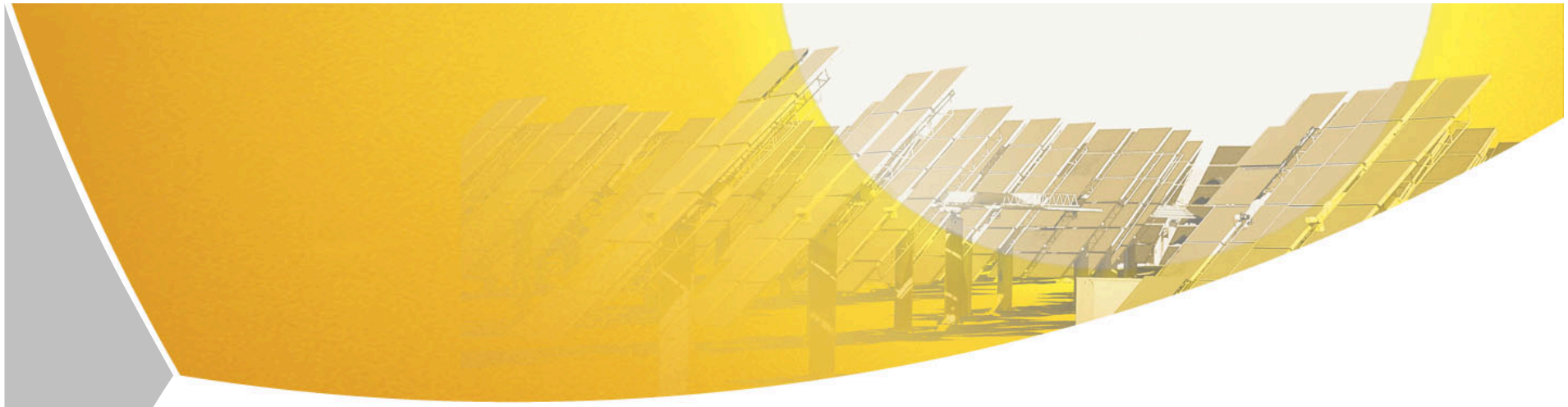

Scaling in Solar Resource Assessments

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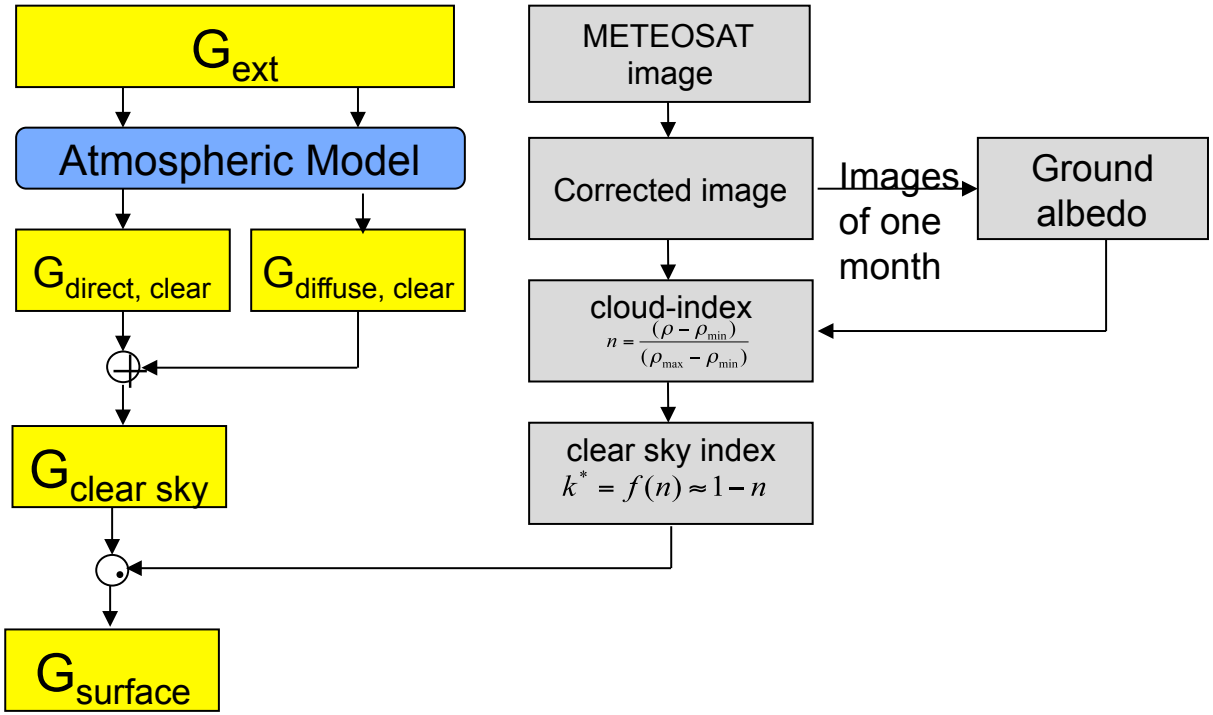
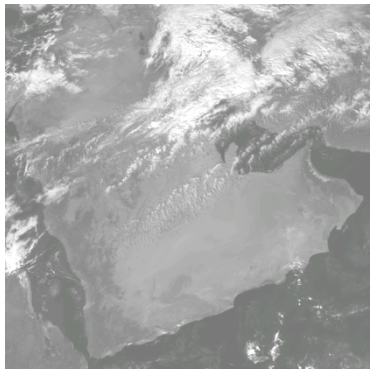
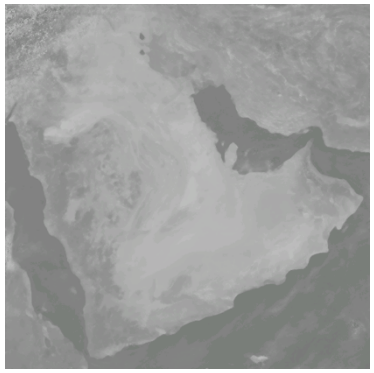
Outline

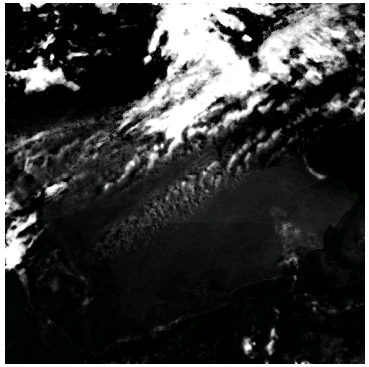
- One slide recap: How do solar resource assessments work
- Averaging versus thinning, coarse resolution data sets in satellite meteorology
- Global solar data sets, NASA SRB+SSE, DLR ISIS
- How do the data sets change in the Mediterranean when the resolution changes
- What does this mean for potential assessments

