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Impact of GC Temperature on Analyte Response for Selected Volatile Organic Compounds in Mainstream Smoke

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Critical for Method Development

Regardless of the method used to collect volatile organic residues from mainstream cigarette smoke, if Gas Chromatography is used for separation and detection, temperature dramatically affects the instrumental response.

This effect becomes significant when multiple compounds of dramatically different chemistries are determined in a single analysis.

Does inlet temperature impact response?

Does MS source temperature impact response?

How do we decide what to use?

The Study

This study examined the effect of varying the GC inlet and MS source temperatures on selected volatile organic residues gathered from a cryo-impinger collection method.

Agilent Multimode Inlet and 5975C MSD
Split injection

Inlet temperature range from 180º C to 260º C

Source temperature range from 230º C to 280º C

The Analytes



	Aliphatic	Aromatic	Oxygen	Nitrogen	Complexity
Isoprene	X				1
Benzene		X			1
Toluene		X			1
Ethylbenzene		X			1
Styrene		X			1
Propylene oxide	X		X		2
Vinyl Acetate	X		X		2
Furan		X	X		2
Benzo[b]furan		X	X		2
Acrylonitrile	X			X	2
Nitromethane	X			X	2
2-Nitropropane	X			X	2
Nitrobenzene		X		X	2
Pyridine		X		X	2
Quinoline		X		X	2
Urethane	X		X	X	3
Acetamide	X		X	X	3
Acrylamide	X		X	X	3

Comparison Method

To compare this variety of compounds:

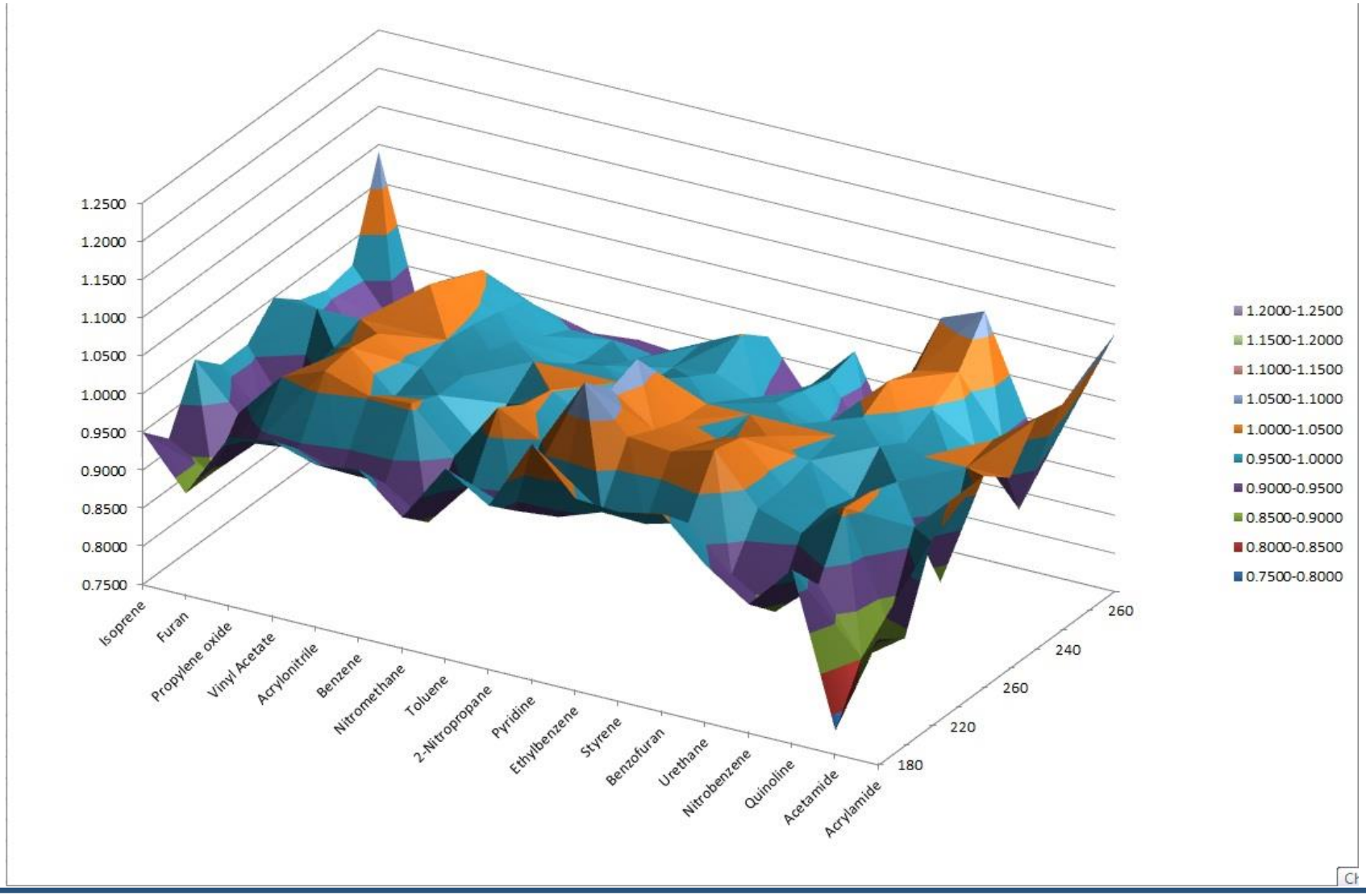
Used integrated area from a standard mixture in methanol.

