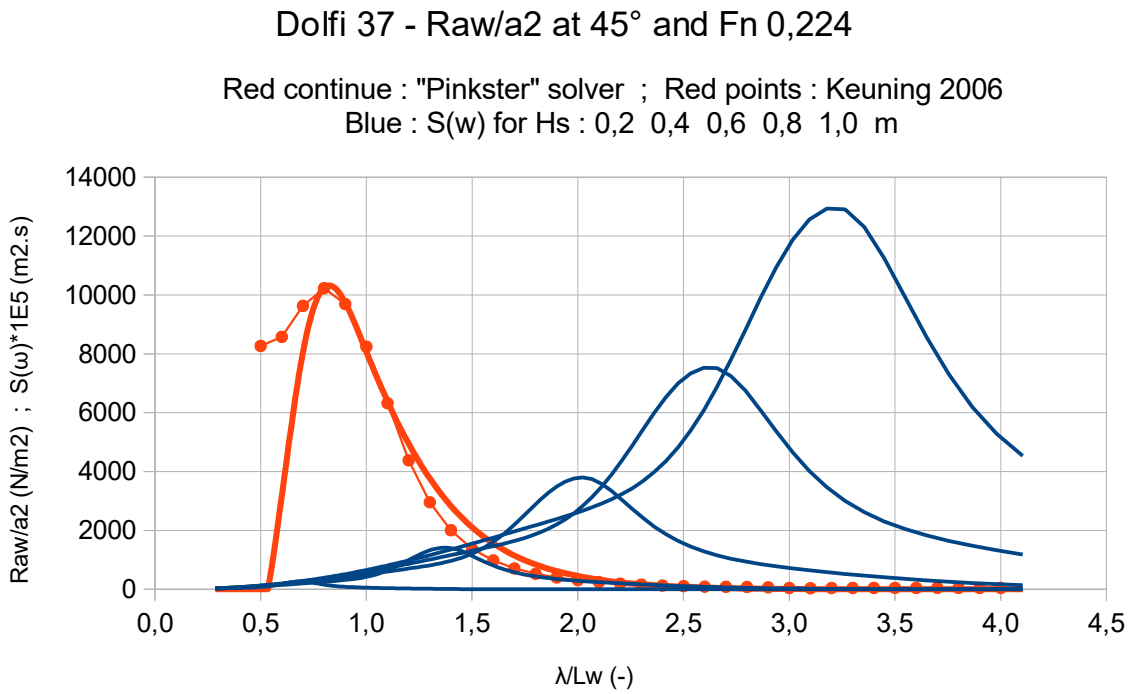
Dolfi 37 at D 2750 kg	Lw (m) 8,62	Bw (m) 2,075	Tc (m) 0,3777	Dc (m3) 2,52446	Ryy (m) 2,03	Cp 0,530

> Lw/Dc^1/3	> Lw/Bw	> Bw/Tc	> Ryy/Lw
6,33	4,15	5,49	0,235

>>> Raw/a2 with Keuning formulation are so computed and comparison with « Pinkster » one and I put also the Jonswap spectra (ϒ = 3,3) for respectively :

Hs = 0,2 m (Wind 6 Knots & Fetch : 10 km)
Hs = 0,4 m (Wind 8 Knots & Fetch : 21 km)
Hs = 0,6 m (Wind 10 Knots & Fetch : 30 km)
Hs = 0,8 m (Wind 12 Knots & Fetch : 37 km)
Hs = 1,0 m (Wind 14 Knots & Fetch : 43 km)

