

SOIL AND ATMOSPHERIC SCIENCES

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ABSTRACTS

Sub-Synoptic Analyses of the Severe Weather of 9/10 July 1980. R. H. BRADY, J. T. SNOW and D. R. SMITH, Department of Geosciences, Purdue University, West Lafayette, Indiana 47907.—The development and movement of severe convection on 9/10 July 1980 in the central Midwest is related to sub-synoptic background conditions by the analysis of meteorological variables determined from an objective analysis scheme. This scheme, utilizing data from approximately 90 hourly observing stations, graphically shows the temporal and spatial evolution of temperature, pressure, and convergence fields associated with the development and intensification of several strong thunderstorms. These storms formed and moved southeastward along a well defined quasi-stationary front extending across north central Illinois and central Indiana. Very strong gradients across this front were evident in the temperature and moisture fields. An enhancement of these already significant gradients occurred during the afternoon of 9 July 1980 over northeast Illinois and northwest Indiana, the area over which the strong convection initially developed. The local intensification of these gradients appears to be a result of a combination of factors:

- a. the advection of hot, moist air into central Illinois in advance of a synoptic scale frontal wave,
- b. the effect of the cool waters of Lake Michigan to modify the thermal gradients, and
- c. residual outflow of cool air left behind by morning thunderstorms in the vicinity.

The influence of Lake Michigan on the thermal as well as the convergence/divergence fields may have played a key role in the location of the initial convective activity. Apparent from the analysis is the development of an area of high MLCL (Modified Lifting Condensation Level) values associated with the frontal wave over Illinois and Indiana with a closed maximum located over central Indiana. This feature was detected 2½ hours prior to the development of very strong convection in this same area. An isallobaric analysis revealed that the largest pressure falls occurred in this region during this time. Differential analyses of surface potential temperature, MLCL, and convergence/divergence fields show the greatest changes in these variables also occurred 2 - 5 hours before the storms reached their peak intensity with a tornado touchdown occurring at 0235Z 10 July. Yet to be investigated is the acceleration of the frontal wave between 00Z and 01Z and its relation to the convective activity.

One interesting aspect of this study is the notable lack of convection over central Illinois, an area which appeared to be highly favorable for severe storm

development. Work continues on identifying the reason(s) why convection was suppressed in this area.

Mapping Hydric Soils of Arctic and Subarctic Wetlands Using Landsat MSS Data.

STEVEN J. KRISTOF and RICHARD P. MROCZYNSKI, Laboratory for Applications of Remote Sensing, Purdue University, West Lafayette, Indiana 47907.—A study was conducted to determine the feasibility of using machine-aided analysis of Landsat MSS data to inventory hydric soils of arctic and subarctic wetlands in the Canadian Arctic, especially in the MacKenzie River area. Hydric soils of these regions belong to Cryosolic soils group. They are mineral and organic soils that have permafrost 1 m from the surface in some part of the pedon or to a lithic contact. Three major Cryosolic soils with their subgroups are recognized as the Great Group:

1. Turbic mineral soils with cryoturbation (broken horizons and displaced materials) with Brunisolic, Regosolic and Gleysolic as subgroups.
2. Static mineral soils without Cryoturbation with subgroups: Brunisolic, Regosolic and Gleysolic.
3. Organic soils with organic layer greater than 40 cm thick with Fibric, Metic and Humic and subgroups.

The vegetation associated with Cryosolic soils varies from the sparse plant cover of the Arctic, to tundra, and to subarctic and northern boreal forest.

A clustering algorithm was used to divide the satellite data into groups of sample points of similar spectral characteristics. Statistics developed on these groupings were input to a maximum likelihood algorithm. The following terrestrial and aquatic environments were discriminated: shallow lakes and ponds, drained lakebeds, sandbars, river channels, lagoons and bays, MacKenzie River water very high in suspended sediments, water of the Beaufort Sea, lagoons and lakes with medium or low amounts of suspended sediments. Separation of the mineral hydric soils from organic hydric soils was quite successful as was the separation of turbic from static mineral cryosols.

Calcium and Magnesium Relationships in *Poa pratensis* L. as Affected by NPK

Fertilization on Edwards Muck. J. W. LIGHTNER, C. L. RHYKERD, D. B. MENGEL, G. E. VAN SCOYOC, E. L. HOOD and C. H. NOLLER, Department of Agronomy, Purdue University, West Lafayette, Indiana 47907.—A two-year experiment was conducted on Edwards muck (Limnic Medisaprist) on the Pinney—Purdue Agricultural Center at Wanatah, Indiana to study the effect of NPK fertilization on the Ca and Mg concentrations in bluegrass (*Poa pratensis* L.). Eight combinations of N-P-K fertilizer (0-0-0, 0-99-0, 0-0-372, 0-99-372, 168-0-0, 168-99-0, 168-0-372, 168-99-372 kg/ha), were applied each spring. Four cuttings were taken annually during the 1979 and 1980 growing seasons from a 1.5 m² caged area. Soil tests for pH, available P and available K for the top 30.5 cm of the soil's profile were performed.

Soil pH ranged from 4.9 - 5.9 averaged over the top 30.5 cm of the profile. Adequate levels of available P and available K were maintained in the soil throughout the study. However, the major percentage of each (62 and 67% respectively) remained in the top 7.6 cm of the soil's profile.

