The Use of Cultural Signifiers in Route Based Network Forecasting

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ABSTRACT

Weather forecast images, as seen on television or on a computer screen, are simplified visualizations of a huge array of weather observations and numerical modelling. This is an interesting overlap between the art of image representation and the science of weather prediction. Users of weather forecasts such as highway engineers, need to be able to decide quickly whether or not to send out salting vehicles, how much salt to spread and when. This forecast information is more easily assimilated if it is presented as a relevant cultural image (eg traffic lights) rather than as weather images such as pressure charts and satellite pictures. Simple action related colour coding of salting routes for route based network forecasting will ensure a much better uniform quality of service across a region.

Keywords: cultural signifiers, network forecasting, road weather

1. INTRODUCTION

Weather forecast images on the television, or in newspapers or on the internet, represent the theory of numerical weather prediction (NWP) in a series of visualizations. There has recently been much debate in the United Kingdom concerning a new visualisation of weather forecasting for the BBC (British Broadcasting Corporation). The new graphics not only leave the viewer with the impression of being in a tailspin over a brown desert (rather than a green and pleasant land), but have greatly foreshortened Scotland at the expense of South East England. This new form of presentation led to a storm of protest but little response from the BBC. What is wrong with this new forecast visualisation? How could this representation be improved? How do we improve the production and consumption of weather forecasts. Weather forecasts have a material effect upon people's behaviour, whether it simply concerns shopping habits, choice of recreational activity, or simply getting safely from A to B. The various symbols currently used to represent the weather are gross oversimplifications across space and time and are almost impossible to verify. Each different type of user (e.g. driver, highway engineer, farmer, sailor, engineer, pilot, retailer, general public, etc.) needs a different, almost bespoke, visualisation to suit their needs. For example, is it better to portray the likelihood of showers to the general public in the UK

with a cultural symbol such as an umbrella rather than a cloud with droplets? The umbrella could be open or closed to express the probability of rain and the size could vary to suggest the amount of rain that is expected. There are many other different formats that could be used to make weather forecasts more memorable and useful. Currently the general public's recall of weather forecast information is very poor. The weather forecasts could be presented as different layers for different users, using appropriate nature or culture signifiers [1].

2. THE VISUALISATION OF ROUTE BASED NETWORK FORECASTING

Let us consider the example of the use of visual literacy in geomatics (GPS plus GIS) to visualise road weather forecasts in a way that condenses thousands of runs of a road energy balance model, and hundreds of mesoscale weather forecasts, into a format that can be understood by a highway engineer at a glance, on the internet [2]. What is in a sense unusual about these bespoke visual road weather forecasts is that they use simple 'cultural' symbols (in this case a form of traffic lights) rather than 'nature' symbols (e.g. a cloud) to get their message across. The prediction converts the risk of frost, ice or snow into a technical response to such phenomena; and since this is a question of managing roads and traffic flows on them, the ''traffic light'' colour coding is appropriate and international. The highway engineer needs to decide whether or not to salt the roads in winter to prevent the formation of ice or frost, or reduce the accumulation of snow. Each different user requires the production of a bespoke visualisation that maximises the value of the forecasts. This is simplified by simulating the decision making of the user rather than presenting the raw weather forecast which the user has to try and understand. This means that the forecaster has to understand the decision making of the user, as well as the user having to understand the weather forecast.

Globally £6 billion is spent every winter to keep roads open and safe and the salting decision is based almost entirely on the road weather forecast. In the United Kingdom there are approximately 3500 salting routes and the highway engineers want accurate weather forecasts presented in a format that can be understand quickly and decisively. The 'traffic light' colour coding for each salting route (red = roads require salting, yellow = standby, roads may require salting, green = no action required) is presented in GIS format over the internet as seen in Figure 1.

Care should be taken to ensure that users are familiar with the concept that red means action. For example in thermal mapping red is the 'warmest' colour and therefore forecast thermal maps suggest that red coloured roads do not require treating. Hence forecast thermal maps must not be confused with route based forecasting maps. The importance of training needs to be stressed here!