Normalized response to a selected baseline value

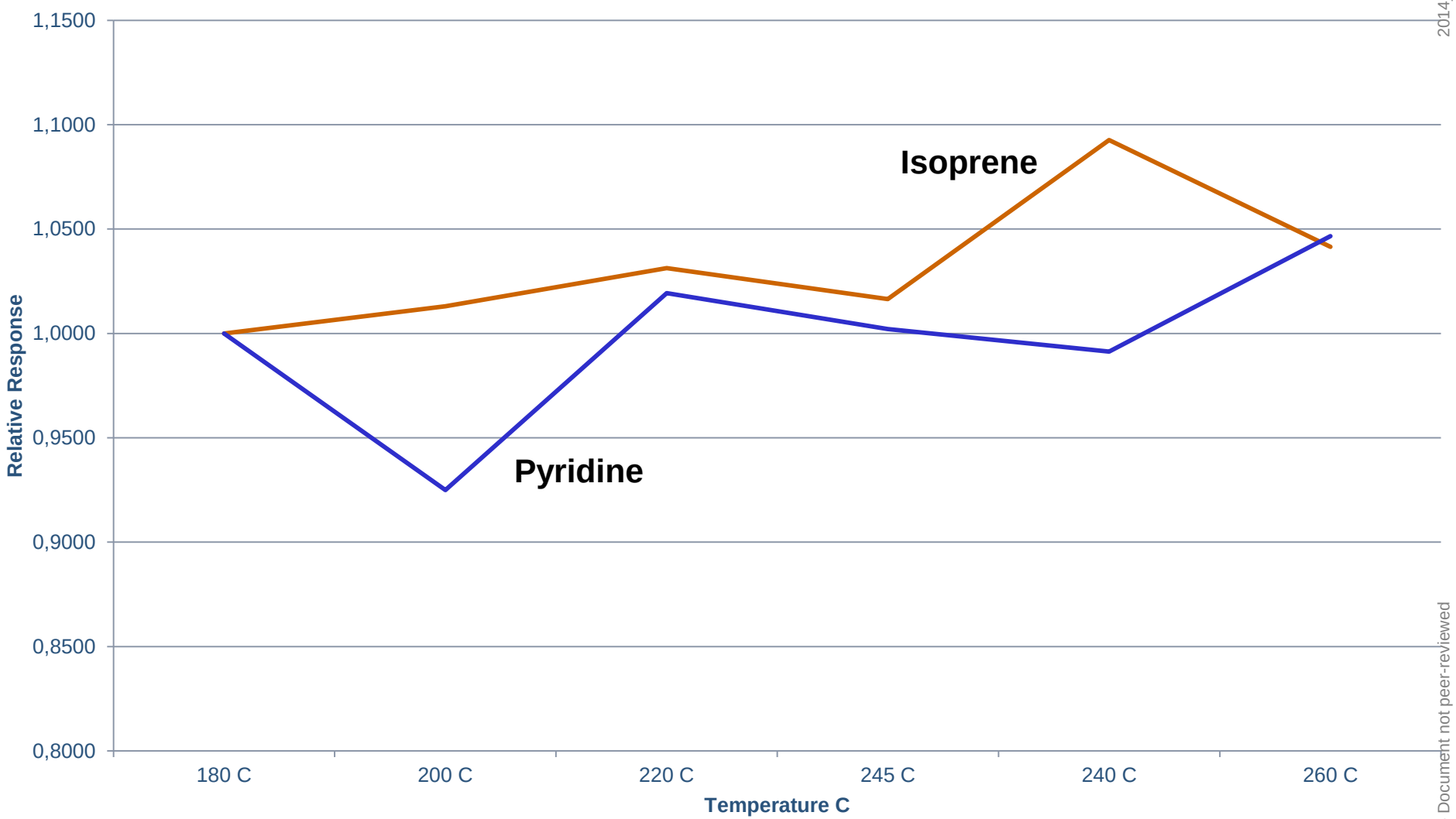
Inlet temperature relative to 180º C
Source temperature relative to 230º C

Looked for patterns and insights

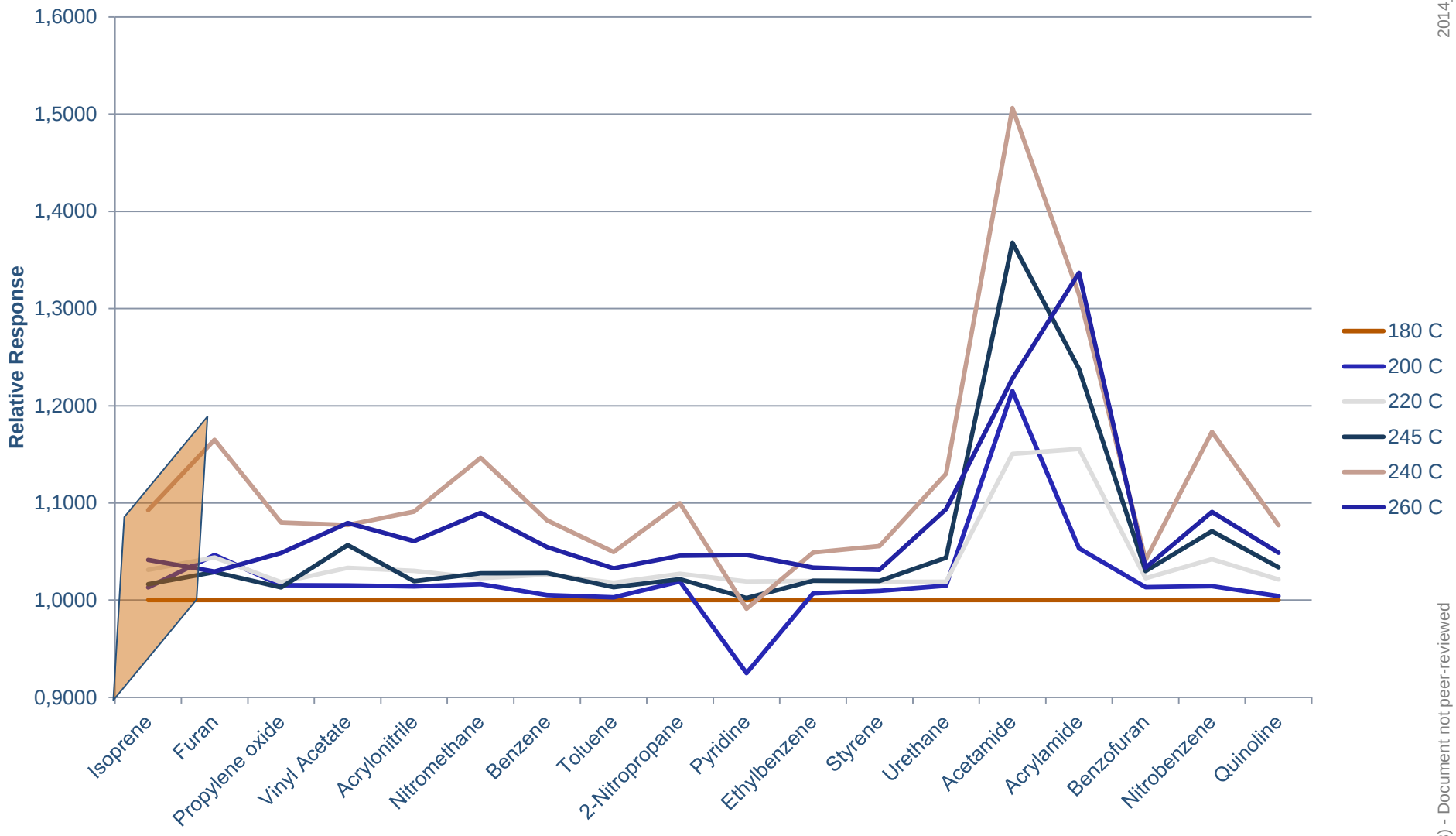
Relative Response Surface



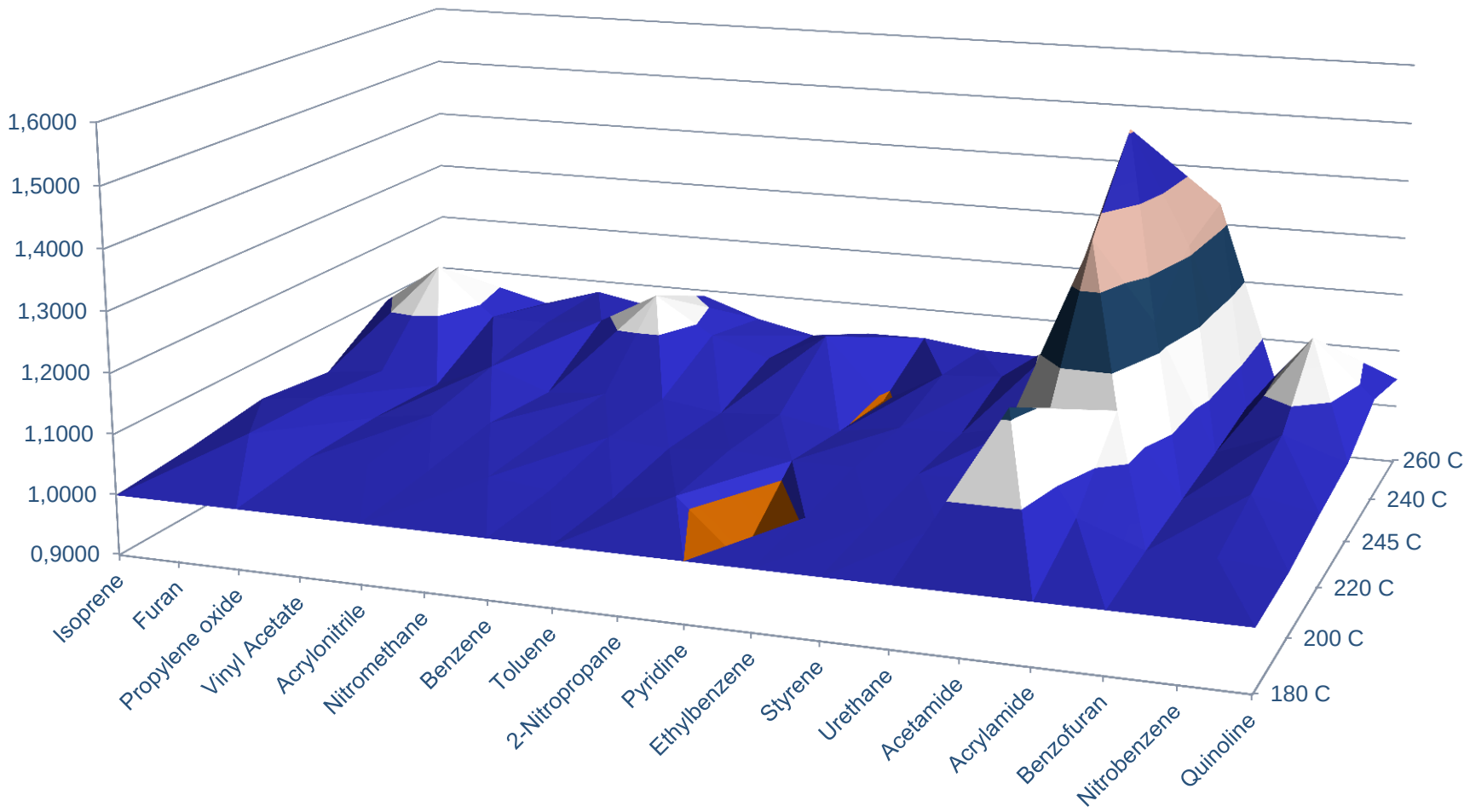
Inlet Temperature Plot



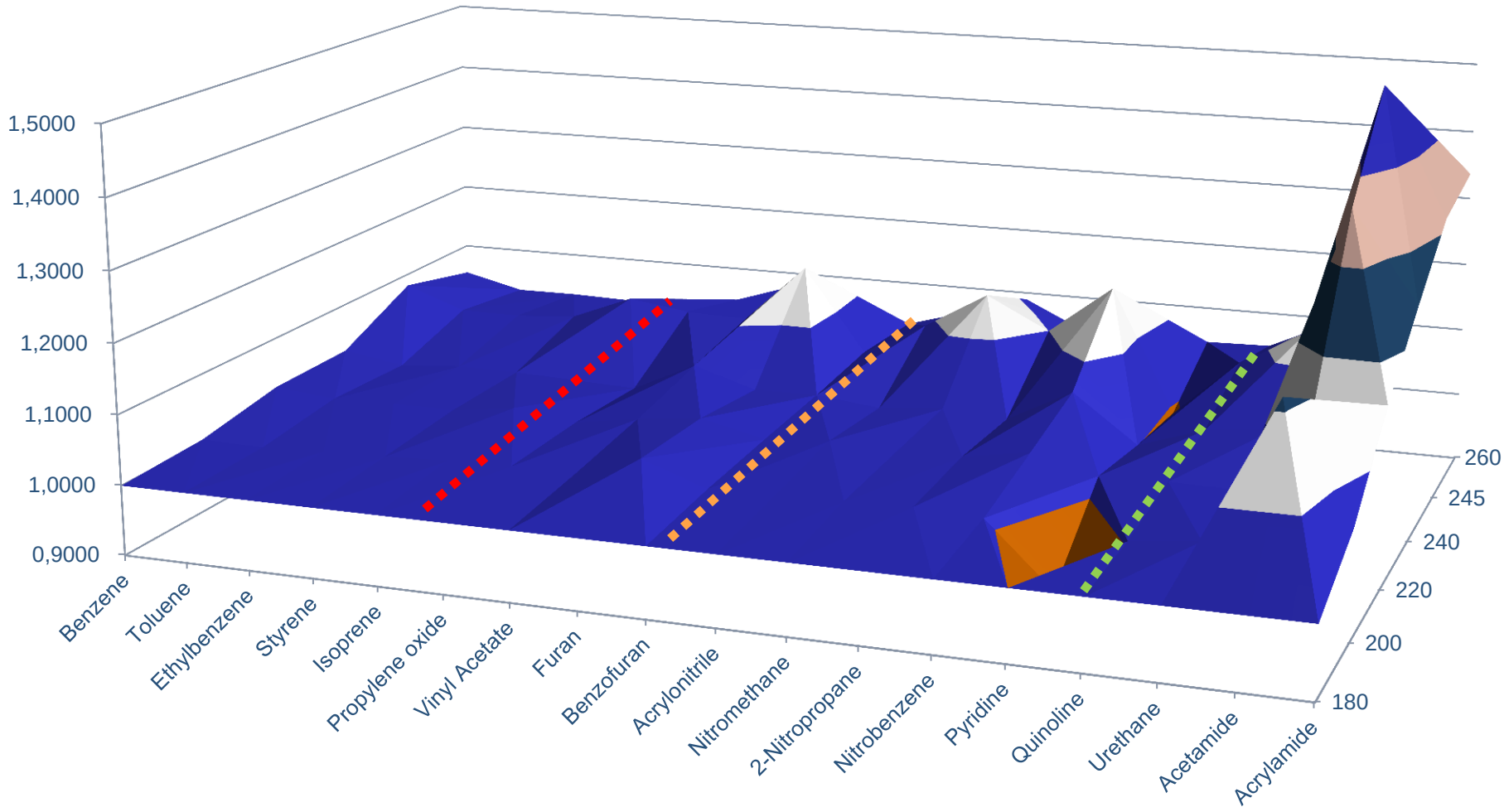
Inlet Temperature Plot



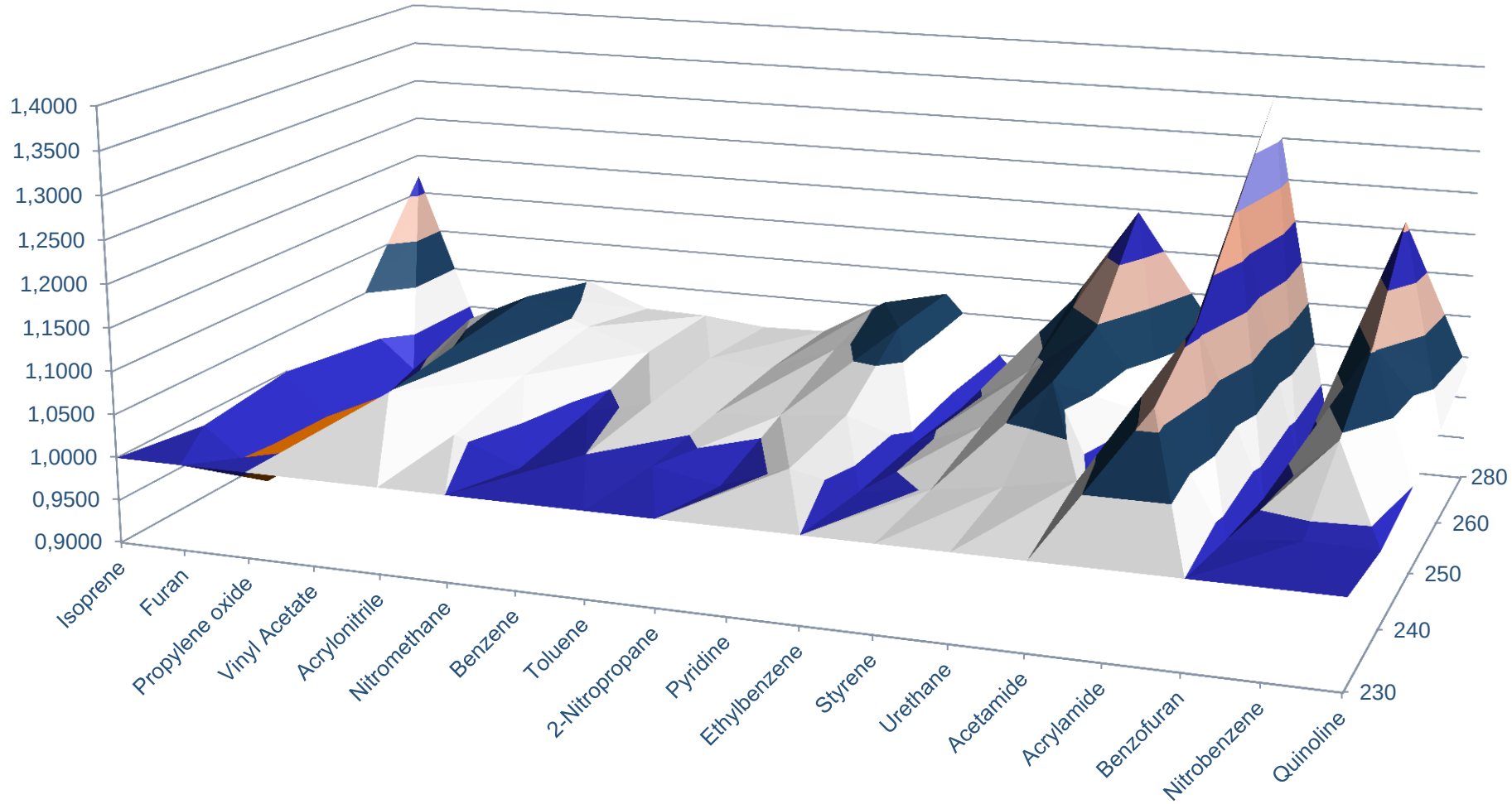
Inlet Temperature by Elution Order



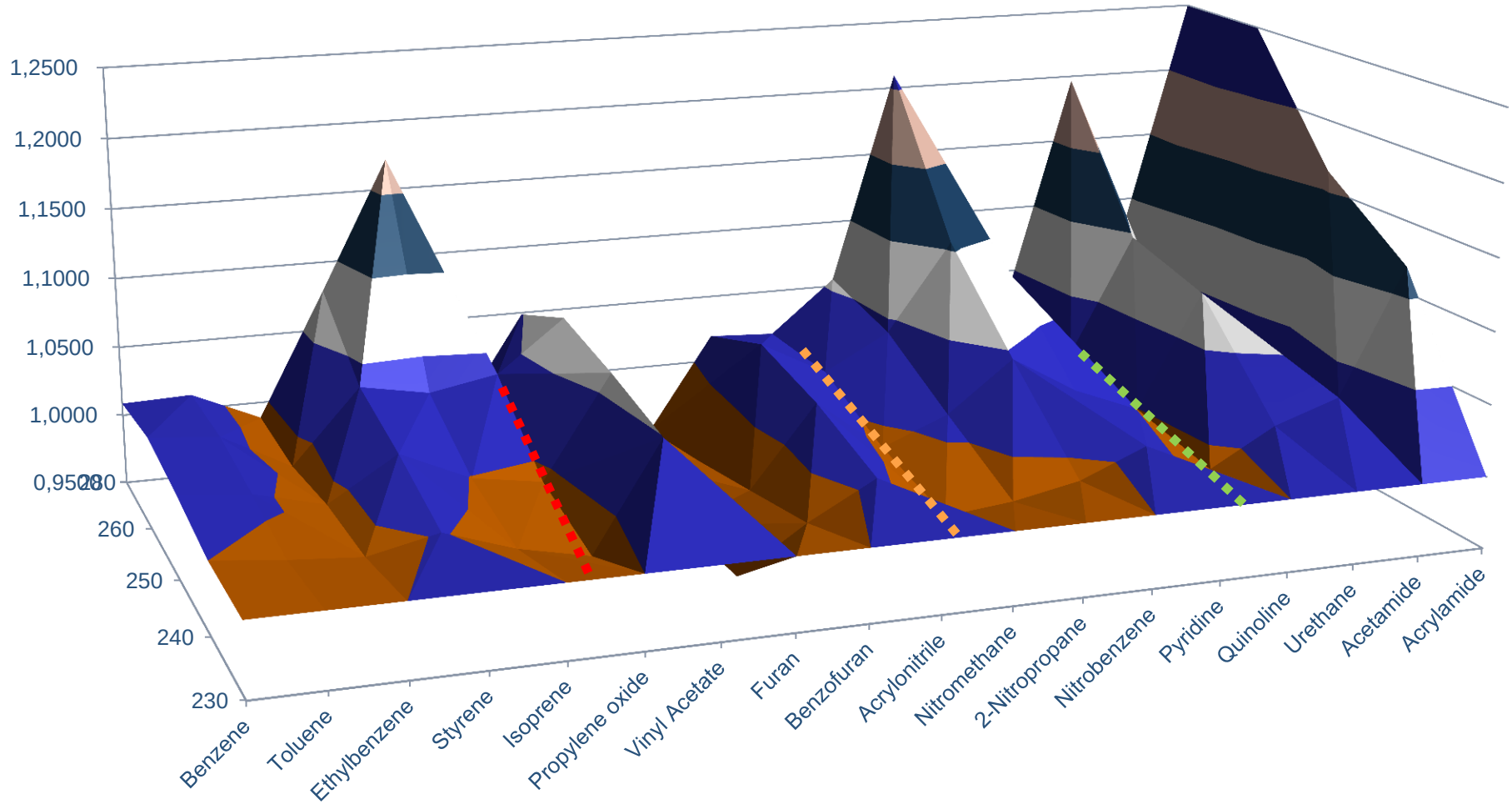
Inlet Temperature by Complexity



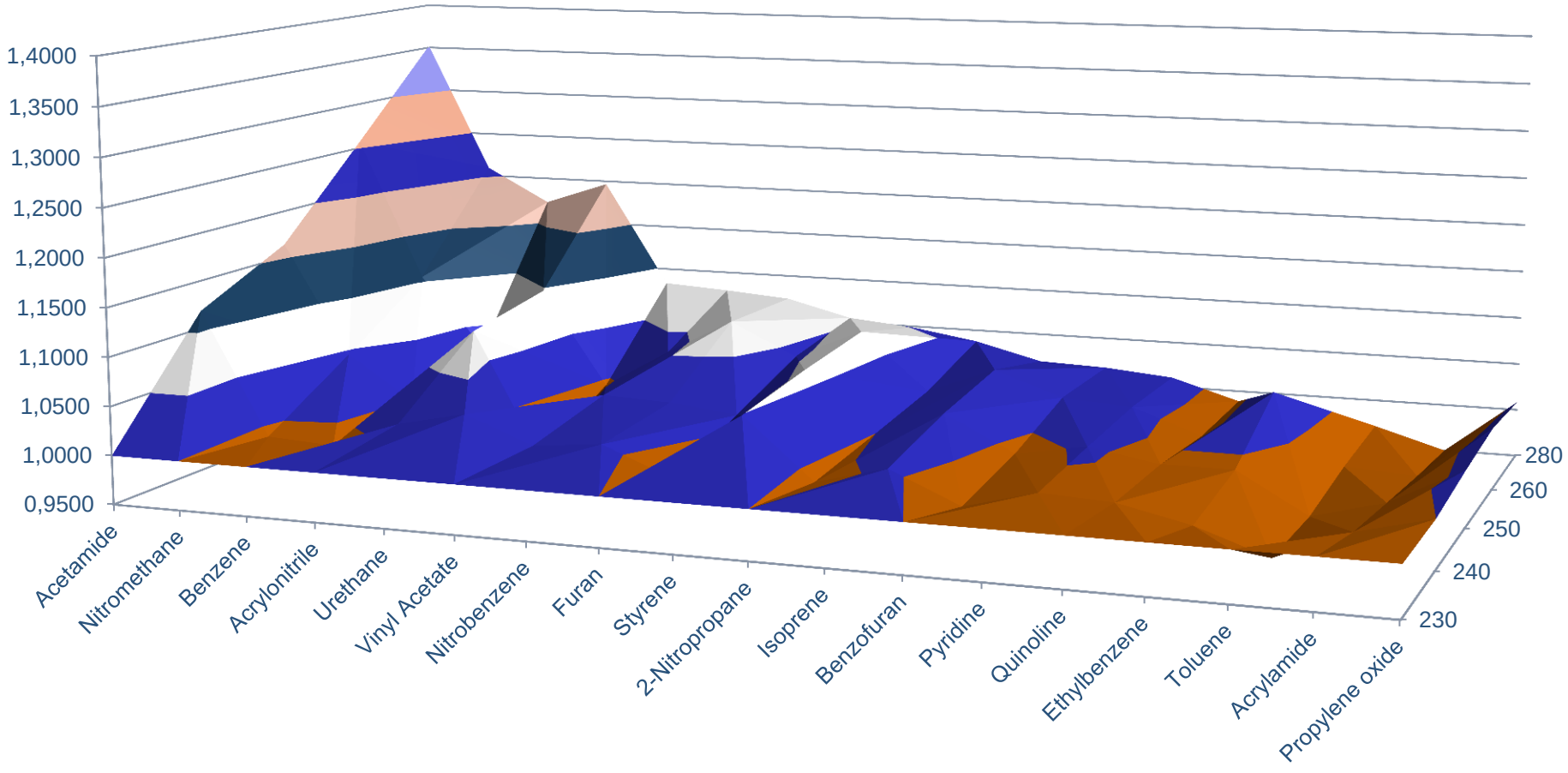
Source Temperature by Elution Order



Source Temperature by Complexity



Source Temperature by Response



Results

The inlet temperature that maximized the response of the most compounds was 245º C. This was used in the method.

The source temperature that maximized the response of the most compounds was 280º C. However, this was a minimum response temperature for some of the trace compounds. 230º C was shown to provide good response across all compounds and was used in the method.

Conclusion

When developing GC methods, especially for multi-compound analysis, optimize the inlet temperature, source temperature as well as:

Inlet liner design – necks, wool, etc.

Inlet liner coating – deactivated is not always good

Split volume – Response factor can vary by split ratio

Pressure pulse vs solvent removal

Acknowledgements

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