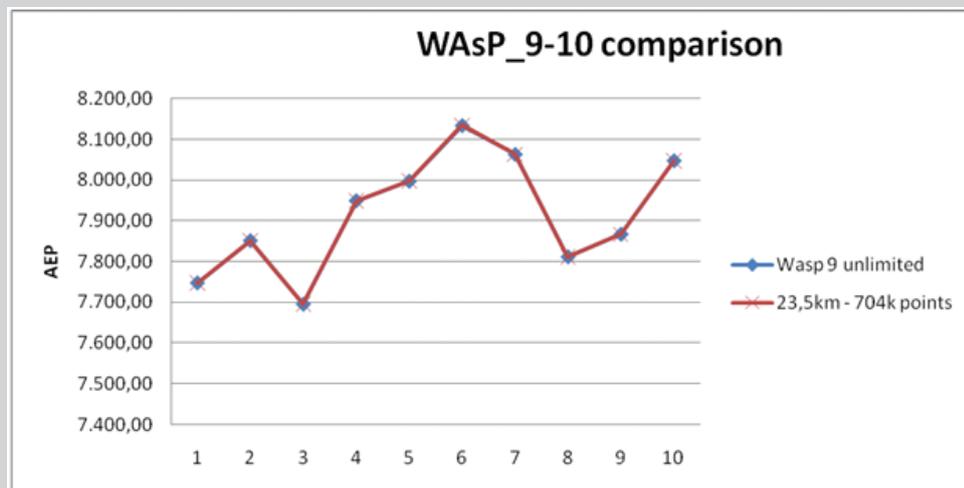




## Technical note #3: WindPRO/WAsP 10 Issues



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The WindPRO 2.7 Beta release December 2009 used the WASP 10 "calculation engine" regardless of which WASP version was installed on your PC. The WASP .DLL included in the WindPRO installation decides the WASP version used, NOT the WASP version installed on your PC. WindPRO 2.6 always uses the WASP 6-9 engine. We call it WASP6-9 as there is only a marginal difference from WASP 6 to WASP 9 despite the updates to the WASP engine in recent years.

However, this has changed with the release of WASP 10. Several changes have been made to the WASP calculation engine. Unfortunately, also some changes that presently do not work as expected, which is explained in this document.

In the final WindPRO 2.7 release March 2010, the WASP 6-9 engine is default <Recommended until WASP 10 issues are solved>, but the WASP 10 engine can be used – even if you have not upgraded your WASP version/license to WASP 10. Running WASP from WindPRO only requires a valid/active WASP license. To change the version of the WASP engine used by WindPRO go to the: Option | Option menu from the WindPRO main screen:

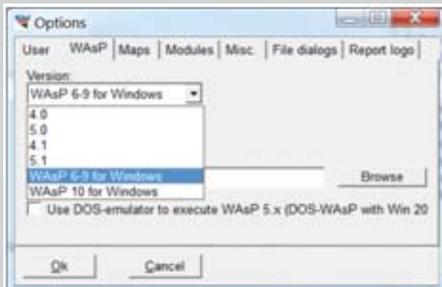


Figure 1. Selection of WASP version - the choice will be valid until you enter this menu again, also if WindPRO is restarted.

A new feature in PARK printout is that the WASP version used is now clearly shown in the report. Changes of WASP standard parameter settings will also be clearly stated in the reports.

## Issue 1: Adjustment of the Offshore Stability Correction

An improved algorithm for the offshore stability correction (vertical extrapolation) results in lower vertical shear predicted for offshore sites using the new WASP 10. We have tested this for tall offshore masts and find the correction OK. So for "purely offshore" projects, we recommend using WASP 10, if vertical extrapolation is needed. If measurements are in hub height, no difference will be seen.

## Issue 2: Change in Roughness Line to Rose Converter

This issue consists of several parts. When WASP is modeling a specific WTG position and roughness maps are used (roughness lines in .MAP file format)<sup>1</sup> WASP always converts the lines to a roughness rose. This rose is used for the calculation at the specific WTG position (or measurement mast position).

The changes are:

- a) Defaults are changed so there can be more roughness changes in the roughness rose.
- b) The way the conversion is performed is slightly different.

These two changes can affect the results in two ways:

## Narrow double lines from WindPRO area object export

If a roughness line MAP is produced from the WindPRO area object and there are neighboring or overlapping areas, the exporter establishes two very close lines, with the area roughness on the one side and the background roughness between the two narrow lines. The new WASP 10 rose generator is more sensitive and can - based on such a double line structure - give unexpected roughness roses. We have seen examples where an off shore sector is attributed class 0.2 instead of 0.0, which it would have gotten with the old WASP version. As WASP uses a roughness of class 0.0 as the indicator of off shore stability conditions, this difference can be critical and lead to several percent different results compared to WASP 6-9 if it affects the main wind direction.

<sup>1</sup>) WindPRO generates the .MAP files and send them to WASP. If the files are .WPO, WindPRO converts these to .MAP using the current selected coordinate system. WindPRO also cuts away data outside the specified radius chosen in the Site data object to limit the file size.



## Different evaluations of sectors which are mainly offshore

For an offshore project, with a small island at some distance or other causes of a slightly higher roughness in a mainly offshore sector, this can make the new roughness converter attribute the entire sector a roughness higher than 0.0, and not just a small part of the sector as with the previous WAsP versions. Again, this affects the stability model (offshore/onshore) used by WAsP resulting in changes of calculated shear. Results might differ several percent using the new WAsP 10 engine as described before.

In general, the new converter seems too sensitive (which Risø also agrees on), but it will take some time for Risø to improve this issue. Therefore, we recommend using the old WAsP 6-9, especially for coastal regions, where the sensitivity to these changes is high. For purely offshore sites, where there is no land near the site (all sectors are roughness 0.0), the WAsP 10 engine should be used. For sites with no offshore roughness within 20 km radius, differences are probably small. However, if the roughness map is created in an Area Object and exported to lines, we recommend continued use of WAsP 6-9 until a new WAsP 10 roughness ROSE converter less sensitive to double lines is available. We will notify all WindPRO users upon this release.

### Issue 3: Very large .map Files - FIXED in WindPRO 2.7 ServicePack-1

Finally, an issue regarding very large .map files with WAsP 10 from WindPRO has been discovered. When the number of points > 750k, WAsP 10 starts to "smoothen out" calculation results, see following graphs.

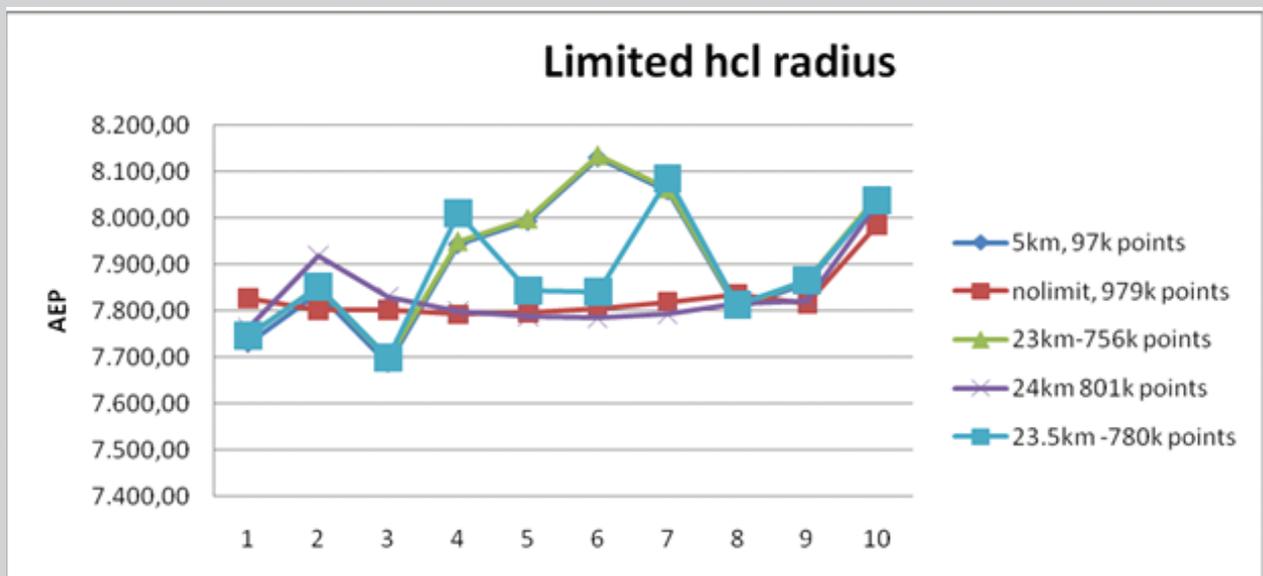


Figure 2. When number of points becomes > 750k, results are no longer reliable using WAsP 10 from WindPRO. It simply "smoothen out" the results. In this case using a height contour line cut at 5 km gives the same as a cut at 23km, which is the correct. Extending the file size to > 23 km (more than 750.000 points) gives in this case wrong results.

