

PREDICTION OF EL NIÑO

Summary of SCOR WG 55 Meeting 11–14 April 1978 in Las Palmas, Gran Canaria, Spain

We reviewed our Charge which is: "To examine possible prediction schemes and indices for El Niño and to recommend the research needed to define the processes that should be taken into account in such forecasting procedures." The chairman mentioned that the SCOR Executive Committee had confirmed its view that WG 55 should *not* be concerned with the biological aspects, which should be considered separately. Hence our charge is narrowed somewhat.

A. What is to be Predicted?

The members present agreed that we needed a definition of El Niño before we could proceed very far. We agreed too, that our interest was in the 'rare' event which has associated climatic (oceanographic and meteorological) and economic effects. Our proposed definition is:

EL NIÑO is a massive influx of warm water into the coast of Ecuador and Peru as far south as Lima (12°S). From our presently available data, the coastal stations must have a positive temperature anomaly, ΔT , of 2°C or greater. Here, ΔT is defined as the difference of the monthly mean (arithmetic) Sea Surface Temperature (SST) at the coastal station from the long term monthly mean (arithmetic) SST for the coastal station. Using this definition El Niños are identified in 1973, 1972, 1969, 1965, 1958, and 1957 i.e. dates well known in the literature.

Our discussion included more sophisticated ways for defining the long term monthly means, but, at least for now, we settled on the straight arithmetic mean. Also, the present data bank dictates that SST data from coastal station be used with $\Delta T \geq 2^{\circ}\text{C}$ being chosen to limit the use of El Niño for those 'rare' events.

With regard to what is to be predicted, we decided the prediction should be of the occurrence or non-occurrence of El Niño only. Having predicted the occurrence of an El Niño this could then trigger predictions of other events which are typically associated with El Niño. Hence, we should focus on prediction of the event only and let others build their specialized sub-forecasts around this.

It was agreed that perhaps a better, or equally good, criterion for the definition of El Niño would be sea level rather than SST. However, the number of stations and years of data for sea level is much less than for SST. The group recommended that the number of coastal stations, measuring sea level in this region be doubled.

B. Prediction Schemes

As mentioned above the discussion was that the objective should be to forecast the occurrence or non-occurrence of El Niño. It was agreed that ultimately this has to be accomplished via some sort of index or indices. It was further stated that such indices should be based on reliably measured meteorological and/or oceanographic quantities and

particularly of readily available quantities — time wise. Even though we could not recommend, at this time, specific approaches to be followed, we wish to encourage the development of indices since currently available indices are not perfect. With the above proposed definition of El Niño we have at least defined which events any index must predict.

Some discussion was directed to the prediction lead time which any index should provide. This we acknowledged is a function of the use to be made of the forecast. As an example an index which gives a perfect prediction of an El Niño event three months in advance may be useful for sub-forecasts dealing with farming operations while for fishing operations an index which can give a perfect forecast of an El Niño event one year in advance is what is needed.

The role of modelling was also discussed. The group could not foresee that the forecast of El Niño would be accomplished by a continuing Ocean-Atmospheric operational model. Rather, modelling effort ought to be of a process type leading to a physical understanding of the whole El Niño phenomena. Hence we need models to give physical understanding of low frequency phenomena. Simulation runs via oceanographic and/or oceanographic and meteorological interactive models should help to identify indicators of an El Niño event. Hopefully, these simulation runs will say what oceanographic and/or meteorological quantities need to be measured, where, and how much in advance to yield a useful prediction. Then the appropriate monitoring program could be set up to verify the model results. If this proves correct then we can go into actual forecasting.

Perhaps the above comments give modellers some ideas of the direction we feel their efforts should go. Professor J.J. O'Brien plans to make simulation runs with an oceanographic model using maps of monthly mean surface stress prepared by Wyrski. It was requested that the chairman investigate what the atmospheric community is doing in their models being employed for FGGE and how these models effect our work. Especially of interest was what is being done in their models to obtain the surface winds. Finally, we invited Professor Newell to discuss his method of SST forecasting at our next meeting.

C. Data Base

As mentioned above, results of model simulation runs ought to be awaited before massive new monitoring programs are set up. However, we feel sure that a knowledge of SST and sea level is quite fundamental and we encourage the continuation and extension of such observations in the Central Equatorial Pacific and along the South American Coast. We recommend the doubling of the number of stations measuring sea level along the South American Coast.

We encourage the improvement of the accuracy and precision of satellite derived SST and of the dissemination of such data. We recommend archiving of calibrated but otherwise unaltered satellite SST data for an equatorial strip (5°N – 15°S) of the Pacific Ocean. The request is for a once daily SST value for each grid box $\frac{1}{4}^{\circ}$ Lat \times 1° Long across the whole Pacific between 5°N and 15°S . Note; similar data for slightly different latitude belts is being recommended by WG 56 for the Atlantic and Indian Oceans.

The group decided not to consider at this meeting the question of a Data Center.

D. Interaction With Other Groups

We briefly discussed various groups with which we should have contact and if possible identified the contacts.

First the various SCOR groups:

WG 36 Coastal and Equatorial Upwelling Processes. This working Group no longer exists but a review-summary volume on physical oceanography of coastal upwelling is in preparation; a similar biological volume is deferred at least until the physical volume is completed.

WG 56 Equatorial Upwelling Processes – Dr Rotschi, Chairman. This group is quite new also and will have biological and physical panels. WG 56 is concerned with equatorial upwelling in all three oceans (Pacific, Atlantic, and Indian). As mentioned earlier we had good interactions with WG 56 at Las Palmas and both groups recognize the need for close cooperation. A general discussion of the interaction of equatorial and coastal upwelling evolved. This included a recognition that the Atlantic might give clues to the Pacific El Niño problem. Stuart is trying to establish contact with groups studying coastal upwelling along the west coast of Africa south of the equator. It was agreed that any low frequency meteorological-oceanographic experiment in any of the oceans would be helpful to WG 55.

WG 49 Mathematical Modelling of Oceanic Processes – Dr O'Brien, Chairman. The contact is well identified but the future of the group was not so definite.

WG 47 Oceanographic Programmes during FGGE – Chairman, Stommel. This Working Group has three separate panels with Dr Taft heading up the Pacific Ocean panel. Various members of our groups have received the latest report (6 Oct 1977) outlining proposed FGGE experiments. A final report on oceanographic programs during FGGE will appear in Fall 1978.

Mention was made of a possible formation of a new group – like Climate and Oceans – later this year.

Other groups of interest with possible contacts are:

GARP –

NORPAX – Namias, Wyrski

ERFEN – Lagos, Parra Suarez, Stuart

IOC/WMO – Working Group in Coordination of Investigations of 'El Niño' – Stuart

CPPS – Lagos

Post FGGE – Tropical Pacific Programs