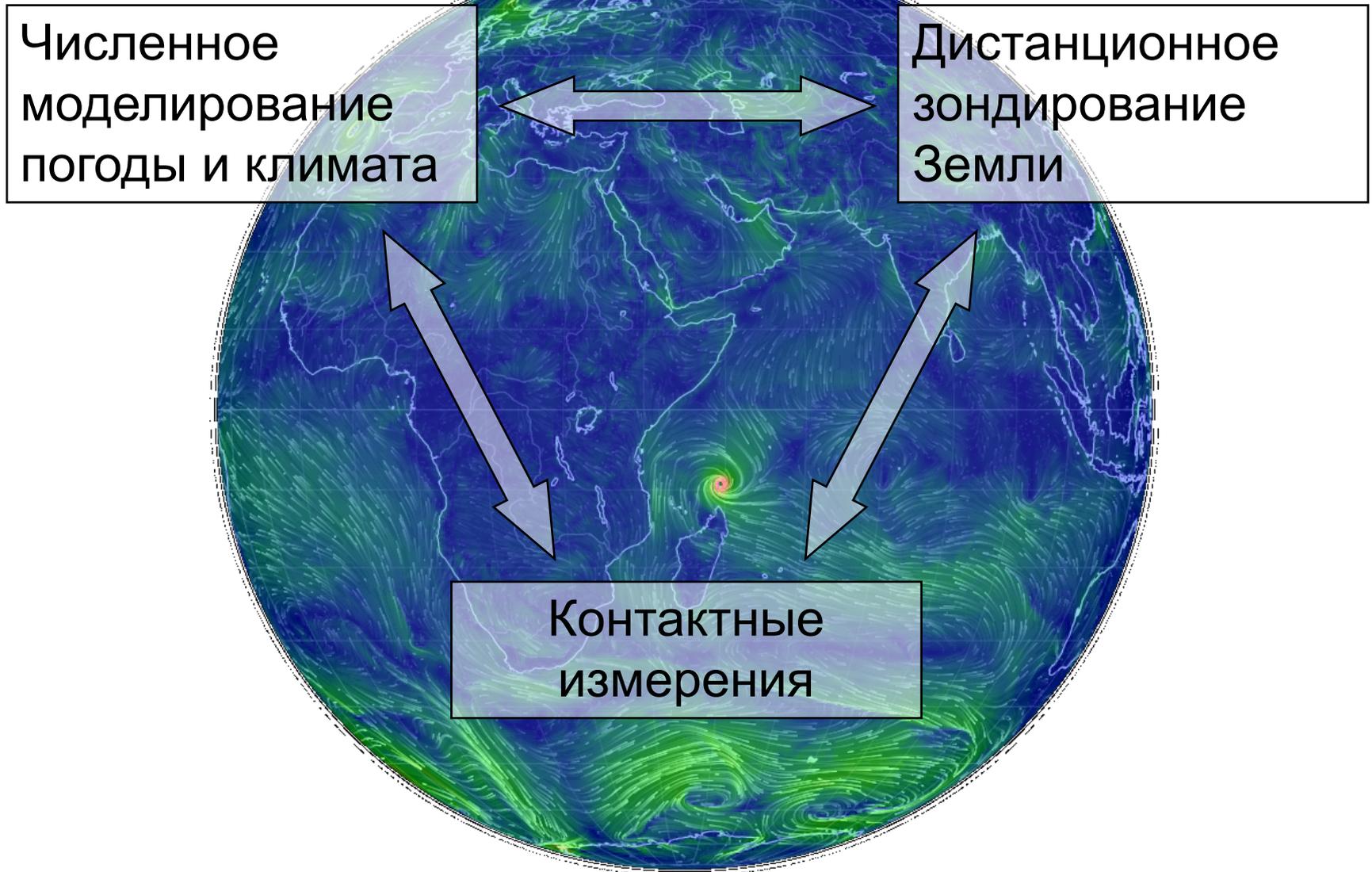


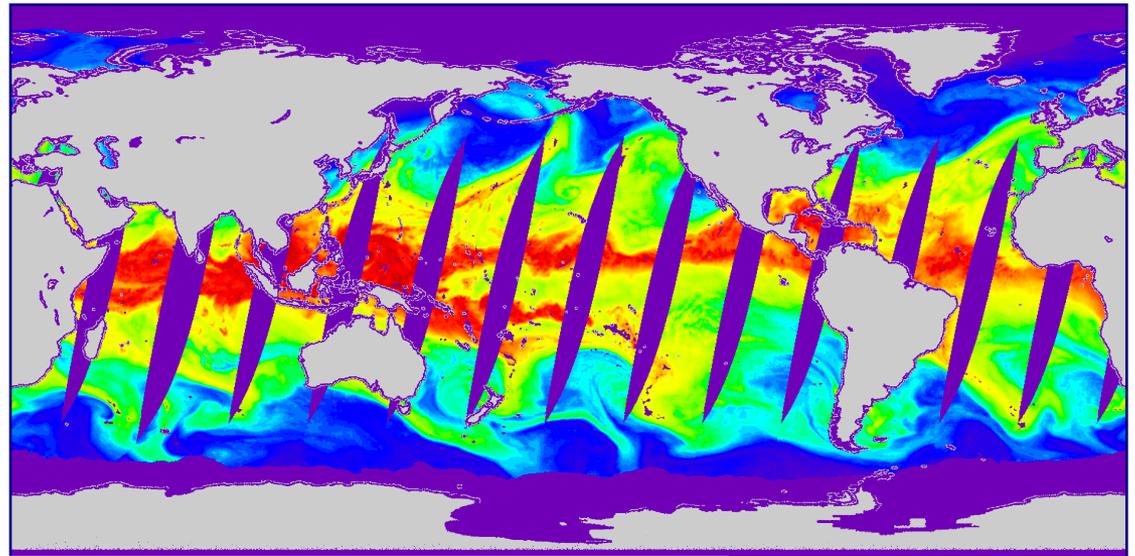
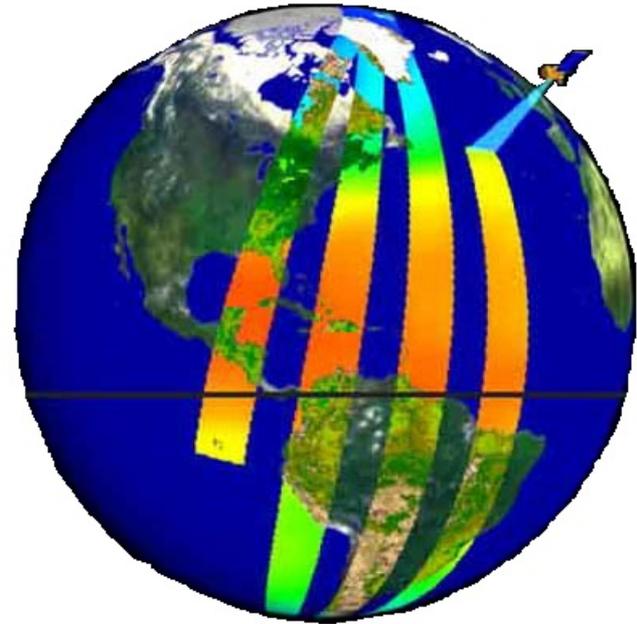
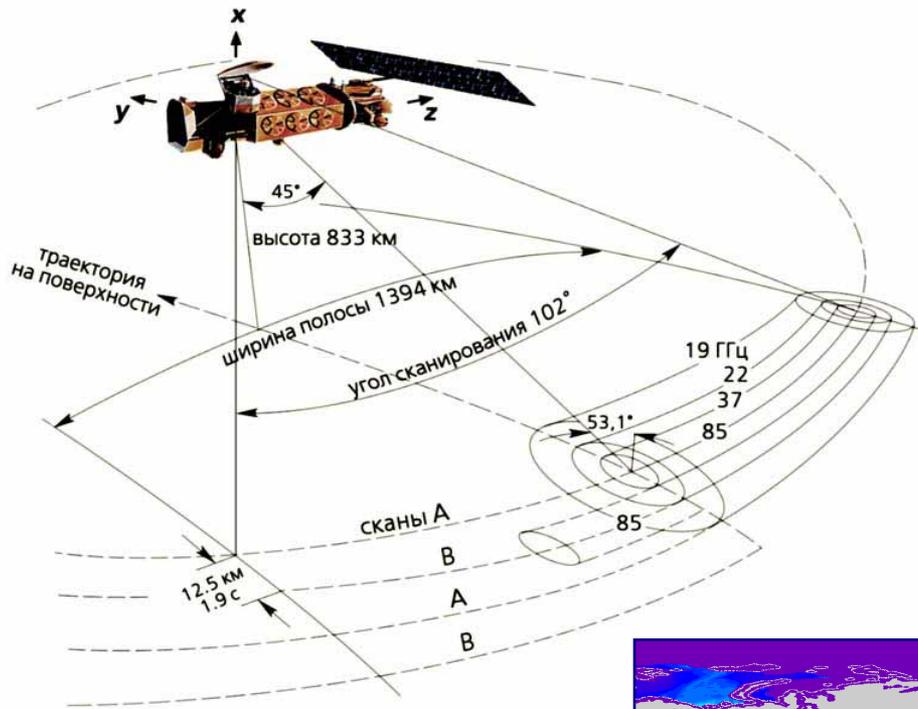
Возможности исследования атмосферной циркуляции по данным радиотеплового спутникового мониторинга

Д.М. Ермаков, ФИРЭ РАН

Численные модели климата и ДЗЗ



Спутниковый радиотепловой мониторинг Земли



Динамика поля интегрального влагосодержания

02-Sep-2004: (dt = -10.25 hrs)

(a)

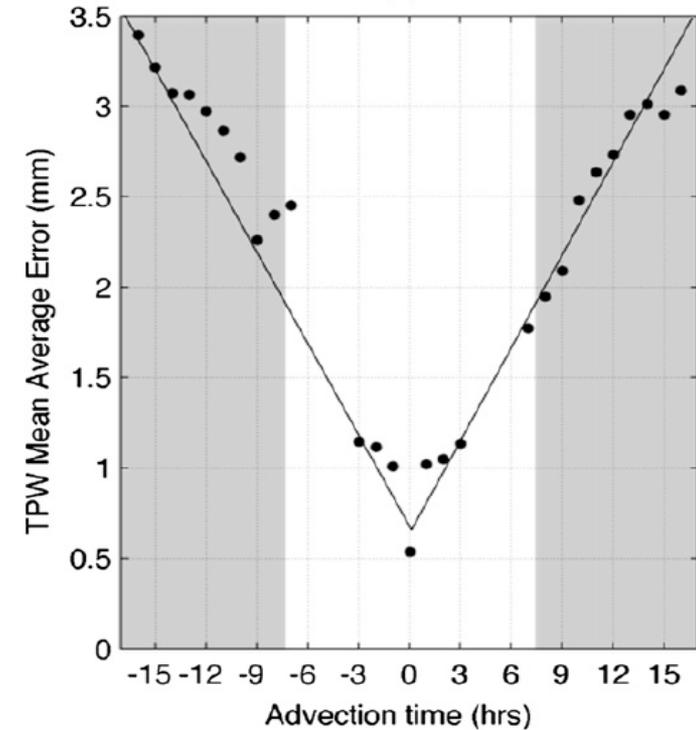
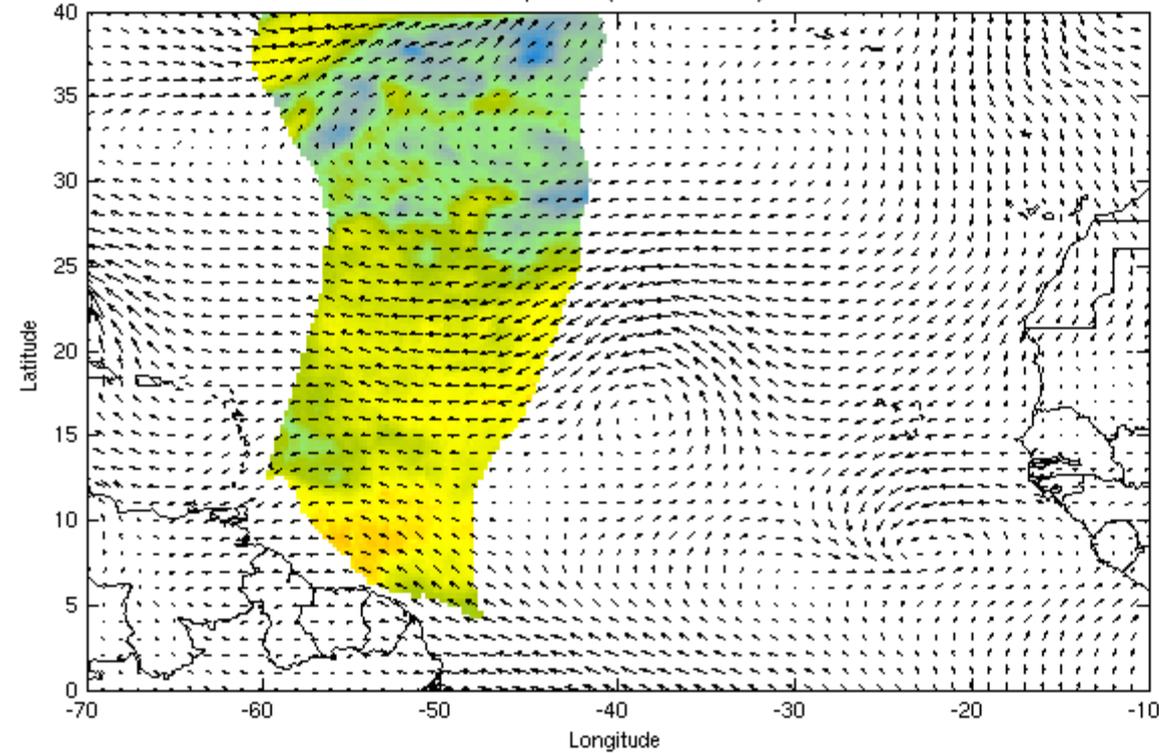


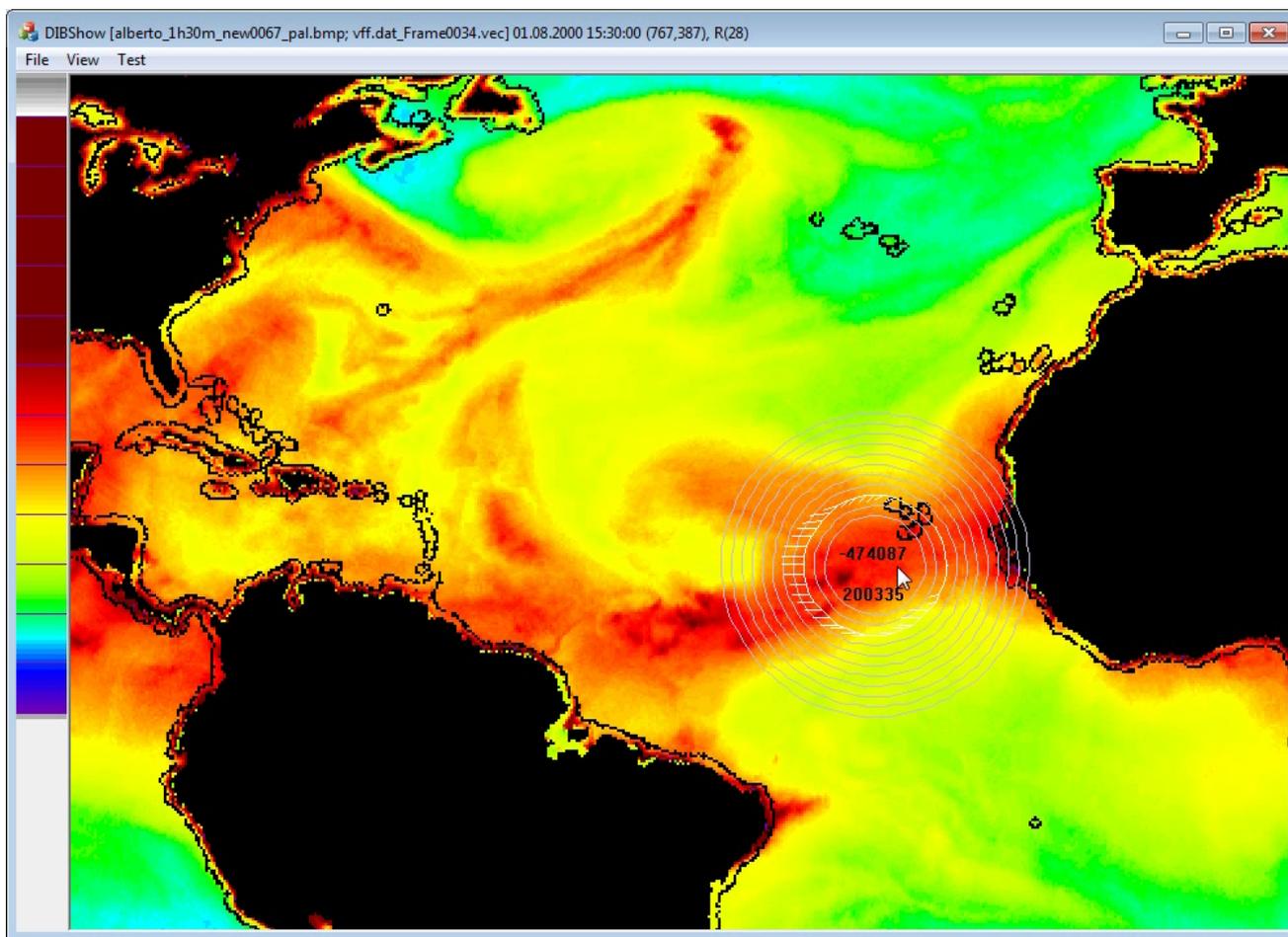
Table 2. Advecting wind profile weighting functions, by latitude.^a

Height (hPa)	weight, $\leq 25^\circ$	weight, $\geq 50^\circ$
700	0.160	0.138
850	0.280	0.345
1000	0.560	0.517

^a Valid for north and south latitude (always positive in this table). Weights between 25° and 50° latitude are calculated by linear interpolation.

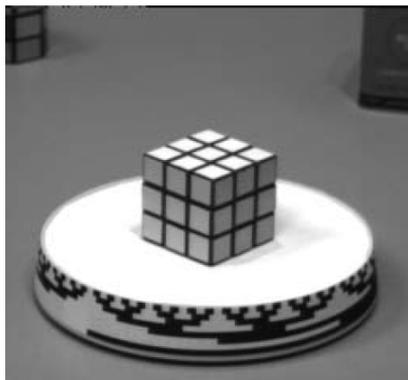
Спутниковое радиотепловидение

1. Расчет поля адвекции напрямую из спутниковых данных
2. Расчет потоков скрытого тепла



Восстановление динамики и алгоритмы зрения

Grzywacz N.M., Yuille A.L., *Proc. R. Soc. Lond.*, B239, 129 (1990)

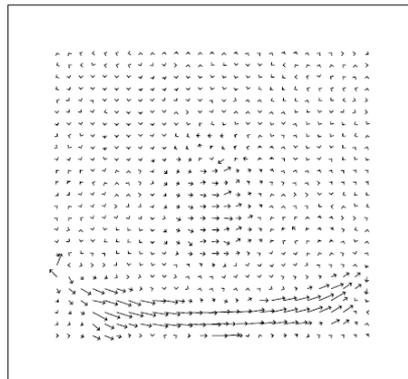


(c) Rubik Cube

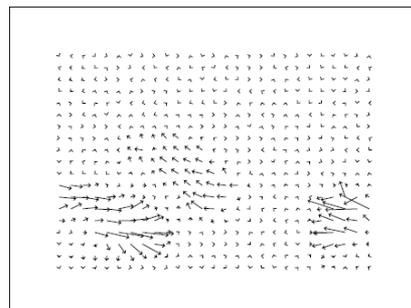


(d) Hamburg Taxi

■ ■ ■



(c) Rubik Cube



(d) Hamburg Taxi

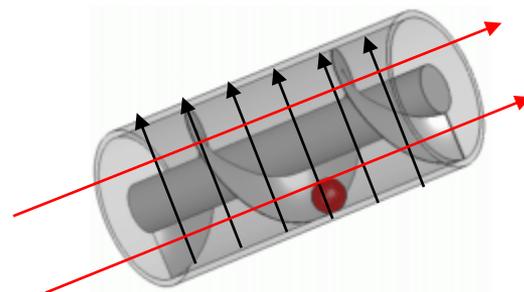
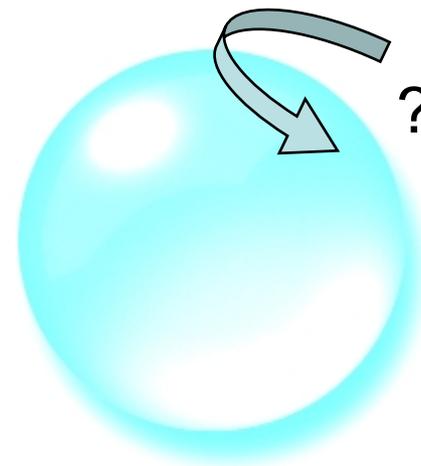


Figure 5.3: Flow fields for the technique of Nagel applied to real image data. With the minimum of energy, the flow fields do not require regularization or non-linear spatial presmoothing. Here we used a Gaussian filter with standard deviation of 3.0 in space and 15 in time. Thresholding was performed.

Baron J.L. et al., *JCV*, 12 (1), 43 (1994)

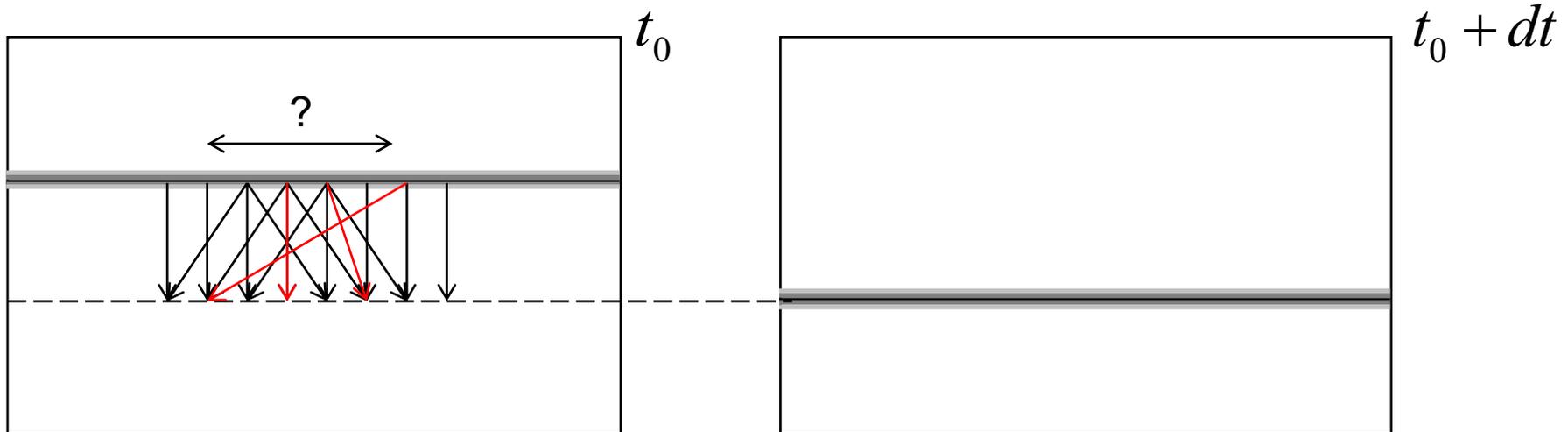
Уравнение оптического потока и градиентный метод

Приближение консервативных трассеров

$$I(x, y, t) = I(x + u \ dt, y + v \ dt, t + dt)$$

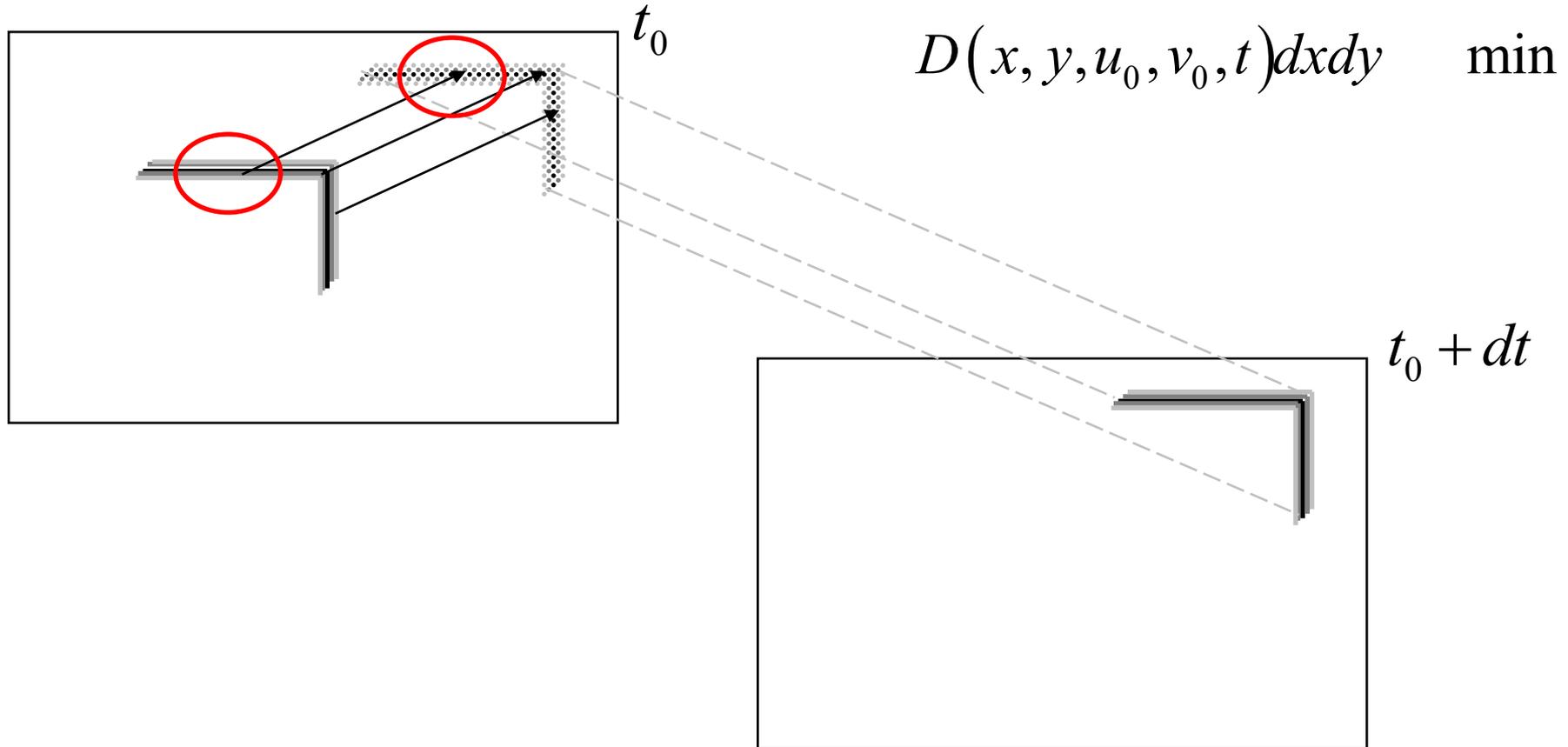
Уравнение оптического потока

$$\frac{I}{x} u + \frac{I}{y} v = \frac{I}{t}$$



Приближение твердого тела и проблема аперттуры

Nagel H.-H. *Art. Intell.*, **33**, 299 (1987)



Fleet D J, Weiss Y, in *Mathematical models in computer vision: The handbook* (Eds: N Paragios, Y Chen, O Faugeras) (Berlin: Springer, 2005) p. 239

Вариационный метод

Horn B.K.P., Schunck B.G. *Art. Intell.*, **17**, 185 (1981)

Глобальная гладкость поля скоростей:

$$\frac{I}{x} u + \frac{I}{y} v + \frac{I}{t} + \frac{u^2}{x} + \frac{u^2}{y} + \frac{v^2}{x} + \frac{v^2}{y} dx dy \quad \min$$

Little J.J., Verri A. *Analysis of differential and matching methods for optical flow*, MIT (1988)

Garbe C.S, Ommer B. in *Model Based Parameter Estimation* (Eds. Bock H.G. et al.) (Berlin Heidelberg: Springer-Verlag, 2013), p. 311

Блочный метод. Векторы атмосферных движений

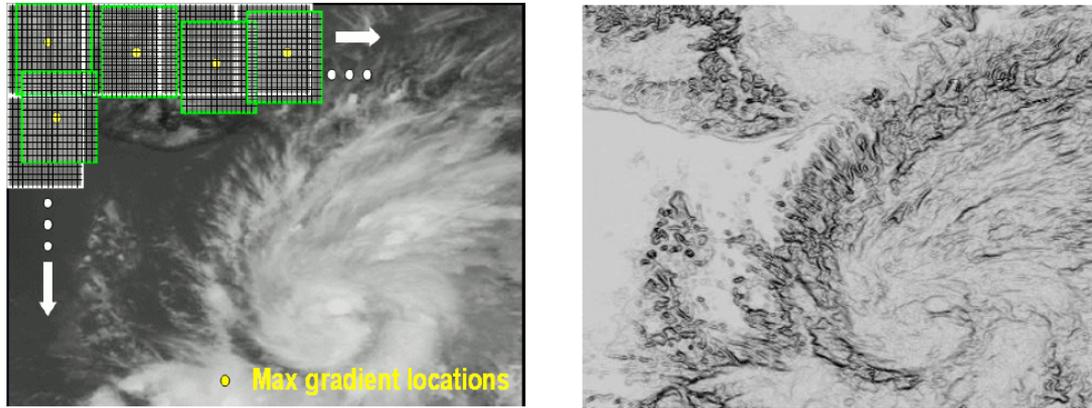


Figure 3. Image of 11um brightness temperature (left) and the 11um brightness temperature gradient (right) from the GOES-12 imager instrument. The white boxes show the target scenes at their original locations. The green boxes show the target scenes which have been repositioned at the pixel location containing the maximum brightness temperature gradient as indicated by the yellow dot.

$$D(x, y, u_0, v_0, t) dx dy \quad \min$$

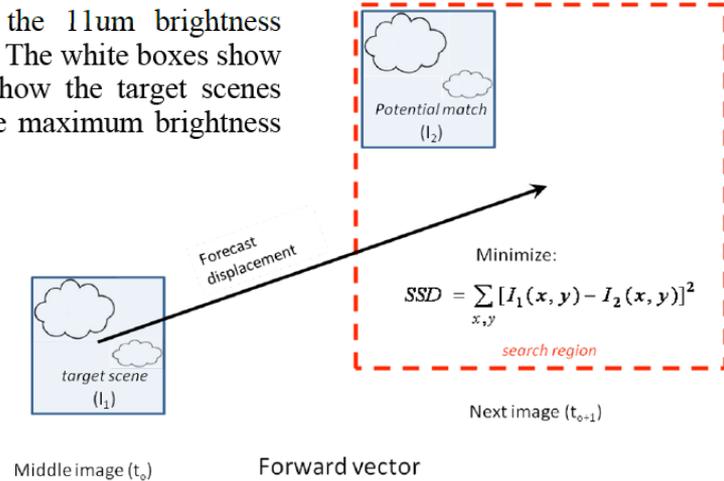


FIG. 6. Schematic showing the basic concepts associated with the feature tracking algorithm. Targets are selected from the middle image of a three-image loop and tracked forward and backward in time via the SSD method. The two displacements are averaged to produce a final motion estimate. Only the forward vector is shown in the figure.

Пирамидальный блочный метод

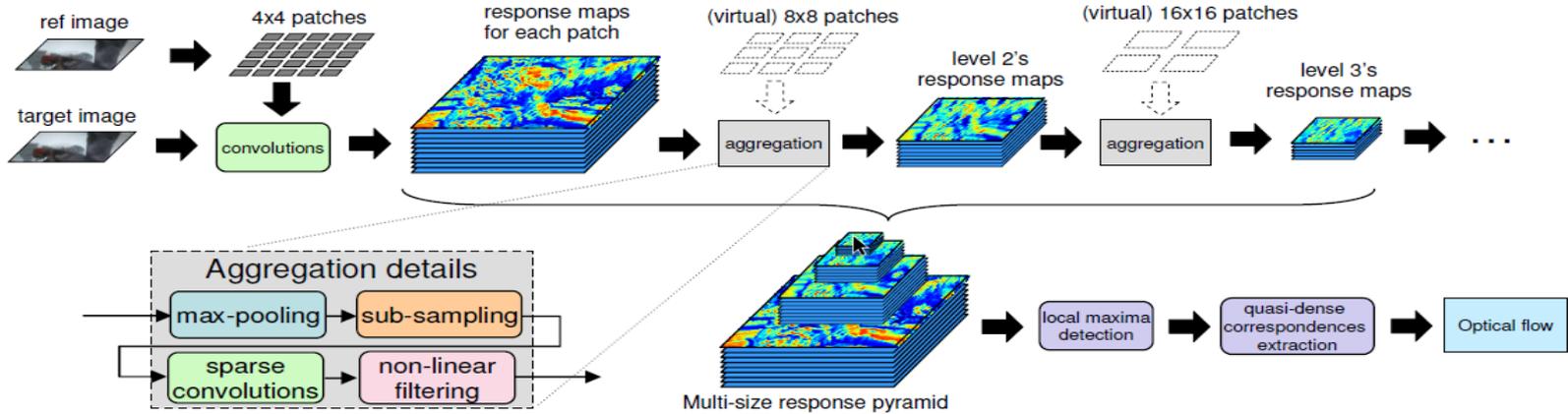
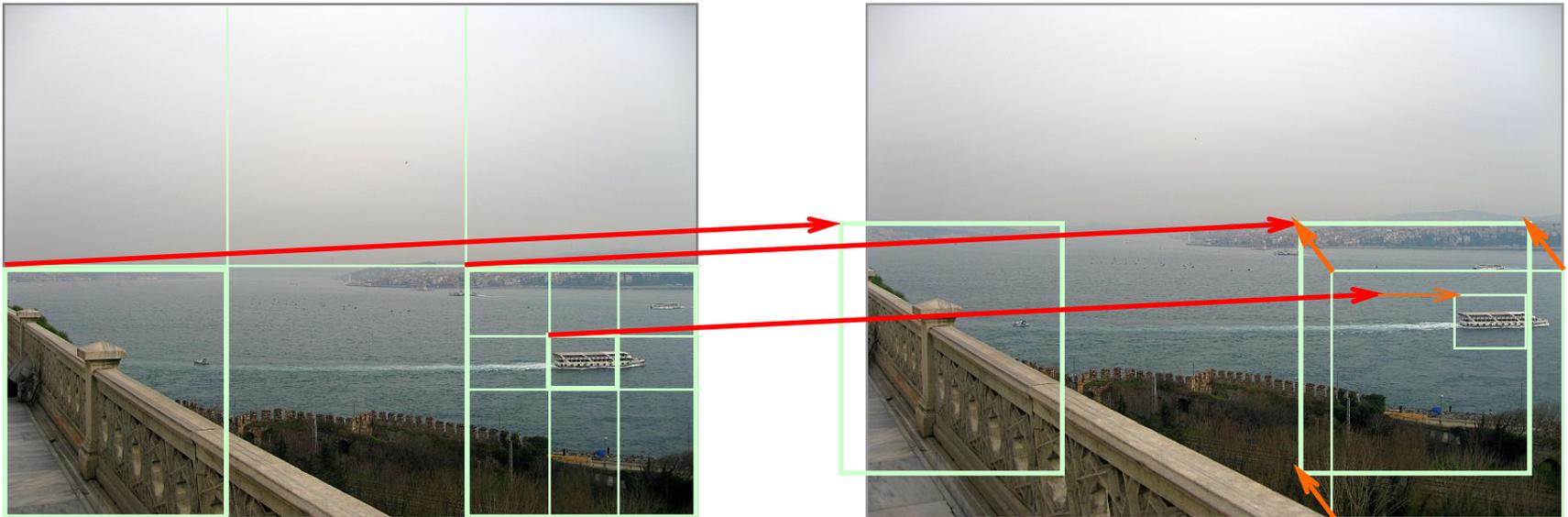
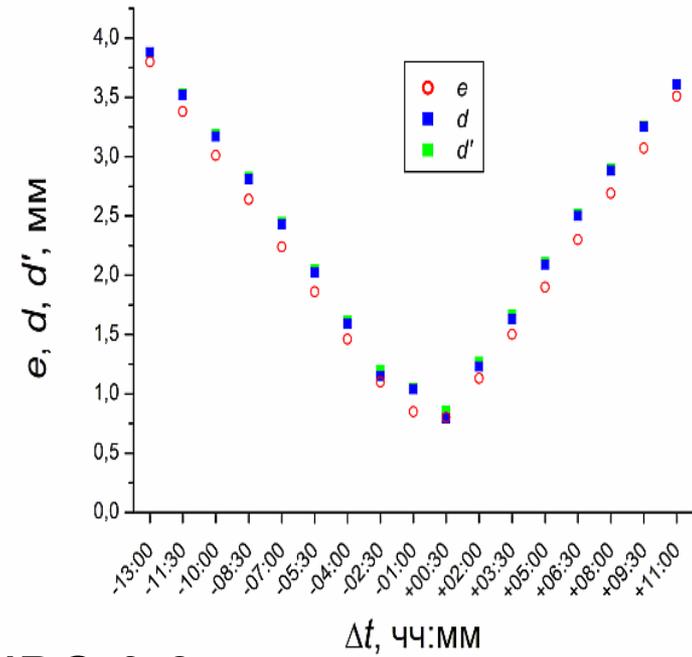
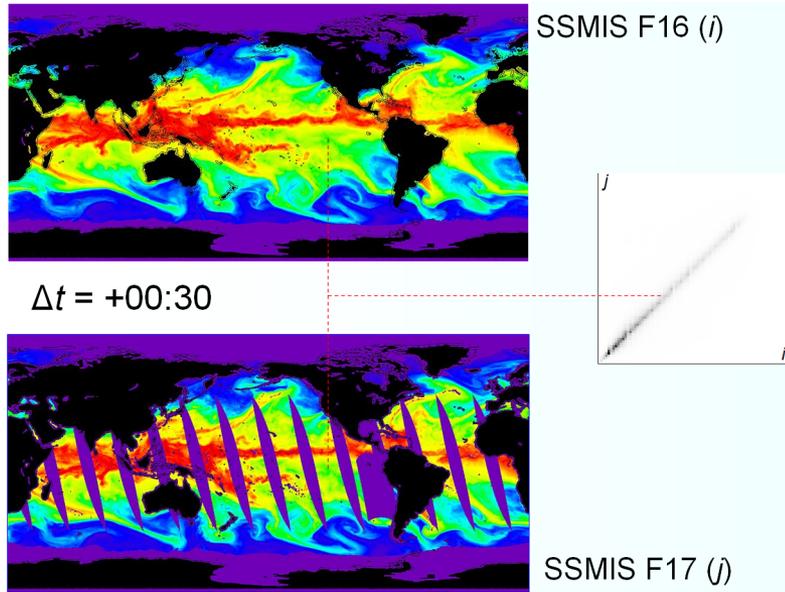