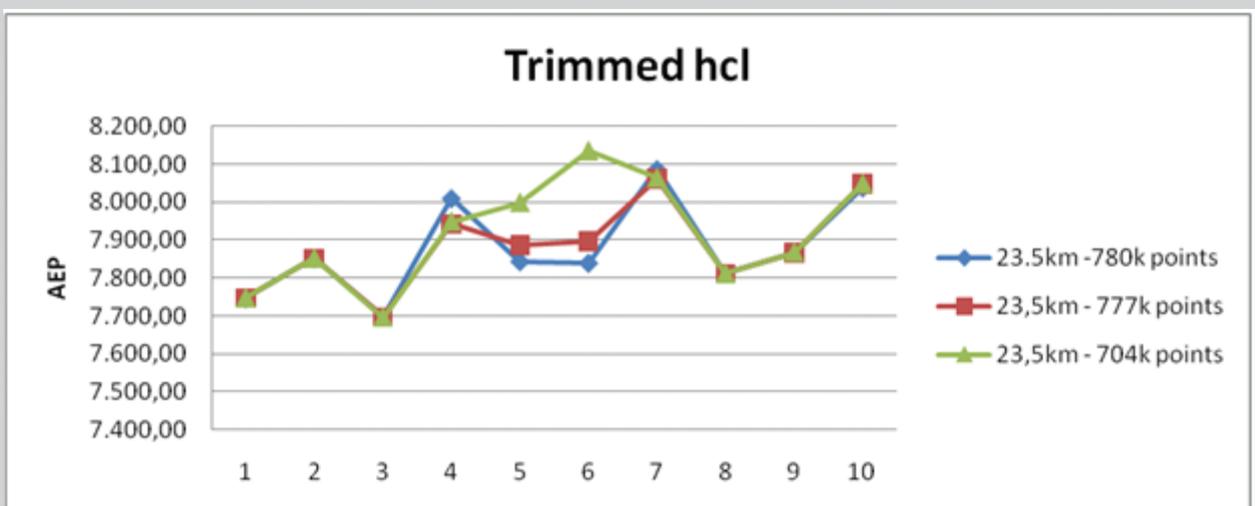


Figure 3. Trimming the height contour data shows that it is the number of points, not the distance that makes the difference. Red line is trimmed very softly, but this already starts making a change. A harder trim, but only in the remote region from the site, makes the results identical to using the much more limited file.

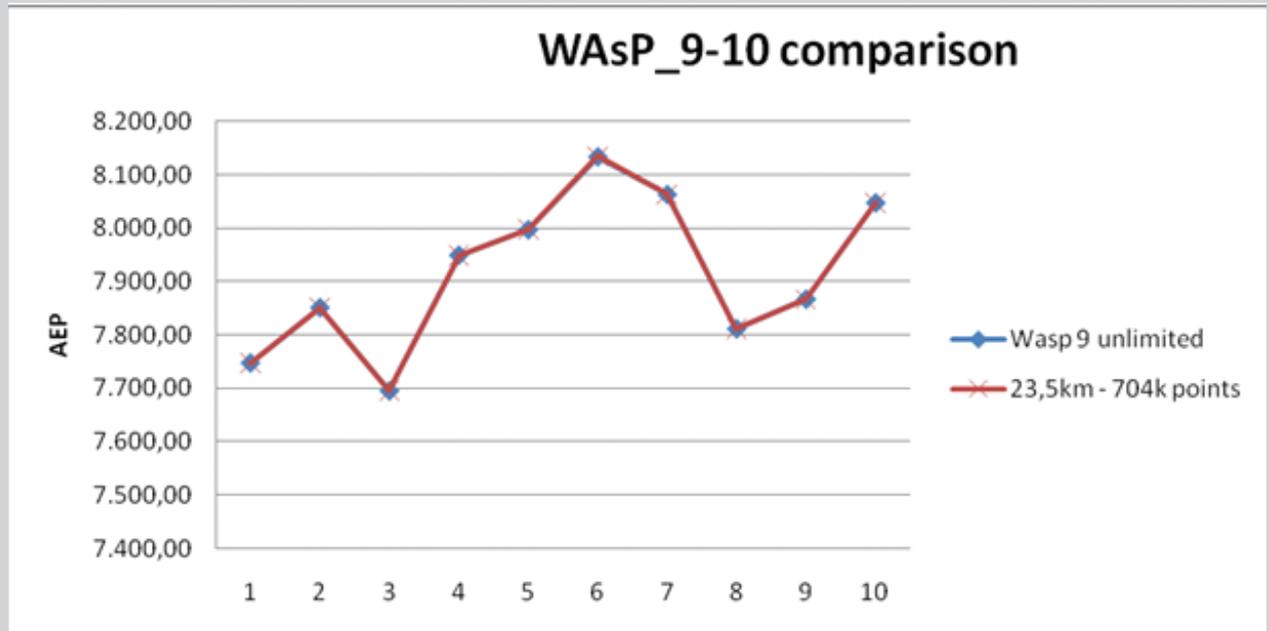


Figure 4. Finally, a comparison to WAsP 9 - here the unlimited file with 979 k points works well.

Where no roughness complications/offshore roughness are involved, results are identical when keeping map file size <750k points.

#### **Issue 4 Slow/unstable resource map calculation due to Dongle check – PARTLY fixed in Service pack 4 for WindPRO 2.7**

When the resource map calculation run from WindPRO, WAsP performs a license check for each calculation point. This leads to slow calculation and might lead to instability (Windows “blue screen” is seen at some users, but the reason is not fully clear). The problem has been fixed in the Service pack 4 for WindPRO 2.7 ONLY for WAsP 10.

We are in dialogue with RISØ regarding these issues and some changes are reported ready for beta test.

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