6 TECHNOLOGICAL INNOVATIONS

ON THE ROAD TO MODERN METEOROLOGY

1850'S TELEGRAPH

Synoptic weather maps became possible with rapid transmission of weather observations. Joseph Henry of the Smithsonian Institution was an innovator in this area. Cleveland Abbe compiled some of the first maps in the U.S. from his observatory in Cincinnati. Because weather moved by knowing what was happening upstream primitive forecasts could be made.

1928–31 RADIOSONDE

This was the next important step in the advance of weather observations. Now a 3-dimensional picture of the atmosphere could emerge. The evaluation and application of static stability to forecasting became possible and the idea of upper winds as "Rossby Waves" took forecasting into new territory.

LATE 1930'S RADAR (AND LATER DOPPLER RADAR)

RADIO DETECTION AND RANGING allowed pinpoint accuracy in tracking of thunderstorms and large-scale events, making warnings possible using the PPI (plan position indicator or map view). The RHI (range height indicator) revealed details of weather systems never before available by scanning vertically.

1950'S ELECTRONIC COMPUTERS

Faster - is one way to describe the effect of computers. A. Gathering, organizing, plotting and analyzing data for charts and diagrams is one task computers do. B. Calculating secondary parameters (i.e. those not observed) is faster and parameters which are very complex and practically impossible to by hand is another, and C. Numerical modeling of the atmosphere finally realizes the dream of Vilhlem Bjerknes and makes forecasting much more accurate than in the past.

1960'S WEATHER SATELLITES

Hurricanes that are far out to sea (and even into the 1960's completely unknown until accidentally discovered) are now routinely detected and tracked even before they become hurricanes. But there is more! By using infrared wavelength energy clouds can be seen at night and temperature can be determined by measuring the wavelength of the radiated energy. By comparing, subtracting or adding different wavelength bands very low clouds (i.e. fog) can be separated from the ground and forecast. Precipitation estimates are possible and soon, radiosondes will be obsolete and the inadequate network upon which we now rely will be replaced by nearly continuous observations at any spot on earth.

1990'S THE INTERNET

Simply put never before in history has more information been available to so many, so quickly.

9 CONCEPTUAL ADVANCES

ON THE ROAD TO MODERN METEOROLOGY

1830'S WILLIAM REDFIELD STORMS ROTATE

It seems too simplistic now but this was a novel idea in the 1830's. Redfield mapped storms and made important contributions to the nature of storms. His theory was purely mechanical emphasizing a balance between pressure change and centrifugal force.

1830'S JAMES POLLARD ESPY LATENT HEAT RELEASE

He was one of the first to state that the release of heat as water vapor condensed drove storms. Today we know that is only part of the energy source of storms. During his lifetime the "caloric" theory treated heat as a mysterious substance, today we know it is merely the kinetic energy of molecules.

1840'S ELIAS LOOMIS USE OF SYNOPTIC CHARTS

Elias Loomis was the first to use synoptic charts, a fundamental meteorological tool, for investigative purposes.

1850'S WILLIAM FERREL GENERAL CIRCULATION

He was the first to explain the large-scale circulation of the atmosphere mathematically, beginning the path to numerical weather prediction.

1890'S VILHELM BJERKNES ATMOSPHERIC HYDRODYNAMICS

A physicist proposed and worked out many of the details of modern meteorology and posed them as a mathematical problem in fluid dynamics.

1918-21 JACOB BJERKNES CYCLONE MODEL, AIR MASSES

Son of Vilhelm, he and his collaborators conceptualized fronts, air masses and the middle latitude cyclone.

1930'S CARL GUSTAVE ROSSBY LONG WAVES

Rossby waves, or long waves are named after him. He advanced the theory and application of the concepts of upper atmosphere wind flow to forecasting.

1945 – 55 ROSSBY, RIEHL, PALMEN, FULTZ, PETTERSSEN JET STREAMS

What the middle latitude cyclone model of Bjerknes could not explain was how quickly a low developed, that is ho fast pressure fell. The answer was in the jet stream.

1970'S VARIOUS AIR-SEA INTERACTION

A subject of study for years, in modern literature this became a hot topic when Jacob Bjerknes (then at UCLA) published a paper on sea surface temperatures off Ecuador and Peru. Jerome Namias followed and soon the topic of El Niño/La Niña was everywhere.