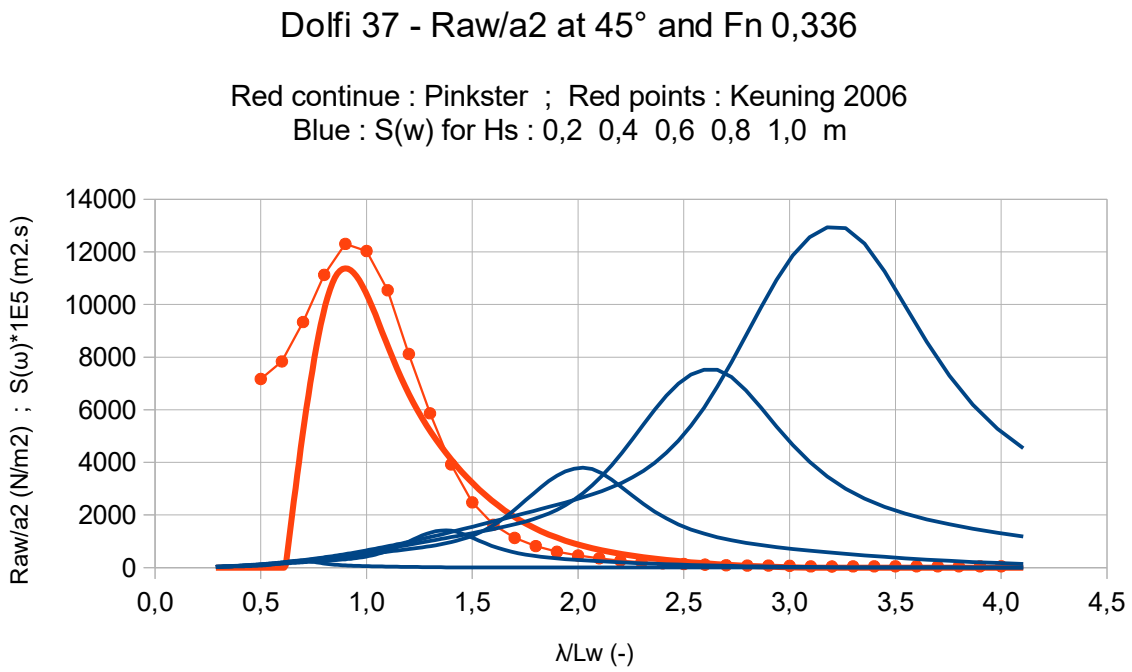
For Vb 4 knots : a = 135 Kyy/Lw = 0,235 Fn = 0,224



One can see a good agreement for the Raw/a2 peak (position and magnitude) and 2 differences :

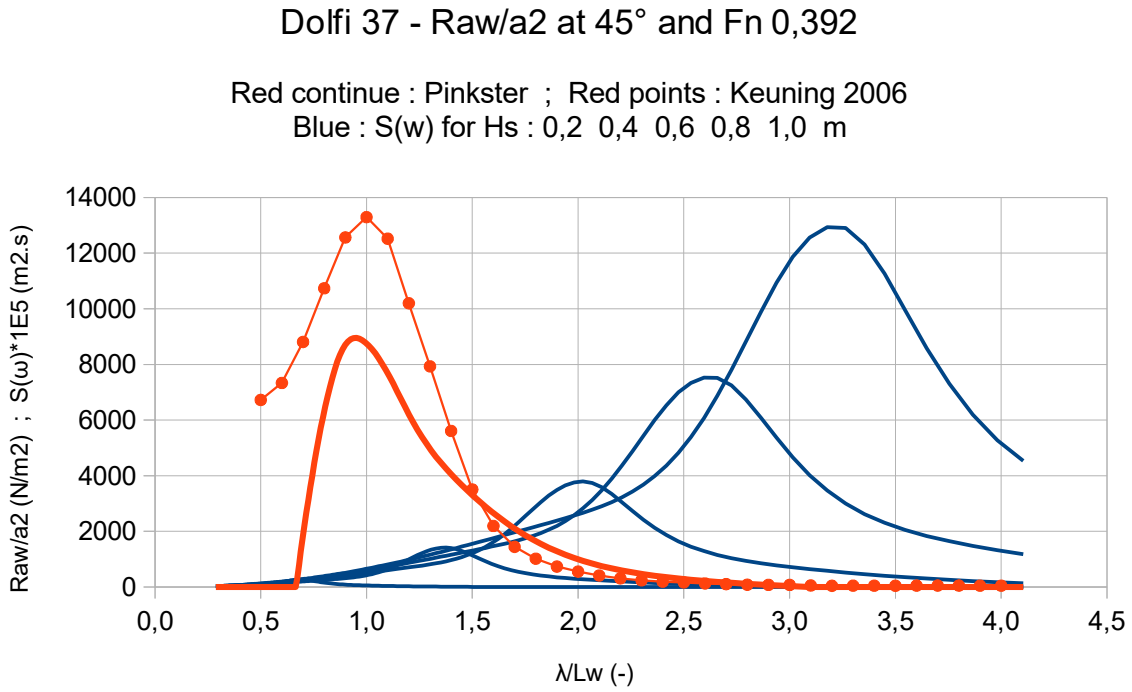
- for λ/Lw < 0,7 : the Keuning value tends to 8000 while the Pinkster drop to zero. Yet, the Jonswap spectra there are also close to zero, the influence on Raw value should be low except perhaps for small waves Hs = 0,2 m
- for 1,1 < λ/Lw < 2,1 : the Keuning values are lower than the Pinkster one in a zone where the Jonswap spectra are not negligeable, especially for Hs = 0,4 m.

