Airborne hyperspectral data: detecting flaming combustion in heather-dominated vegetation

How the potassium line technique works: When vegetation burns at high temperatures associated with flaming combustion, trace elements like K are mobilised. This produces a sudden increase in reflectance at 766.5nm and 7.69.9nm, which very narrow band (hyperspectral) sensors detect as a sharp emission peak or line. The strength of the peak decreases as temperature falls. Smouldering combustion results in a much smaller peak.

Can flaming and smouldering combustion be distinguished in heather? The K-line technique works in Italy and California. It was tested during experimental burns in heather moorland in Northumberland during an airborne campaign funded by NERC-ARSF funded on March 2010.

The strength of K-emission line (Figure 3)
- Eagle spectra (A) can be translated into a “flaming map” by calculating a new metric called an Advanced K Band Difference (AKBD) (B)
- Weak signal in AKBD map was confirmed as flame by using super resolution Leica camera (C)

CONCLUSIONS AND WORK IN PROGRESS
- flaming and smouldering combustion in heather can be distinguished using a hyperspectral airborne sensor
- The flaming signal is still seen through smoke

Future work will:
- Test the correlation between Fire Radiative Power and K emission
- Optimise the spectral index used for burnt area delineation and CO2 mapping in moorland
- Test the ability of neural networks to recognise actively burning areas

REFERENCES
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- A study that led to the development of this technique is part of a project funded by the European Space Agency as part of a work package entitled “Spectral characterisation of open fire” (ASI-ASI (2013-2015)).
- Airborne Research and Survey Facility, National Environment Research Council (NERC) for SPERM Eagle and Hawk images and aerial photographers.
- Professor John Cull (University of Manchester and Fire Ub�for the experimental burns at Debdon, Northumberland, March 2010.

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