Calculation of solar radiation from remote sensing

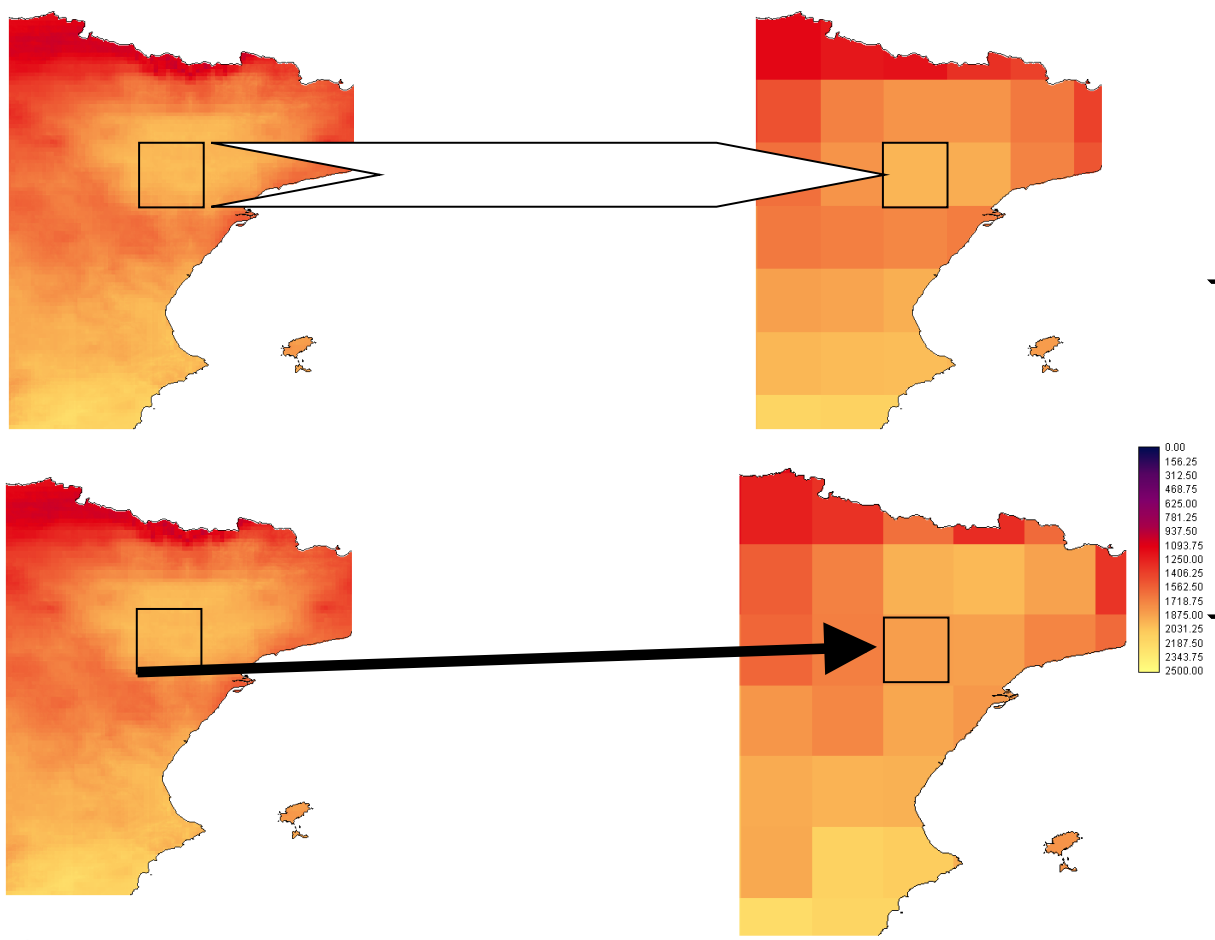






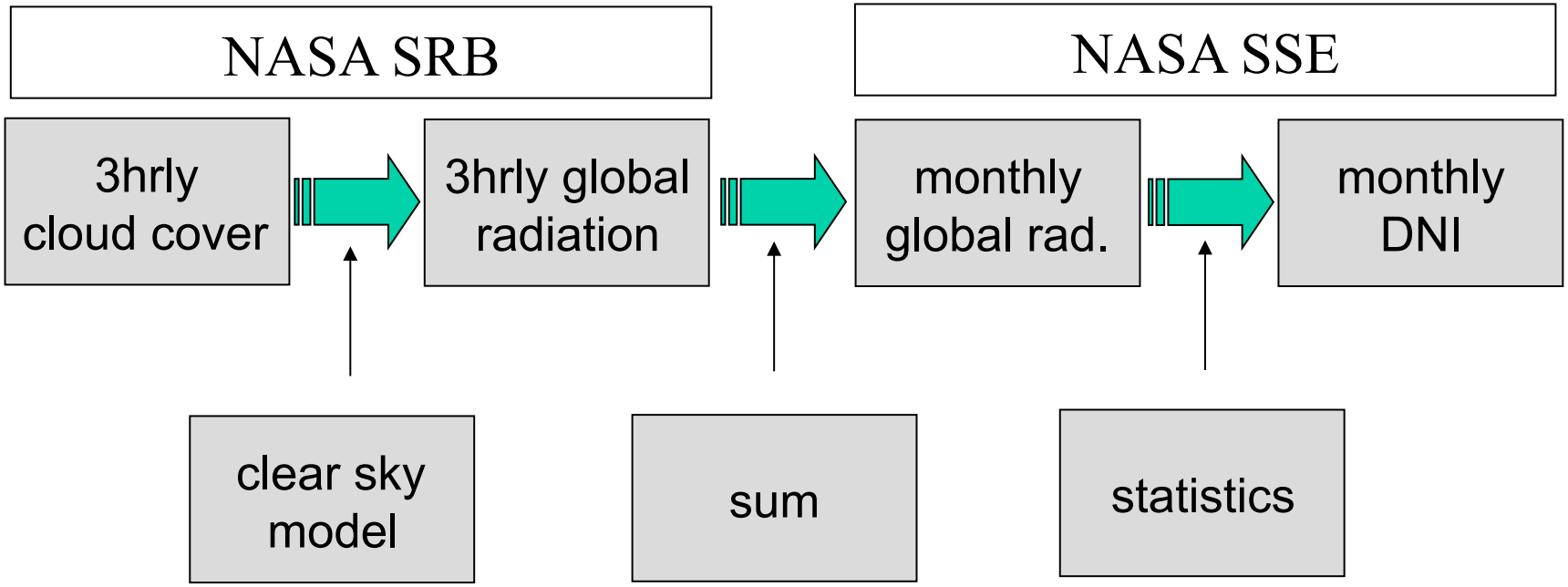


Averaging versus Thinning

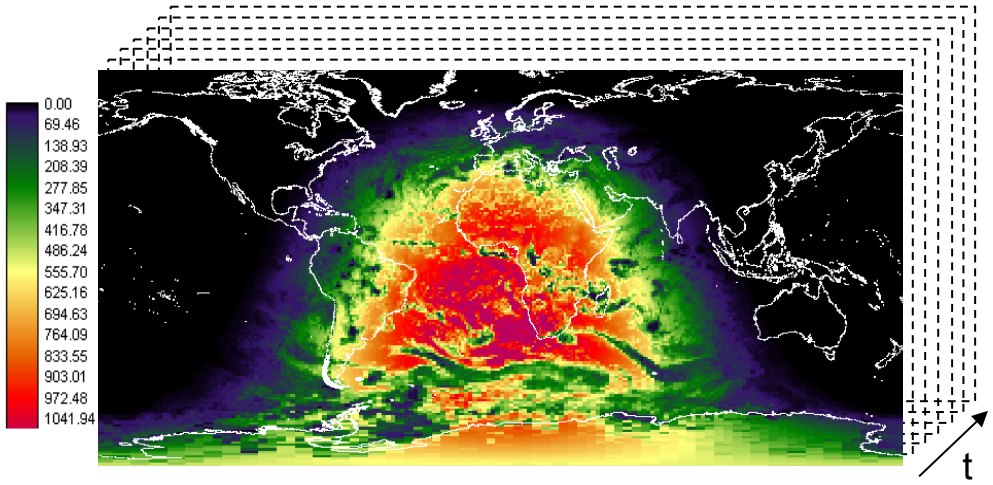


- averaging: all pixel are used for averaging the target pixel
- Thinning, one pixel (e.g. lower left) is used as a sample for the target pixel
- Coarse resolution data sets in satellite meteorology are often done by thinning

Global Data Sets, e.g. NASA SSE

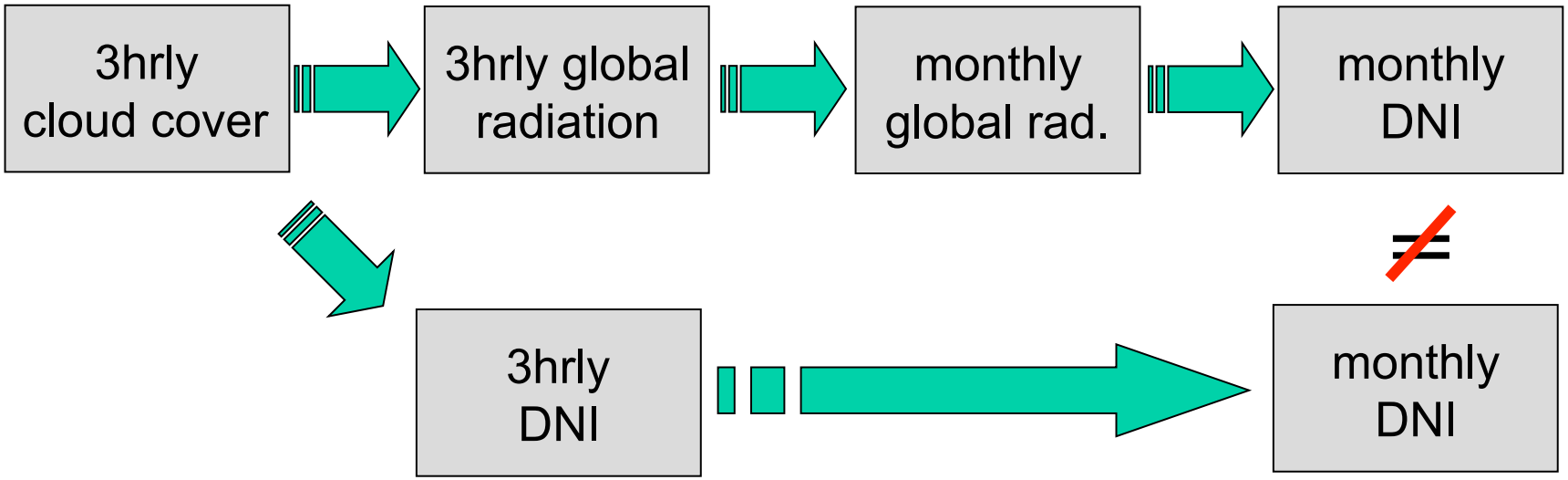


Global High Temporal Resolution Data Sets



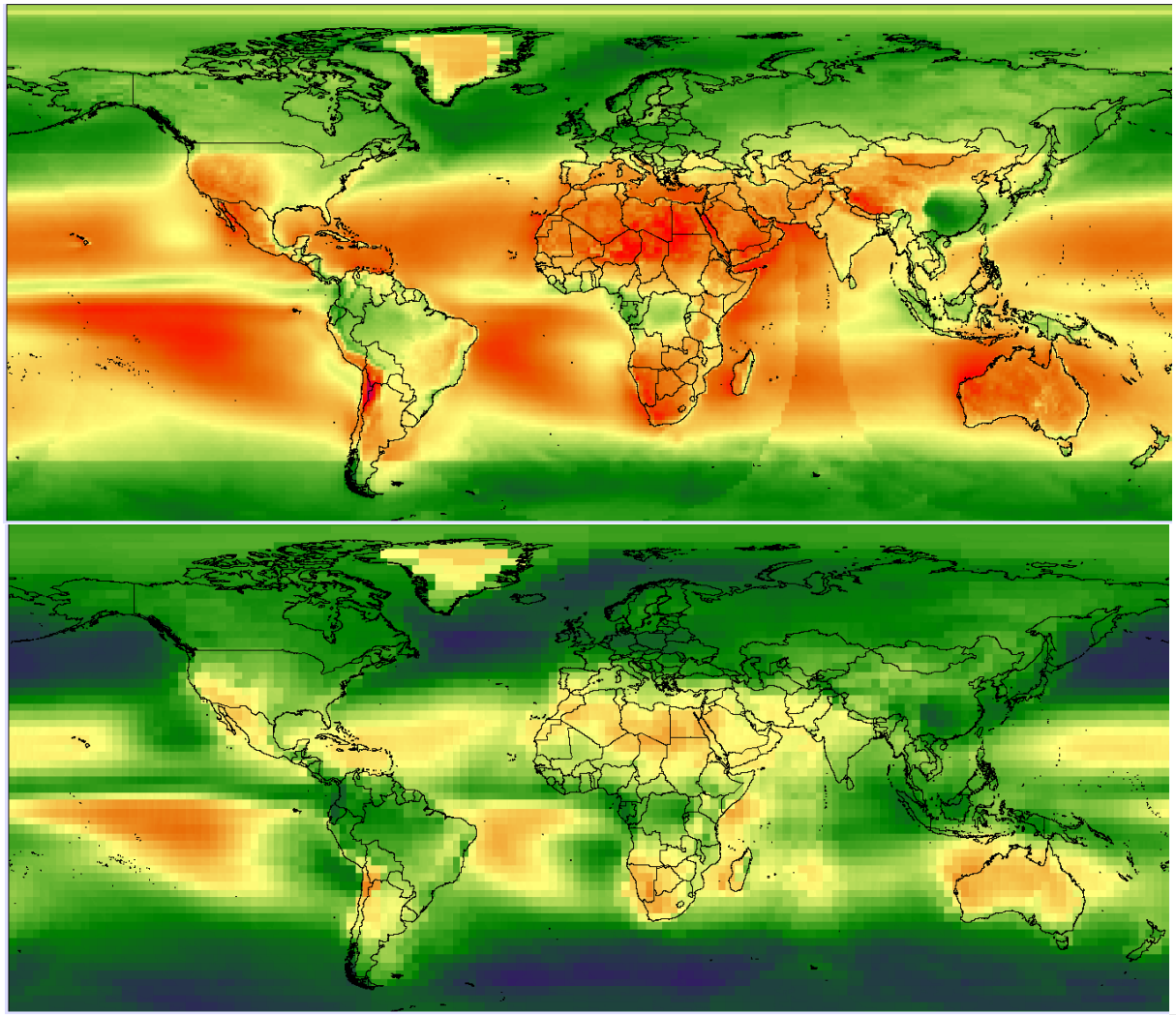
- Global data set in 1h resolution for RE integration studies
- Regional balancing
- Inter technology balancing (consistent data for solar, wind, biomass, etc).
- What are the real needs in backup capacity for a specific mix of RE soruces

High resolution (1 or 3h) Modeling of DNI



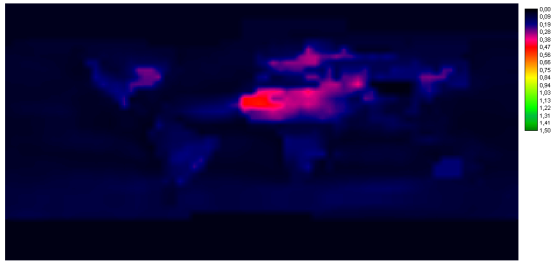
- **When going down the lower row, we were not able to reproduce the monthly DNI values**
- Further Research needed to generate high resolution DNI data

Comparing DLR ISIS vs. NASA SSE

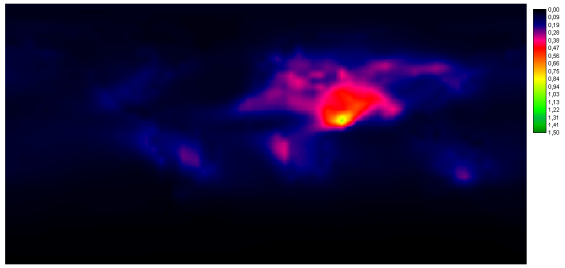


- Patterns are similar in both data sets
- Absolute values are very different
- NASA SSE (top) is done the “upper” pathway
- ISIS (bottom) is done the “lower” pathway

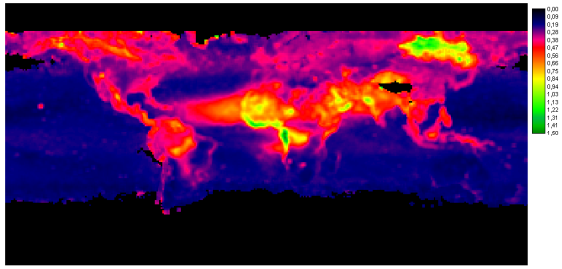
Uncertainty in Aerosols



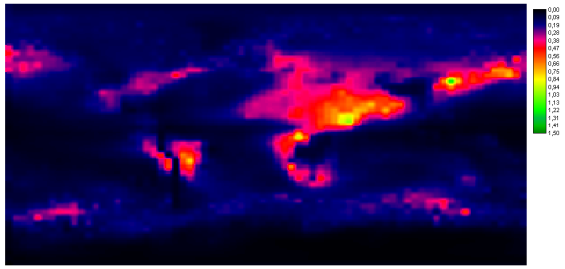
GADS



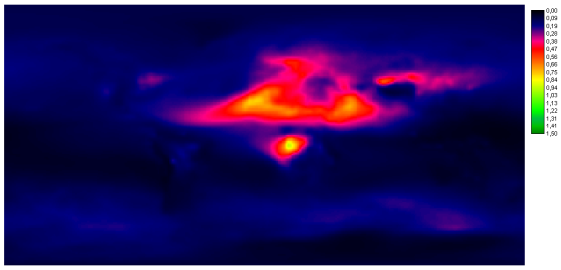
NASA GISS v1



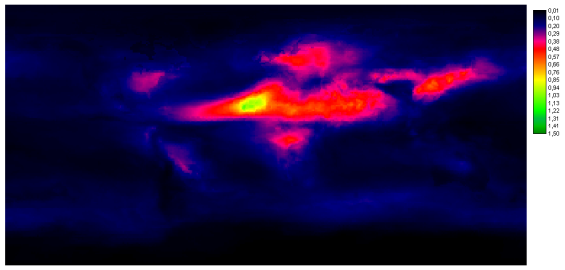
Toms



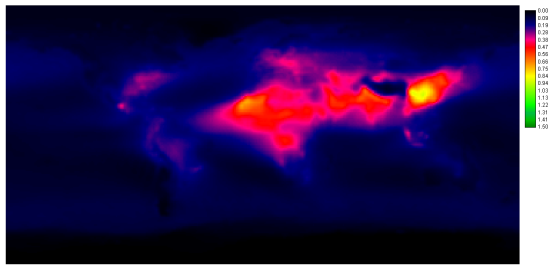
NASA GISS v2 1990



GOCART



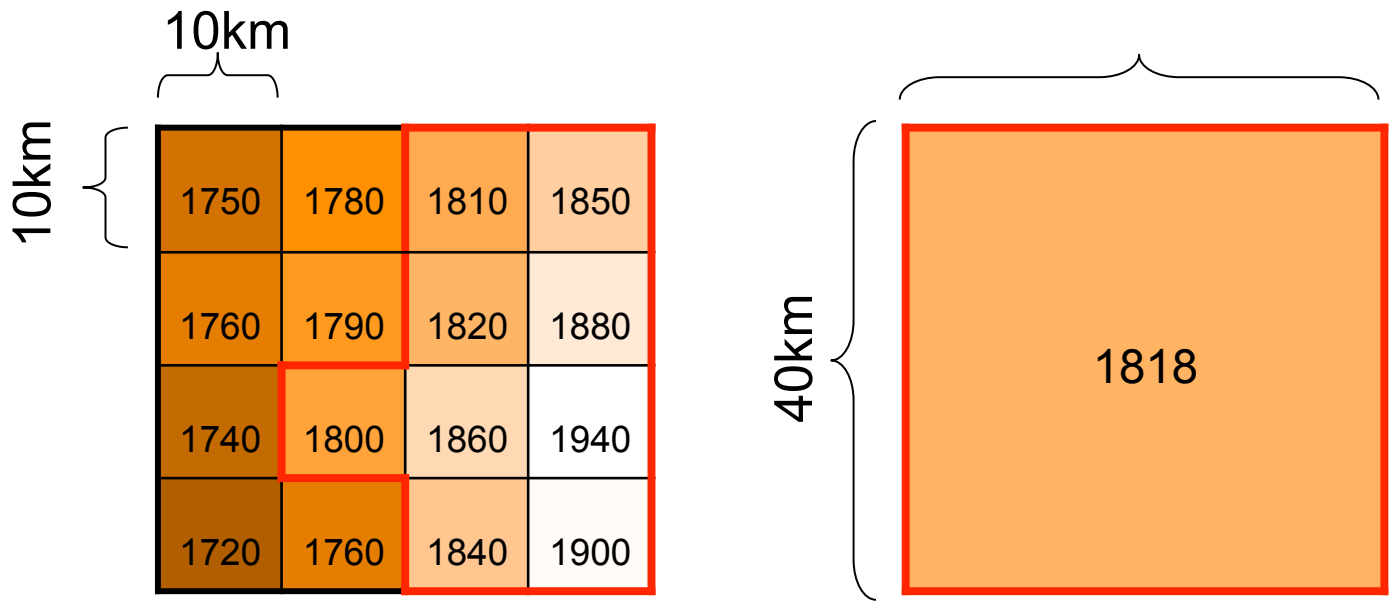
AeroCom



MATCH

- All images are for July
- Scales are all the same
- Significant differences in the various data sets
- Aerosols are one of the major uncertainties in climate modeling

Assessing Potentials – What could be the problem

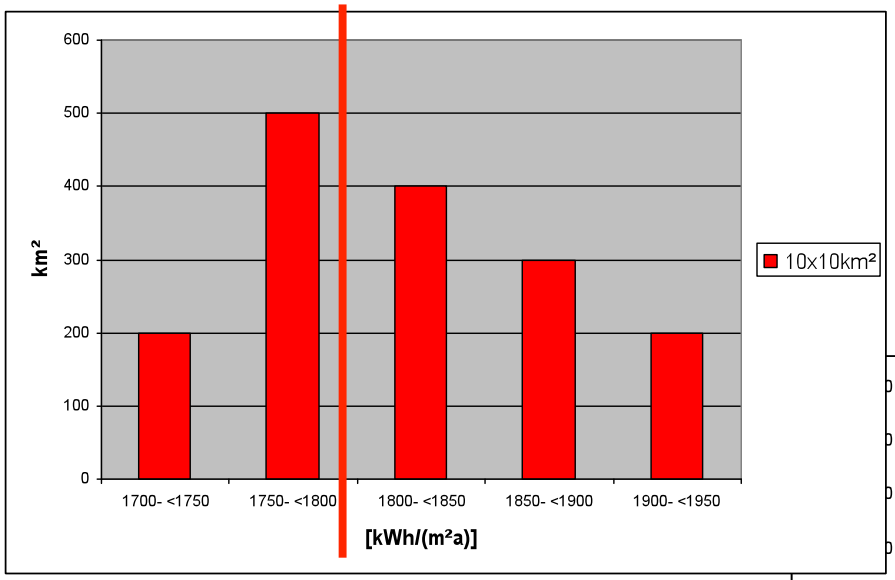


Area of technical potential:

900 km²2

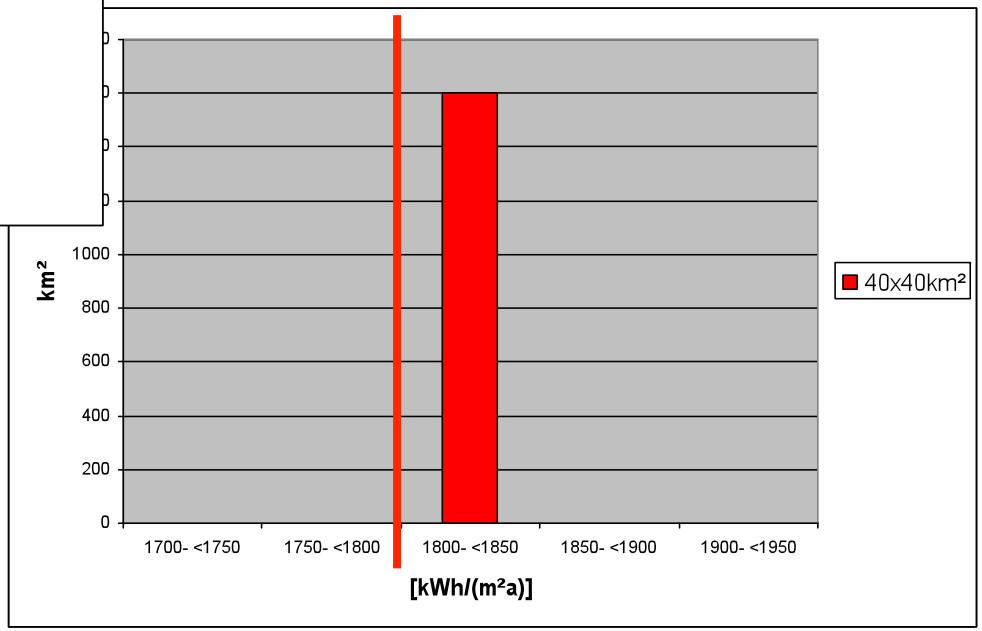
1600 km²

Tabular view of potentials



Technical potential with a conversion efficiency of 10%

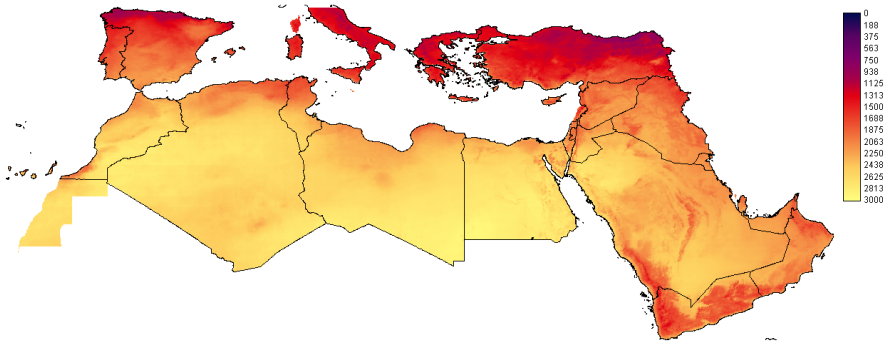
167 TWh/year



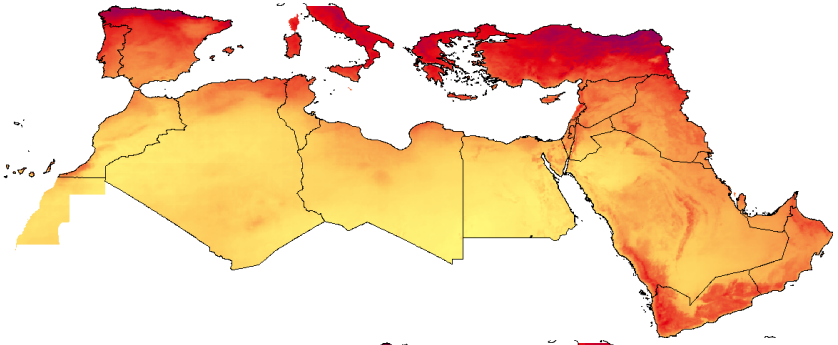
Technical feasibility

292 TWh/year

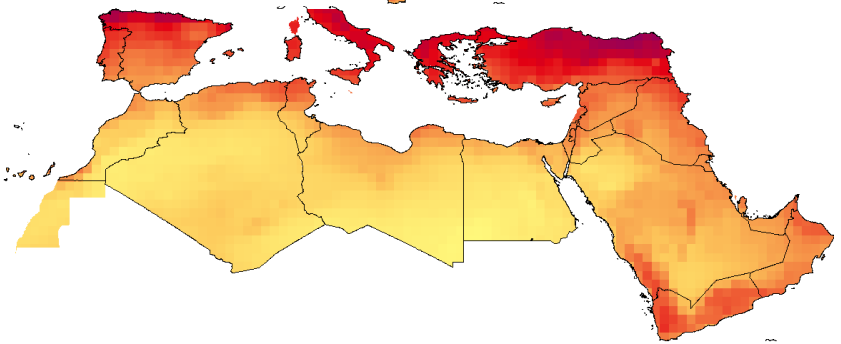
Scaling in the Mediterranean - Averaging



