

JOINT COLLOQUIA

25-26 June 1970

OPERATIONS AND RESEARCH AT THE UNITED STATES
NATIONAL METEOROLOGICAL CENTER

by F. G. Shuman

The organizational and functional aspects of the National Meteorological Center were highlighted in the initial address made to the Colloquium by Dr. Shuman, Director of the National Meteorological Center of the U. S. Weather Bureau. It was pointed out that the National Meteorological Center (NMC), in association with the National Hurricane Center and the National Severe Storms Forecasting Center, is primarily responsible for the production and dissemination of meteorological guidance to forecasting offices throughout the U. S. A. Historically, the Center may be traced as a natural outgrowth of the Joint Numerical Weather Prediction Unit, which was formed in 1954 for the purposes of developing operational numerical methods for analysis prediction in the U. S. A. This emphasis on numerical techniques continues to be a feature of operational processing at NMC. Of the four hundred or so meteorological products prepared each day by the Center for field utilisation, approximately 50 percent receive no manual modification whatever. A further 25 percent are subject to only minor manual modification. This commitment to computerised methods was justified by the very favourable trends in statistics relating to operational forecasting skill in the U. S. A. Since the inception of automated methods there have been considerable and sharp improvements in forecasting skill scores. The speaker was optimistic that this trend would continue, and by extrapolating recent trends in observational and computer technology forwarded some interesting estimates on future model configurations to be utilized by NMC.

Consideration of the NMC operations-research interface represented a major portion of the speaker's second address to the Colloquium. In particular, the responsiveness of the Center's Development Division to operational requirements was highlighted as a major influence in maintaining and improving the Center's operational standards. It was claimed that the close proximity of operations and research personnel at the Center, both from an organizational and physical viewpoint, was the most important factor in achieving this response.

A further aspect of operations at NMC which received emphasis was the recognition and subsequent manual correction of bias in certain numerical forecasts. The extent of this man machine mix process is, however, conditioned by the natural decay in predictive skill which inevitably follows any delay in forwarding forecast products to field stations.

A highlight of the Colloquium proceedings was the extensive and frank discussion which followed each of Dr. Shuman's addresses to the Colloquium. Included among the many interesting questions and replies was a query by Mr. Muffati relating to the operational performance of the NMC primitive equation model in low latitudes. Dr. Shuman stated that the model performed quite creditably at least to within 20° of the equator. For latitudes equatorward of twenty degrees, NMC was relying on a specific tropical model. As yet, however, this model had shown only marginal skill between 20°N and 20°S .

In a related question, Dr. Tucker asked whether the NMC models were capable of describing adequately the growth and movement of hurricanes. Dr. Shuman replied that hurricanes, because of their unique meteorological structure, could only be adequately handled by special models. At present, hurricanes were treated as a point advected in a barotropic model. During hurricane situations, this advection procedure is performed every 12 hours and the results forwarded to NMC.

In commenting on the time required to manually remove an established bias from the products of a particular numerical system, Dr. Gibbs asked whether the forecasting process might be facilitated by the incorporation of automatic correction techniques in the numerical system. Dr. Shuman supported this suggestion but pointed out that with the continual updating of numerical models at operational centers it was very difficult to establish an appropriate climatology on which the automatic correction technique could be based.

Mr. Kelly suggested that an additional factor associated with the considerable improvement in forecasting skill at NMC since the advent of numerical prediction might be the availability of satellite information over sparse data areas. Dr. Shuman replied that although the improvements in the observation system (aireps, satellite photos, etc.) undoubtedly contribute to the skill achieved, the principal source of Numerical Weather Prediction improvement must be due to model development. Dr. Shuman based this judgement on the sharp favourable reaction observed in skill scores, following the introduction of new models into the operational system.

Mr. Rutherford enquired as to the present extended range forecasting potential of models similar to that used operationally by NMC. Dr. Shuman replied that although there was currently considerable theoretical speculation as to the ultimate limit of predictability, the practical limit of present models in the Northern Hemisphere was around five days.

D. G.

10 July 1970

THE INVERSION PROBLEM IN INDIRECT SENSING OF THE ATMOSPHERE

by S. Twomey

In his opening remarks, Dr. Twomey of the C. S. I. R. O. Division of Radiophysics, Sydney, mentioned some of the problems, especially in the field of atmospheric physics, that involved the solution of an integral equation. This equation arises when indirect sensing methods are used to determine the profile of a parameter distributed throughout the atmosphere. Examples given included: