Evaluation of satellite-derived heat fluxes in oceans and DIAGNOSIS OF TROPICAL HURRICANES BEGINNING WITH THE METHODS OF PASSIVE MICROWAVE RADIOMETRY

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PART 1. RESUME

GOALS

1. Studying of potential of the passive MCW radiometric methods to estimate the surface heat fluxes from space in areas of activity of mid-latitude cyclones with emphasis on the North Atlantic.
2. Studying of conditions when the *direct* relations between the brightness temperature measured from satellites and surface heat fluxes are arising.
3. Diagnosis of tropical hurricanes *beginning* with remote sensing methods and the methods of mathematical modeling.

CONCEPTION

Using the resonant regions of natural MCW radiation of the atmospheric water vapour (1.35 cm) and molecular oxygen (~5mm) as some "bridges" between the brightness temperature measured from satellites and surface vertical turbulent fluxes of sensible and latent heat.

APPROACH

(1) Joint analysis of *satellite* passive MCW radiometric and *vessel* oceanographic, meteorological, and aerologic measurements in areas of the mid-latitude cyclone activities in the North Atlantic on the synoptic time scales.

(2) Joint analysis of results of *long-term* satellite passive MCW radiometric measurements and the data of reanalysis (archives NCEP/NCAR) on the seasonal and climatic scales in the Norwegian, Newfoundland, and Gulf Stream energy-active zones of the North Atlantic.

INSTRUMENTATION

1. Radiometers SSM/I (satellites DMSP)
2. Radiometer MTVZA (satellite METEOR-3M №1)
3. Research Vessels V.Bugaev, Musson, Volna (experiments NEWFOUEX-88 and ATLANTEX-90)
4. NCEP/NCAR archive

EXPERIENCE

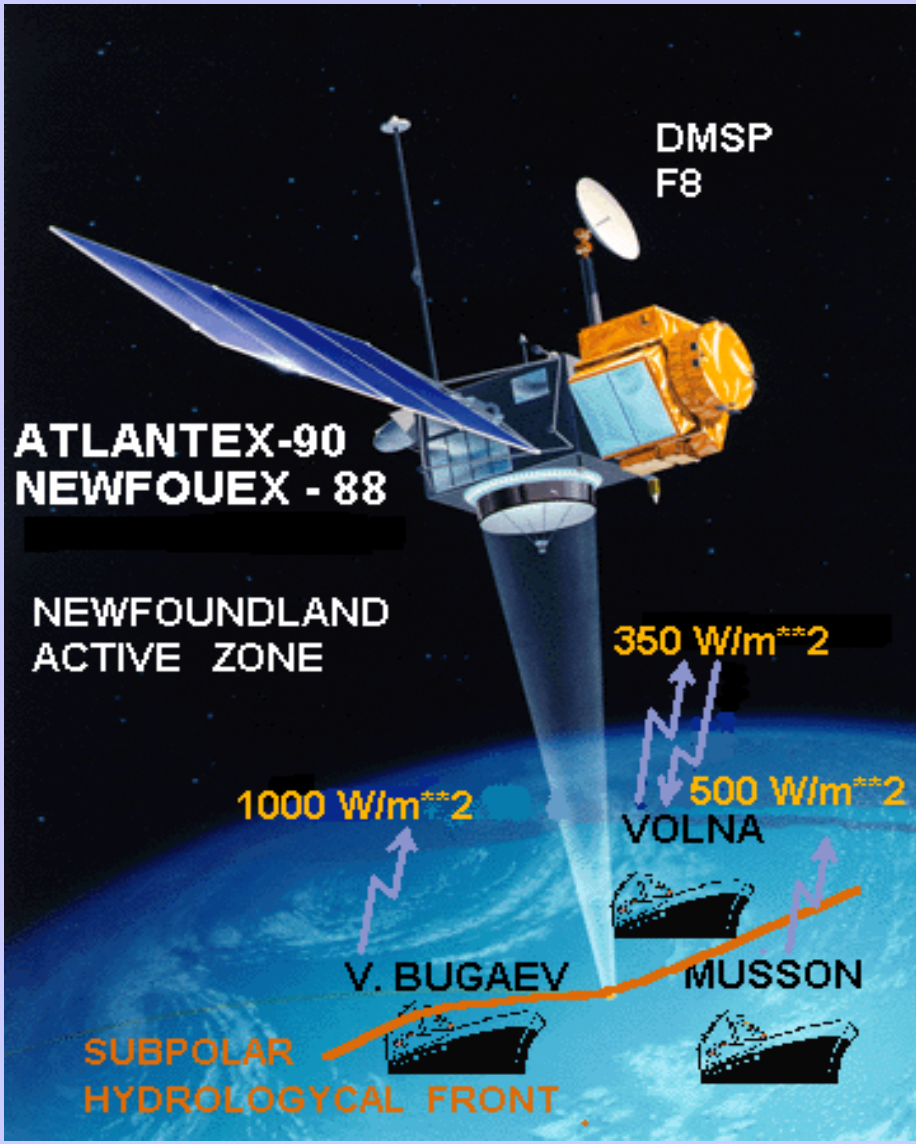
1. Grant RFBR 94-05-16234^{a} (1994-1995).
2. Grant NAS15-10110 (Russian Space Agency (RSA) / NASA) (1996-1997).
4. Contracts with the Center of Space Observations RSA (1998-2006) and Shirshov Institute of Oceanology RAS (from 2003).

PART 2. RESULTS

SYNOPTIC SCALES

Initial and fruitful idea in our studies was to combine the data of the DMSP F-08 satellite with the vessel data in the experiments NEWFOUEX-88 and ATLANTEX-90, as if it was the united project.

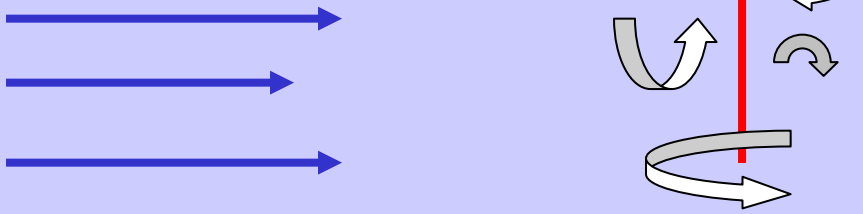
- more than 2000 meteorological measurements (1-h resolution);
- more than 400 aerological zondings (6-h resolution);
- more than 120 MCW radiometric data sets (24-h resolution).



When analyzing the factors forming the brightness temperature measured from satellites and vessels in synoptic range of time scales the following scheme is taken into consideration:

Satellite level

Horizontal advective fluxes



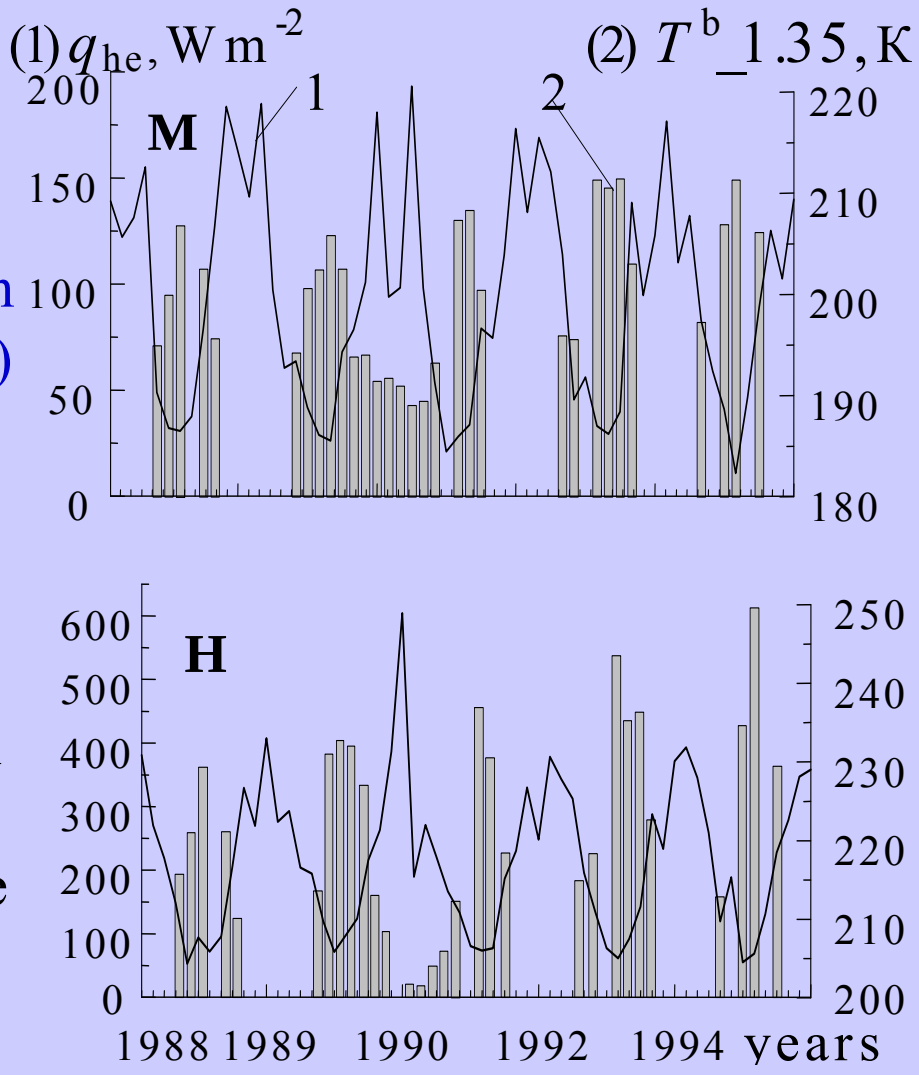
Vertical turbulent heat fluxes

Vessel level

CLIMATIC SCALES

It is a noticeable relation between long-term variability of monthly mean heat fluxes q (NCEP/NCAR) in Norwegian (M), and Gulf Stream (H) energy-active zone and SSM/I brightness temperature T^b at the wavelength 1.35 cm.

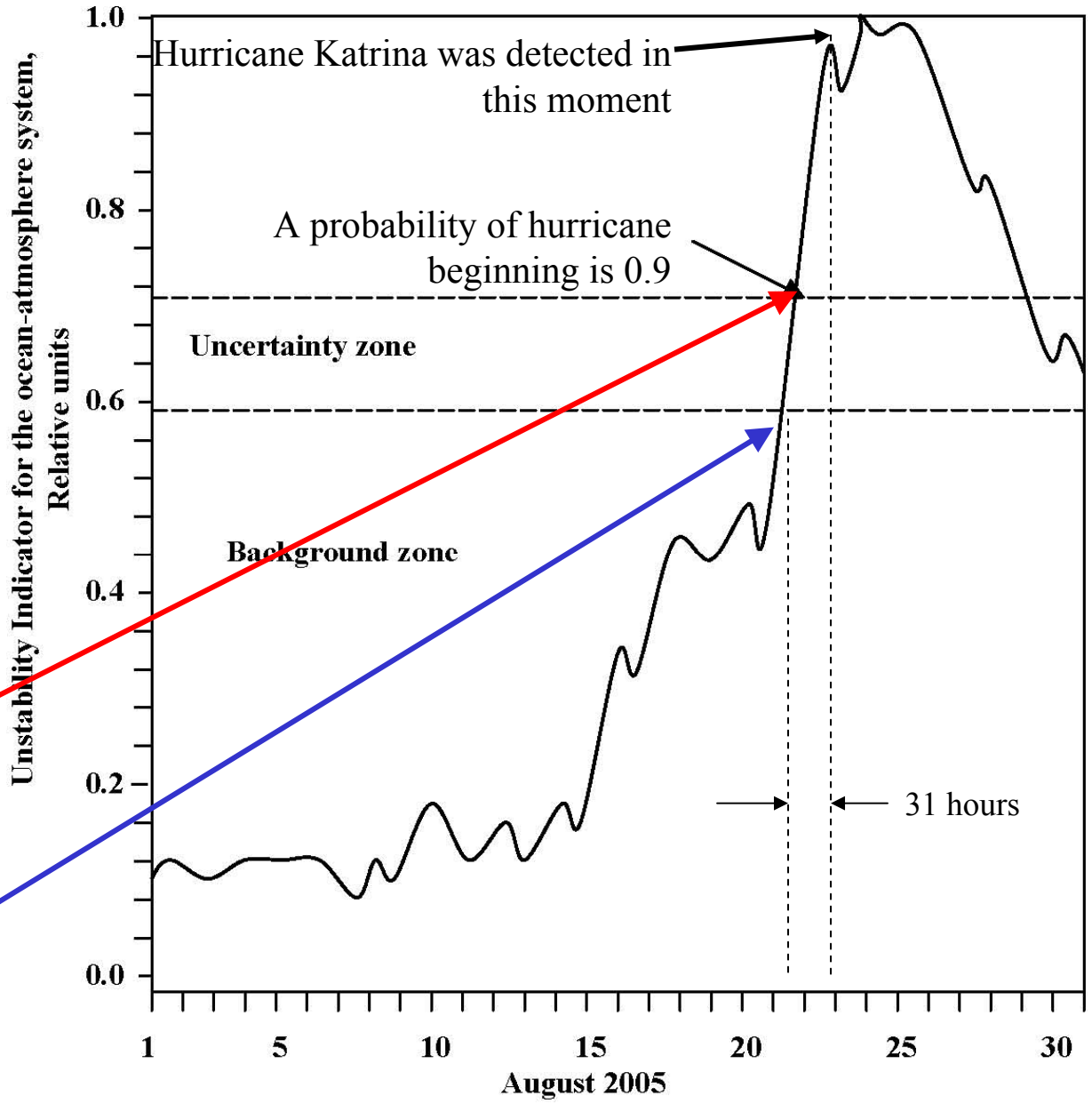
These results display the feasibility of determining the climatic heat flux in the SOA interface based on the data of *meteorological* sensing of the atmosphere.



Unstability Indicator for the ocean-atmosphere system

Hurricane Katrina was formed above the Islands of the Bahamas

(Meteostation SPGF1)



Beginning from this moment none point of phase space does not migrate to the uncertainty and background zones

Beginning from this moment a majority of the points was in uncertainty zone

SUMMARY

1. Changes of the horizontal transfer intensity in the North Atlantic areas initiate the changes both surface heat flux and the brightness temperature simultaneously; this is the reason for *direct* bonds between them.

2. The brightness temperature in the resonant line of the atmosphere water vapor absorption (at the wavelength 1.35) is also a good quantitative indicator of the air-sea heat exchange over various energy-active zones of the North Atlantic in the range of *climatic* time scales.

3. Application of modeling results gives a possibility to detect a moment of transition of the ocean-atmosphere system from the background (quasistationary) state to the hurricane beginning state.

4. Proposed unstability indicator allowed to make more precise the time of the hurricane Katrina beginning. Delay time equals 31 hours in the case of hurricane Katrina. Another indicators were analyzed.


Natural Disasters as Interactive Components of Global Ecodynamics
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