1 km

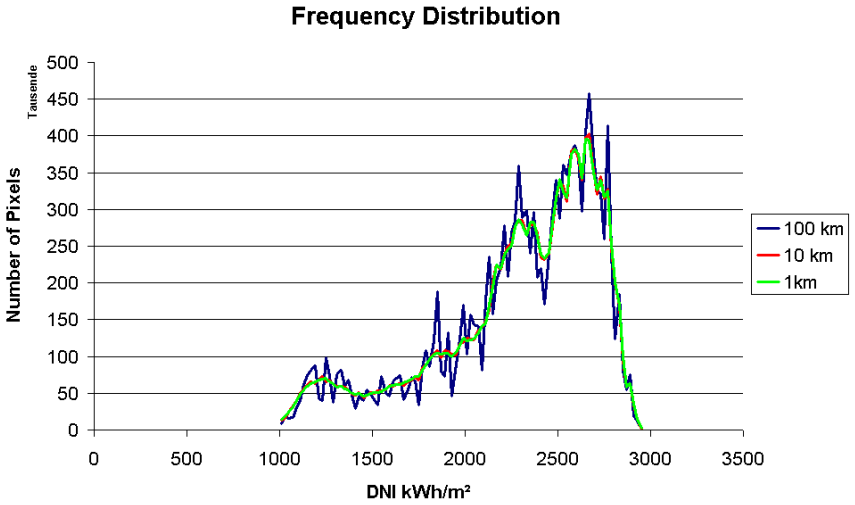


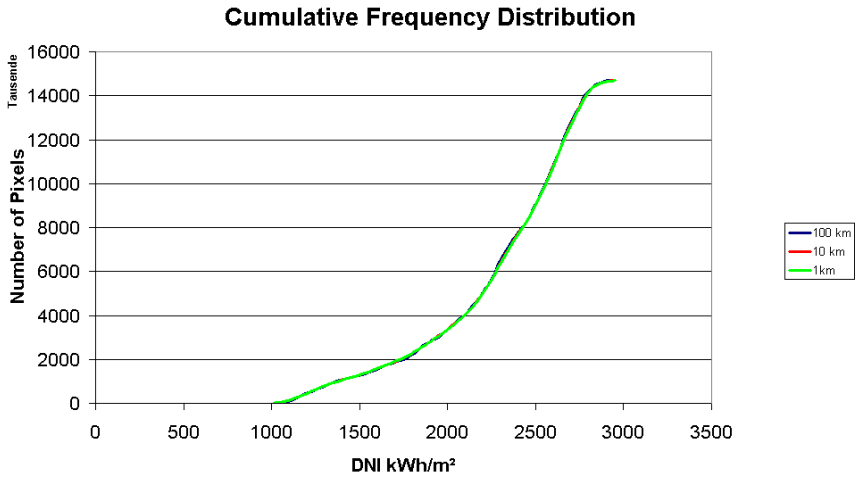
10 km



100 km

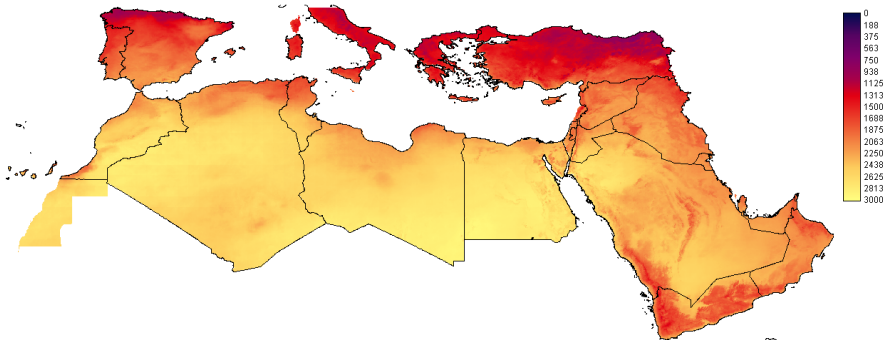
Averaging



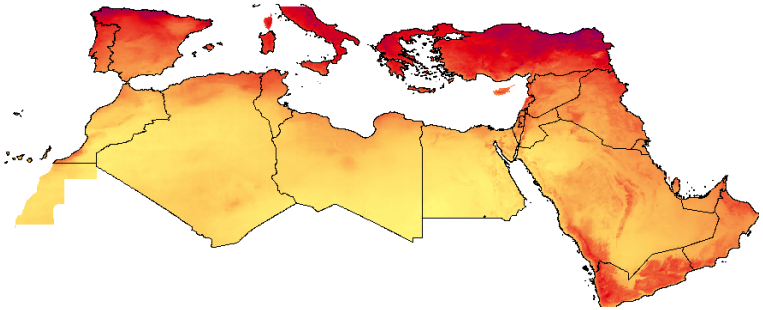


- Distributions are very similar
- 100 km adds some noise in the frequency distribution but it disappears in the cumulative distribution

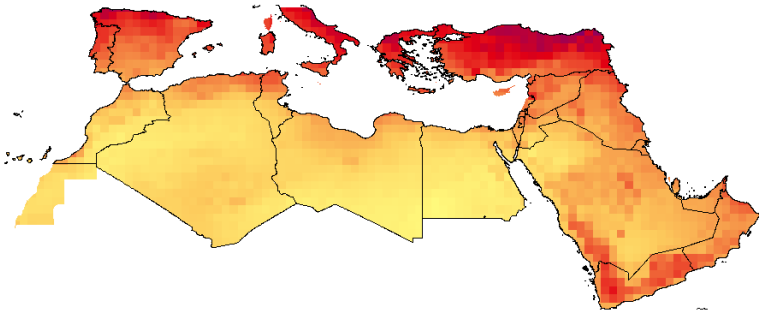
Scaling in the Mediterranean - Thinning



1 km

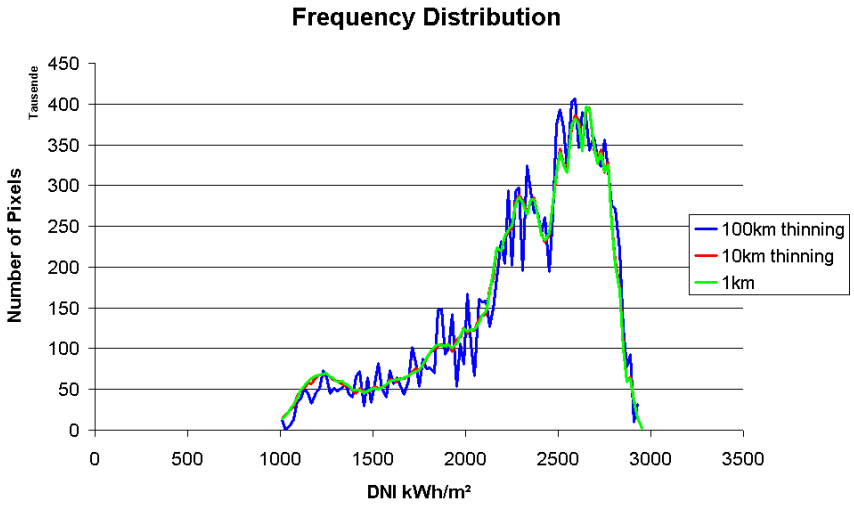


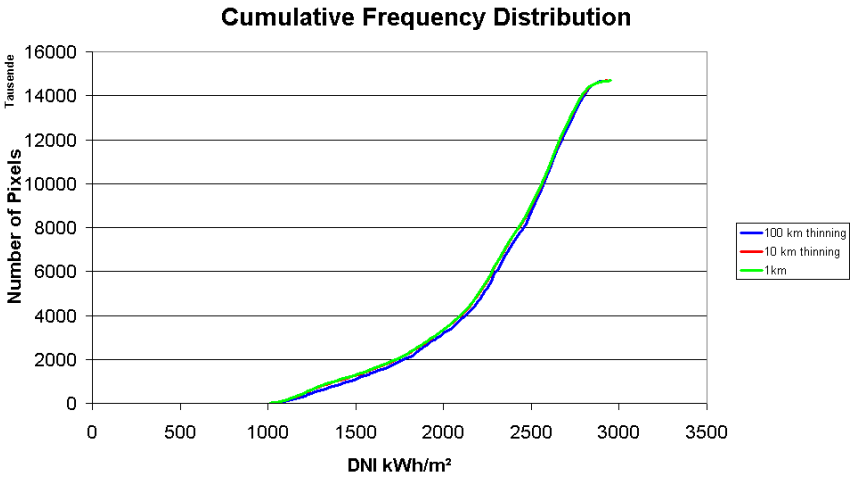
10 km



100 km

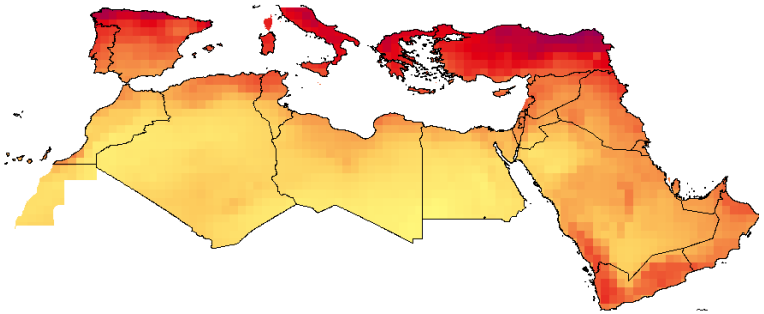
Thinning



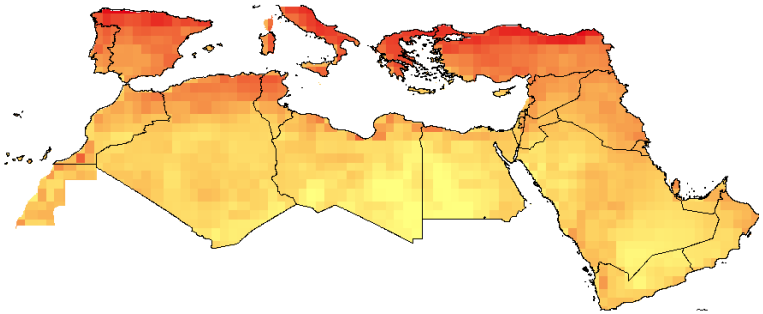


- Distributions are very similar
- 100 km adds some noise in the frequency distribution and the CFG for 100 km is slightly lower.