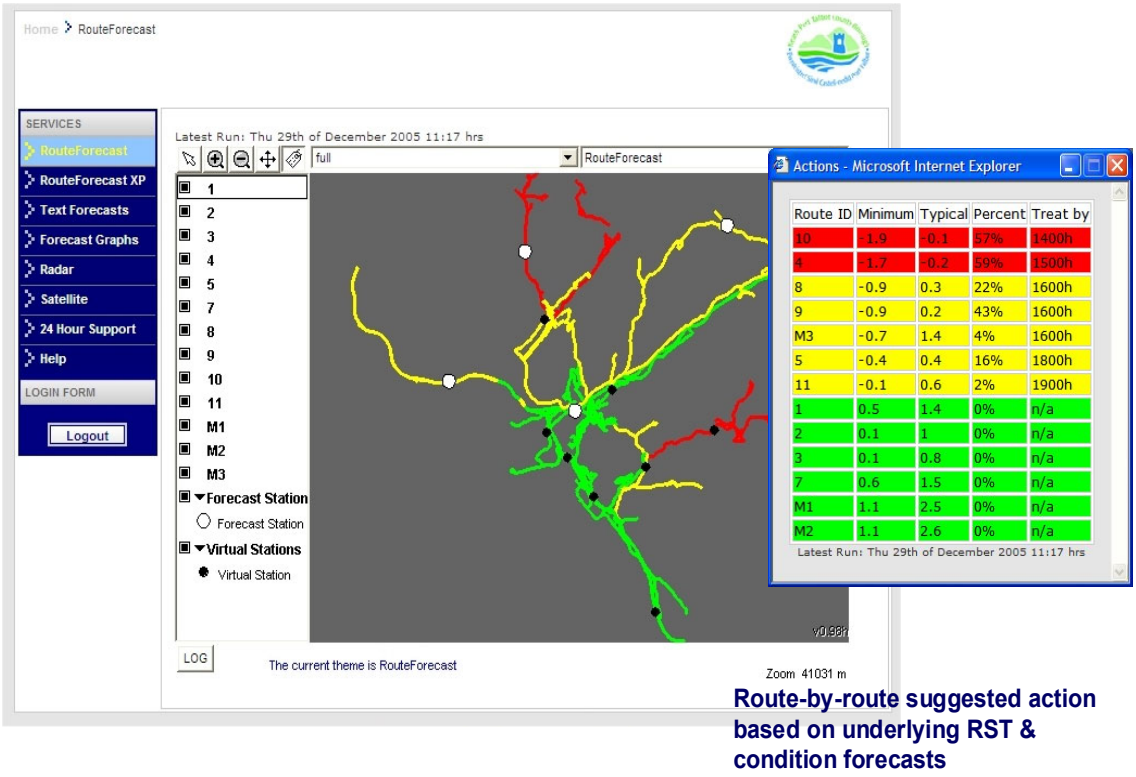

Figure 1: Visualisation of Route Based Network Forecasting for Neath Port Talbot in Wales

Previously, weather forecasts have always been presented using weather (nature) symbols/signifiers. The use of cultural signifiers is of great value as the highway engineers have no meteorological background. This does not imply that accuracy or quality is being lost, for example in transforming interval road temperature forecast data into an ordinal series of colours. In reality the accuracy and quality is increased, as the visual front-end of the weather forecasts is just the top layer of information. All of the interval data is available for inspection as drill-down layers below the front-end visualisation. However, rather than confuse the end user with huge amounts of forecast data, which could lead to a variety of decisions being made by different end users with the same information, the visual cultural image helps to provide high-quality, consistent levels of service across the whole country. The forecast is continuously available on the internet and updated every six hours. All the technical information contained in the colour choice is available to the user, and the thresholds and colours can be interactively changed. Feedback from the users and road weather sensors is fed into the forecasts in real time. The production of these images can be tuned in order to build in a safety factor, so that accuracy can be sacrificed for the public good. The cost of an inaccurate forecast will be different depending on the type of error. Type I errors [3] are potentially more serious as they involve forecasting that the roads need not be salted when

in fact they do, possibly leading to accidents. Type II errors involve forecasting that roads do need to be salted when in fact they do not; these count as false alarms, and result in over-salting. The forecasts need to have a negative bias to reduce type I errors. These forecast images do therefore have a profound material effect on road safety as well as reducing travel delays.

3. CONCLUSION

Producing forecast images is not just about accuracy, it is also about the material implications of constructing these images in a particular way. This is one example of the recent creation of a commercial weather forecast product, but there is still much room for improvement. In the future it will be possible to visualize different weather forecasts for the consumption of different users, and users will be able to choose the visualisation they prefer. More detailed layers of information will be accessible using remote controls, touch sensitive screens or jog-dials. Users will also be able to feed information back regarding the quality of the weather forecasts they have received which will automatically (with quality control built in) improve the forecasts for others.

Note that one has to be careful in the use of colour coding as certain users may be colour blind – therefore alternative shading schemes have to be made available that need to be checked with users that have a problem.

4. REFERENCES

[1] Thornes, J.E. 2008**,** Cultural Climatology and the Representation of Sky, Atmosphere, Weather and Climate in selected art works of Constable, Monet and Eliasson, *Geoforum*, **39**, 570-580

[2] Chapman L. & Thornes J.E. 2006 A geomatics based road surface temperature prediction model *Science of the Total Environment* 360 68-80

[3] Thornes, J.E. & Stephenson, D. 2001 How to judge the quality and value of weather forecast products, *Meteorol. Appl.,* 8 (3), 307-314