Figure 1. Outline of DeepFlow.

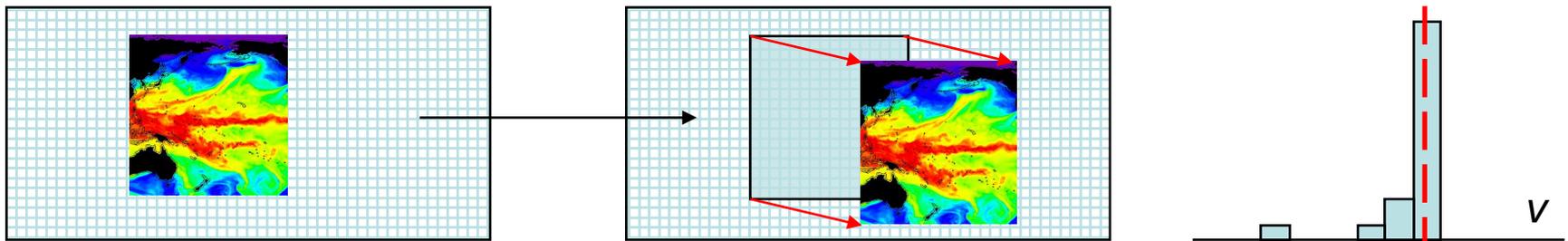
Weinzaepfel P. et al. *ICCV 2013*. IEEE, p. 1385



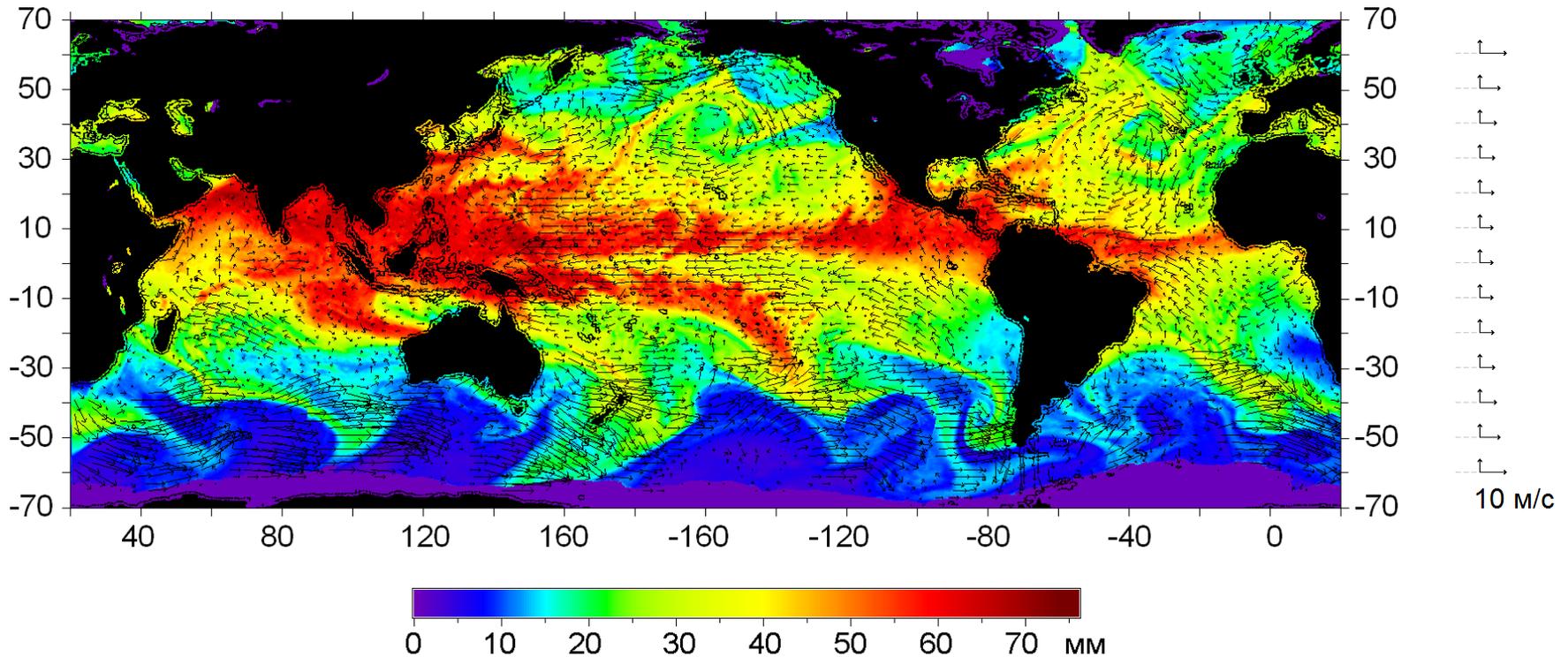
Спутниковое радиотепловидение: оценка ошибок



Средняя невязка ИВС 0,8 мм



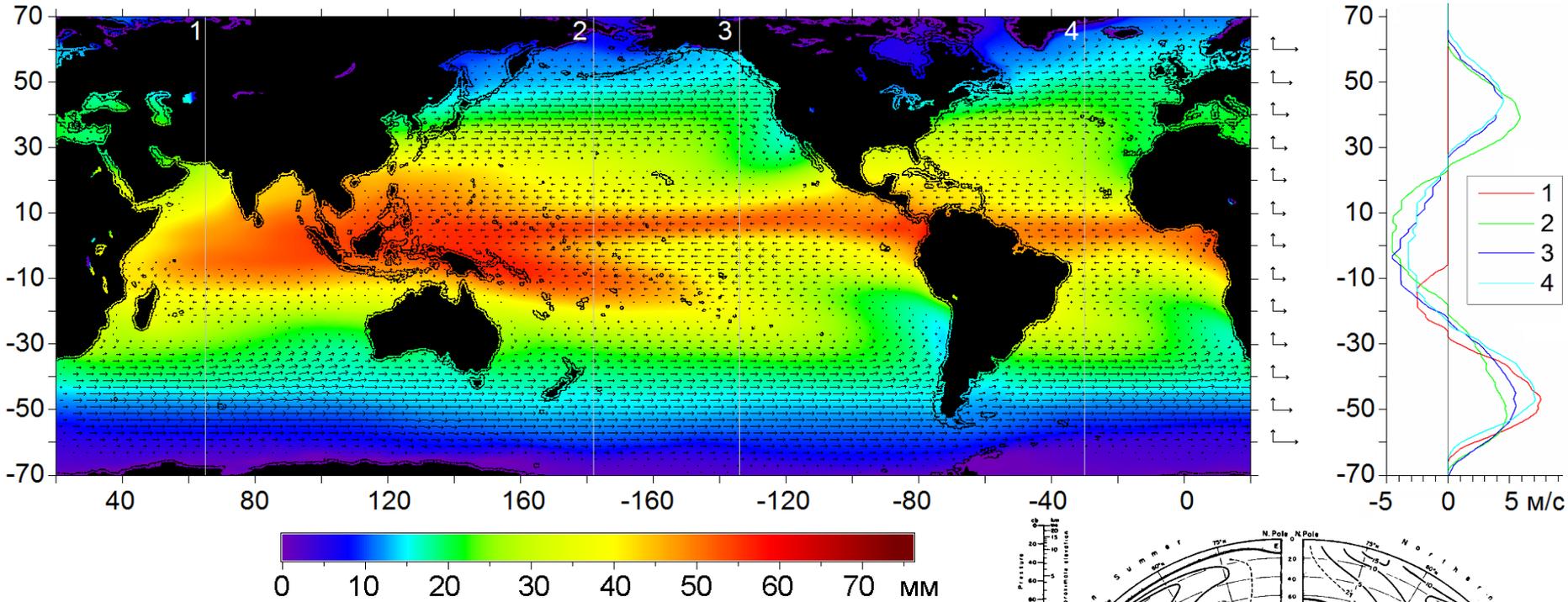
Выходные данные: динамика поля ИВС



Пара (скалярное поле ИВС и векторное поле адвекции) на сетке
1440 x 720 элементов

4 (пары в сутки) x 365,25 суток x 14 лет

Средняя картина циркуляции по водяному пару



Palmén E., Newton C.W., *Atmospheric circulation systems: Their structural and physical interpretation* (New York: Academic Press, 1969)

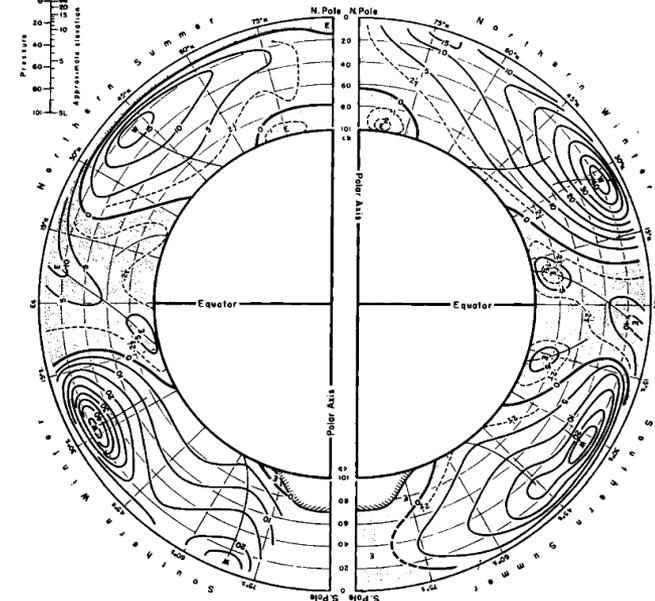
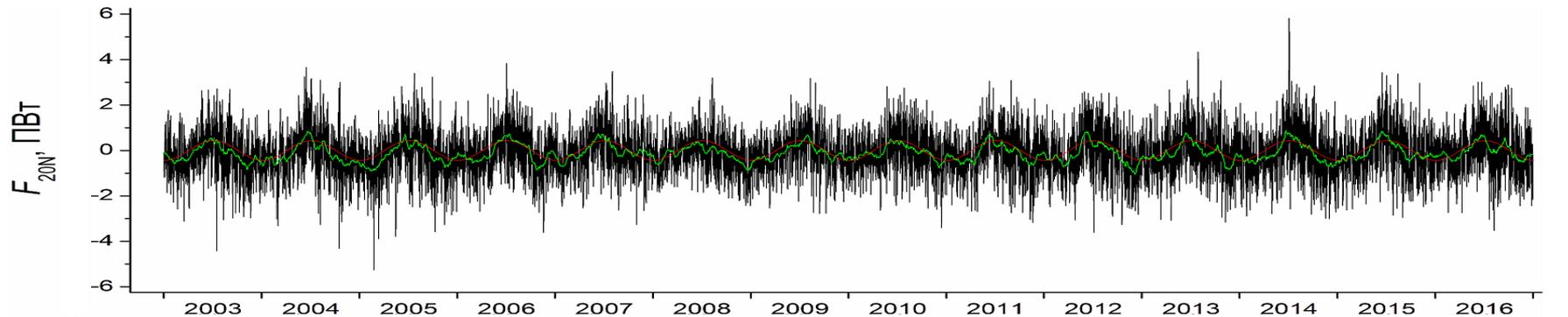
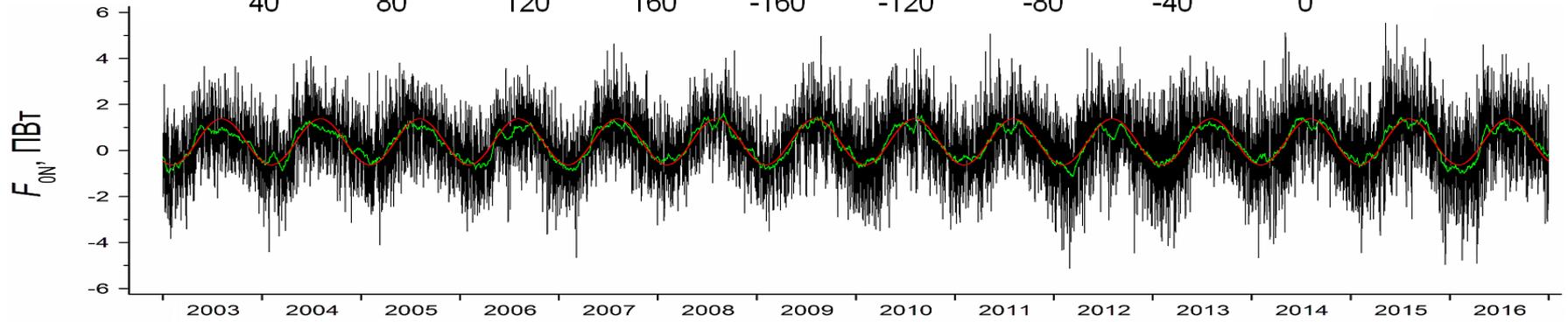
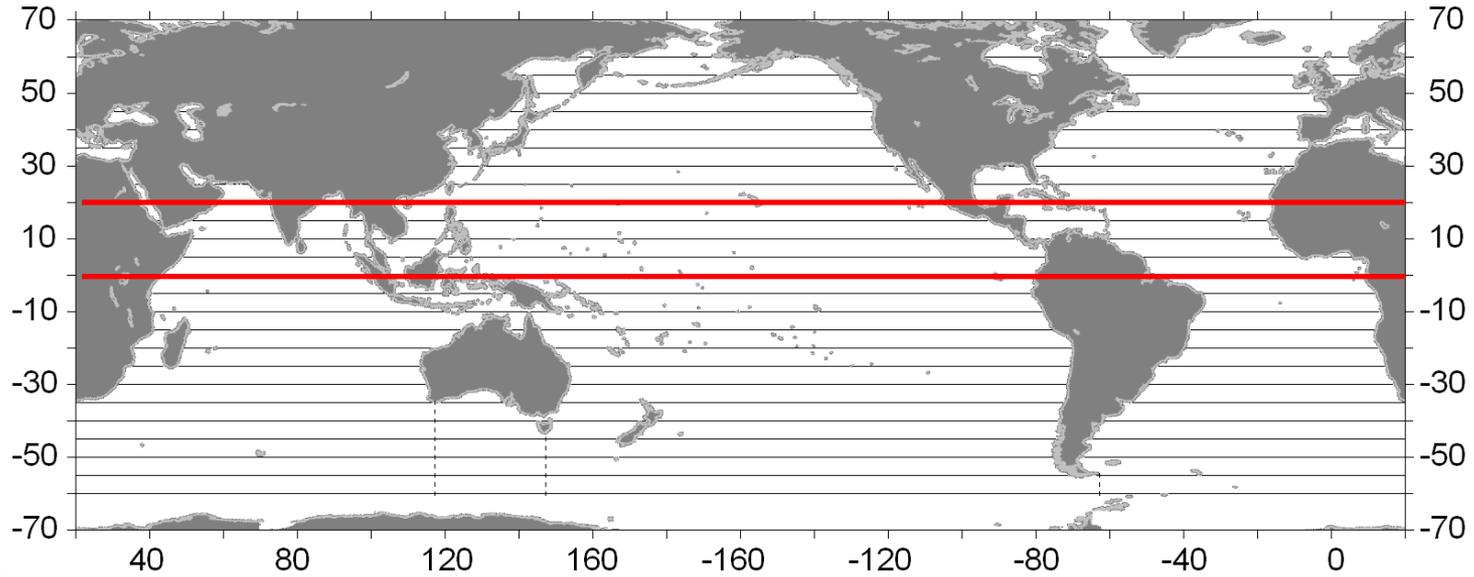