For Vb 6 knots : a = 135 Kyy/Lw = 0,235 Fn = 0,336



Same remarks as above + the peak with Keuning is a bit higher than with Pinkster.

For Vb 7 knots : a = 135 Kyy/Lw = 0,235 Fn = 0,392



Here this Pinkster curve for Fn 0,392 is not relevant, firstly because lower than the Pinkster one at Fn 0,336 as already mentioned, and so radically lower than the Keuning one for Fn 0,392.

3. The Raw computation with Jonswap spectra and comparison

Done for Vb 4 Knots (Fn 0,224) and 6 Knots (Fn 0,336) and with the Jonswap spectra mentioned above , given in % of the Displacement 2750 kg :

Raw (%Displacement) at Fn 0,224 (Vb 4 Knots)

Wind (Knots)	16	2	10	0	0
Fetch (km)	λ/Lw < 0,7	λ/Lw < 0,7	Fetch (km)	at Fn 0,336 (Vb	λ/Lw > 2,0
Jonswap >	Hs 0,2 m	Hs 0,4 m	Hs 0,6 m	Hs 0,8 m	Hs 1,0 m
Pinkster	**0,09**	**0,30**	**0,34**	**0,38**	**0,42**
λ/Lw < 0,7	*0,03*	*0,02*	*0,02*	*0,03*	*0,03*
,7 <λ/Lw < 2,0	*0,06*	*0,28*	*0,31*	*0,34*	*0,38*
λ/Lw > 2,0	*0,00*	*0,00*	*0,01*	*0,02*	*0,01*
Keuning	**0,12**	**0,31**	**0,35**	**0,40**	**0,44**
λ/Lw < 0,7	*0,06*	*0,06*	*0,07*	*0,07*	*0,07*
,7 <λ/Lw < 2,0	*0,06*	*0,25*	*0,28*	*0,31*	*0,34*
λ/Lw > 2,0	*0,00*	*0,00*	*0,01*	*0,02*	*0,02*

Raw (% Displacement) at Fn 0,336 (Vb 6 Knots)

Wind (Knots)	6	8	10	12	14
Fetch (km)	10	21	30	37	43
Jonswap >	Hs 0,2 m	Hs 0,4 m	Hs 0,6 m	Hs 0,8 m	Hs 1,0 m
Pinkster	**0,07**	**0,35**	**0,43**	**0,48**	**0,52**
λ/Lw < 0,7	*0,01*	*0,01*	*0,01*	*0,01*	*0,01*
,7 <λ/Lw < 2,0	*0,06*	*0,35*	*0,40*	*0,43*	*0,48*
λ/Lw > 2,0	*0,00*	*0,00*	*0,02*	*0,04*	*0,03*
Keuning	**0,13**	**0,44**	**0,48**	**0,55**	**0,60**
λ/Lw < 0,7	*0,06*	*0,05*	*0,06*	*0,07*	*0,07*
,7 <λ/Lw < 2,0	*0,07*	*0,38*	*0,41*	*0,45*	*0,51*
λ/Lw > 2,0	*0,00*	*0,00*	*0,01*	*0,03*	*0,03*

>>> For Fn 0,224 : the concordance is quite good, but for Hs= 0,2 m due to the contribution of the left side of the λ/Lw range (when < 0,7), more important with Keuning as predictable.

>>> For Fn 0,336 : in addition to the left side effect, the central zone 0,7 < λ/Lw < 2,0 is also a bit higher contributor for Keuning.

>>> In both cases, the right side contributions for λ/Lw > 2,0 are equivalent and poorly contribute to Raw (for 3% at the max).