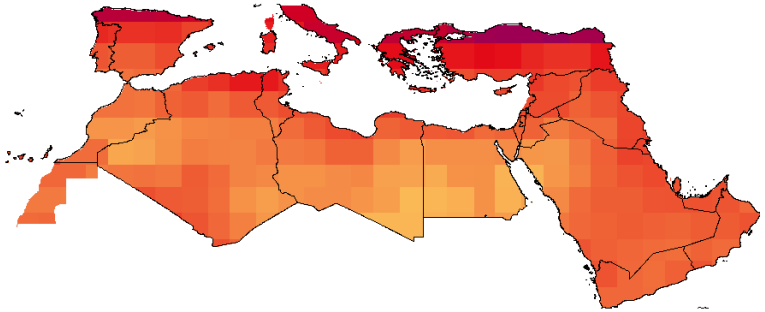
Coarse Resolution Data Sets



1 km average

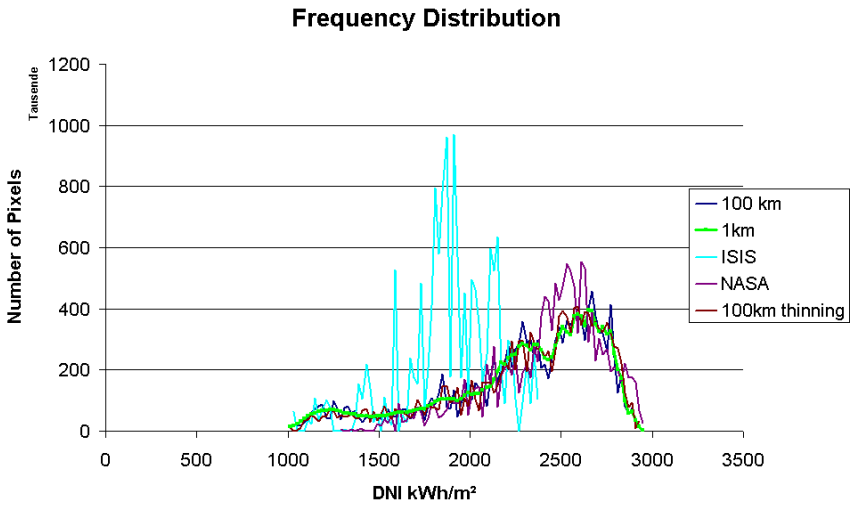


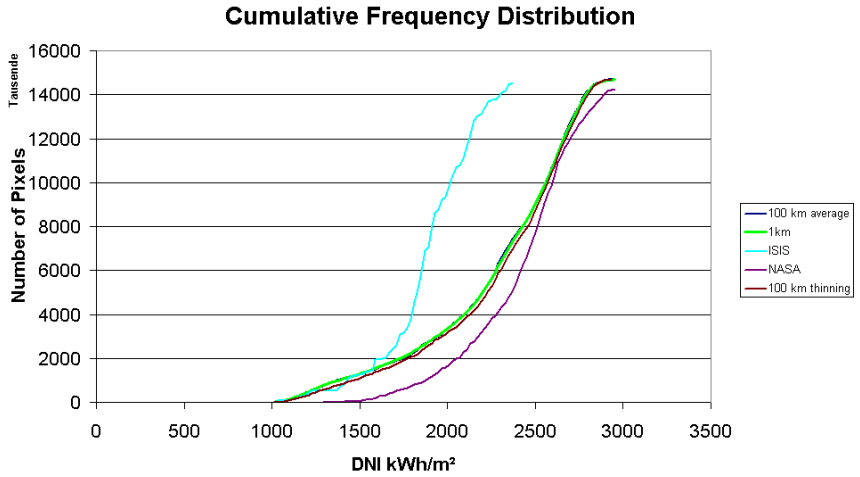
NASA SSE



ISIS

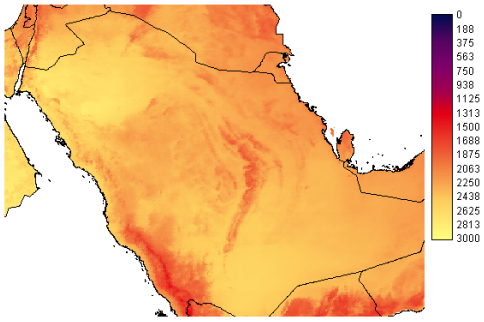
Coarse Resolution Data Sets



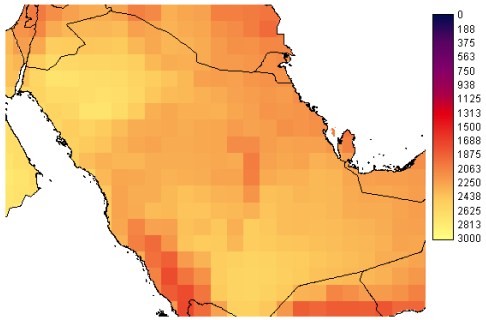


- DLR ISIS has a very different distribution function
- NASA SSE is qaulitatively similar to SOLEMI data, but with more high values (even > 3000 kWh/m² which were excluded here).

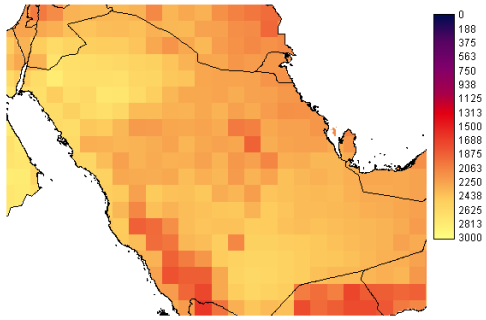
Fine Structures



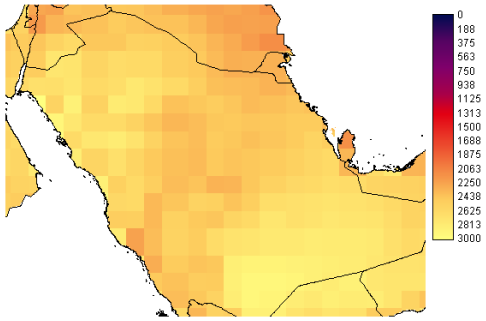
1 km



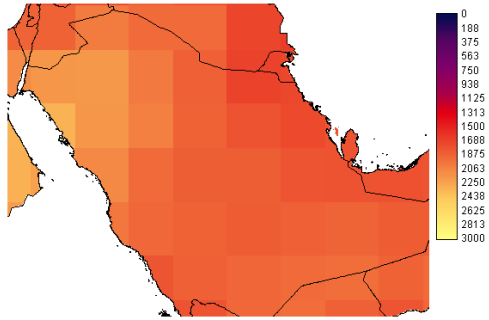
100 km average



100 km thinning



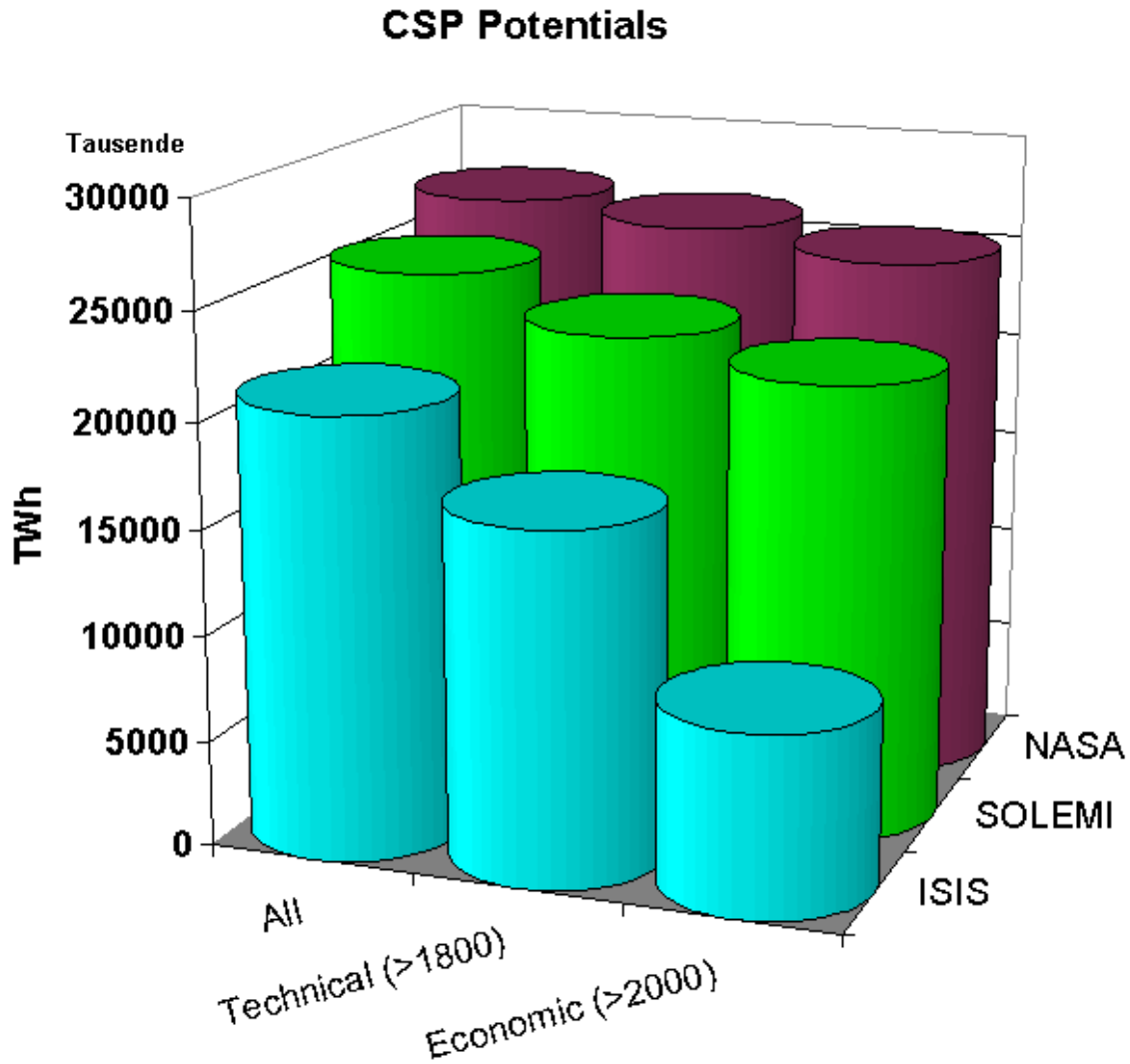
NASA 1° (~100 km)



ISIS (280 km)

- Fine structures disappear in thinning, NSA and ISIS
- Thinning shifts pattern towards the East

Potential Assessment



Conclusions

- Global DNI contains a lot of uncertainties
- More research to generate good global DNI maps is urgently necessary.
- Averaging or thinning does not make a big difference in the Mediterranean. At least the effect is much smaller than the differences between data sets.