Averaged over both years, the Ca and Mg concentrations in the forage ranged from 0.31 to 0.64% and from 0.18 to 0.34% respectively. According to the results, 168 kg/ha of N and 99 kg/ha of P applied together increased the Ca concentration in the forage. However, when N and P were applied alone, there was a tendency for Ca levels to decrease slightly. Nitrogen fertilization increased the concentration of

Mg in bluegrass forage while concentrations of both Ca and Mg were significantly reduced by the application of 372 kg/ha of K fertilizer.

Based upon exchangeable cation data and recorded concentrations of Ca and Mg in the forage, it appears that Kentucky bluegrass is able to obtain sufficient amounts of both minerals from the Edwards muck in northern Indiana. However, the levels of Ca and Mg, in the forage tend to be lower in the first cutting, especially when K fertilizer is applied. Therefore, it may be necessary to include both these nutrients in the mineral supplement of the animal's ration, early in the growing season for some classes of cattle grazing these types of pastures.

Dissolution Rates of Agricultural Limestone Granules in Soils. A. J. OHLROGGE and SHERRY FULK-BRINGMAN, Purdue University, West Lafayette, Indiana 47907.—Dolomitic and Oolitic agricultural limestone granules between 4.76 and 2.38 mm in diameter were mixed into the 0-5 and 5-10 cm soil depths at three locations in Indiana. Plots were established in the fall of 1980 before the first freeze and the granules were quantitatively recovered in the spring after the last freeze. Recovery ranged from 65.8% to 78.2% at the 0.5 cm depth and 79.4% to 86.0% at the 5-10 cm depth indicating dissolution rates much higher than generally accepted.

Similar granules saturated with water and subjected to 20 freeze-thaw cycles in the laboratory resulted in a recovery of 90% of the 8 mesh sieve. This decreased to 45% when a one percent methanol wetting solution was used.

The Purdue Regional Objective Analysis of the Mesoscale (PROAM) Scheme. J. T. SNOW and R. H. BRADY, Department of Geosciences, Purdue University, West Lafayette, Indiana 47907.—A simple objective analysis scheme designed to directly utilize hourly surface data as reported in the FAA 604 teletype circuit is described. Based upon earlier work by Barnes (1964, 1973), this analysis routine follows in outline several similar schemes developed at the Oklahoma University and the National Severe Storms Laboratory (eg., Inman (1970), Ruthi (1978)). This scheme was specifically designed to serve as an aid to the forecaster in predicting the onset and short term movement of strong convection in the central Midwest. Input consists of hourly surface data from approximately 120 reporting stations located in an 11 state region bordering Illinois and Indiana. Analyses of standard surface data and other parameters including moisture convergence, vorticity and MLCL (Modified Lifting Condensation Level) fields are produced within 30 minutes. The scheme has recently been modified to analyze the time differences of these same variables. Future modifications include the analyses of the surface *u* and *v* component wind fields. The output can be obtained in the form of a "printer plot" on a standard line printer and hence requires no external contouring routines; therefore any facility with a functional computer system could quickly obtain the analyzed fields.

PROAM has been operational at Purdue University for about one year. During this time, this scheme has proven invaluable in helping predict the outbreak of strong convective activity. The applicability of PROAM to three recent severe storm events will be presented.

i) 8/9 June 1981

An approaching cold front triggered intense convection over the northern sections of Illinois and Indiana. Strong convergence was noted in the affected area two hours before the occurrence of the severe weather.

ii) 13 April 1981

Heavy thunderstorms developed along a warm frontal boundary in Illinois and

northern Indiana. Strong gradients in surface equivalent potential temperature and increases in convergence were a forewarning of the severe activity to come.

iii) 29 May 1981

Strong convergence and high values of the MLCL were evident ahead of an area of developing thunderstorms over eastern Wisconsin and northern Illinois.

It is the opinion of the authors that this type of objective analysis scheme can be readily adapted for operational use in forecast offices using the AFOS computer system.

Literature Cited

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3. INMAN, R.L., 1970: Operational objective analysis schemes at the National Severe Storms Forecast Center. Tech Circular No. 10, National Severe Storms Laboratory, Norman, Oklahoma, 50 pp.
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TABLE 1.

PROAM	
Grid Point Spacing	44.45 km
Grid Center	40.48 N, 88.93 W
Grid Size	21 x 21
Grid Area	790.321 km ²
Total No. Possible Data Stations	241
Avg. No. Data Stations	120
Approx. Station Spacing	123.3 km

Monitoring Crops for Integrated Pest Management Using Color Infrared Photography. G. C. STEINHARDT, J. E. YAHNER, and B. L. DELKS, Department of Agronomy, Purdue University, West Lafayette, Indiana 47907.—During the cropping season of 1981, infrared and conventional color pictures were taken from a small airplane of several fields in Montgomery County, Indiana. Three flights were taken, and the resulting photographs were interpreted using the techniques for conventional aerial photography. One advantage of color infrared photography is the ability to spot problems before they can be found by other monitoring techniques. Certain properties of the soil, such as drainage and slope, are apparent. Significant crop problems such as lodging and insect damage are also apparent. Crop conditions are more difficult to evaluate using oblique photography. This is because in oblique photographs, the rows merge together so that problem areas are difficult to identify. Future work will involve more vertical photography. It is apparent that color infrared photographs can be a very useful tool in monitoring crops.