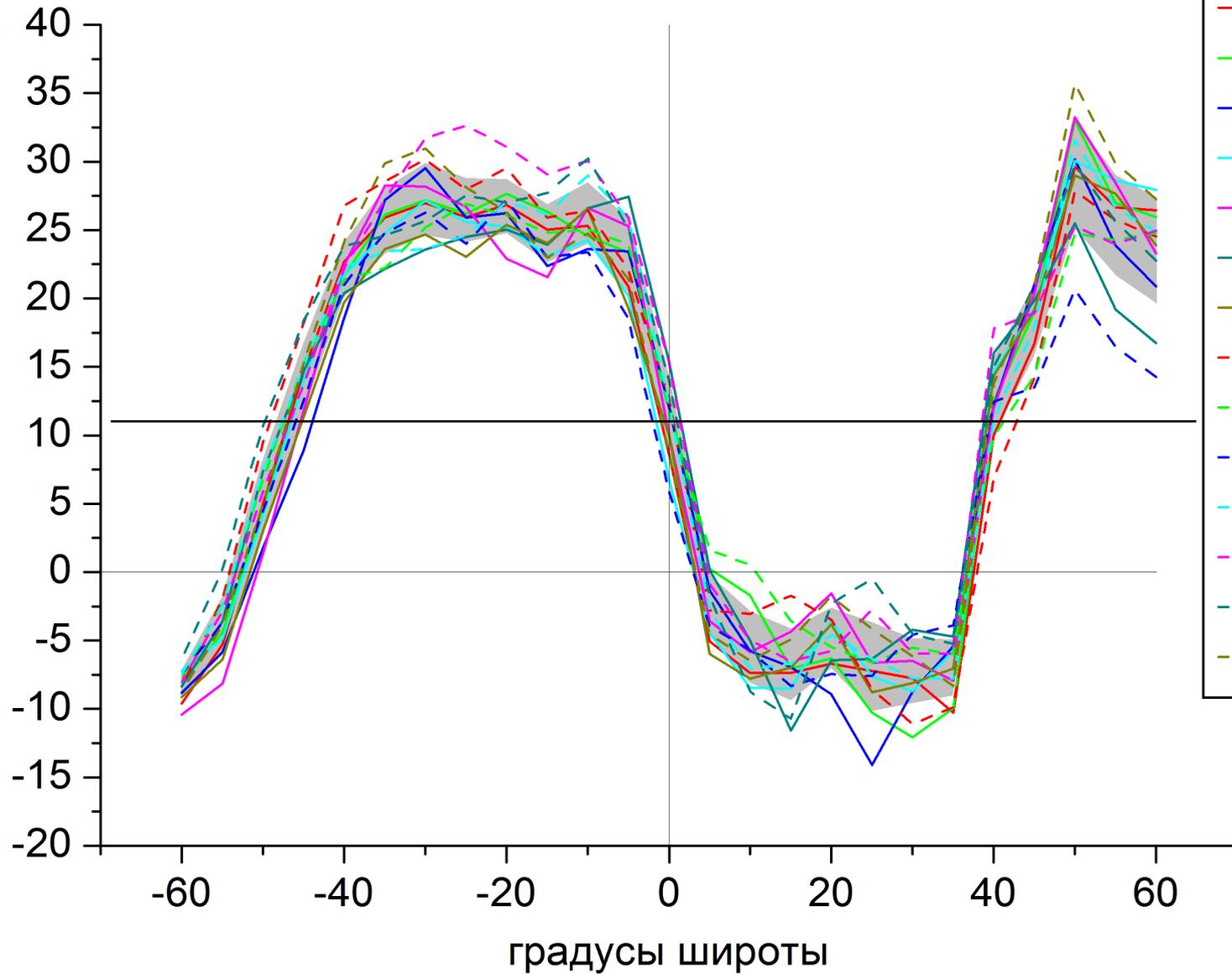
FIG. 1.2 Mean zonal wind (m/sec) averaged over all longitudes, in summer and winter. Negative values denote mean easterly wind. (After Mintz, 1954.)

Меридиональные потоки скрытого тепла

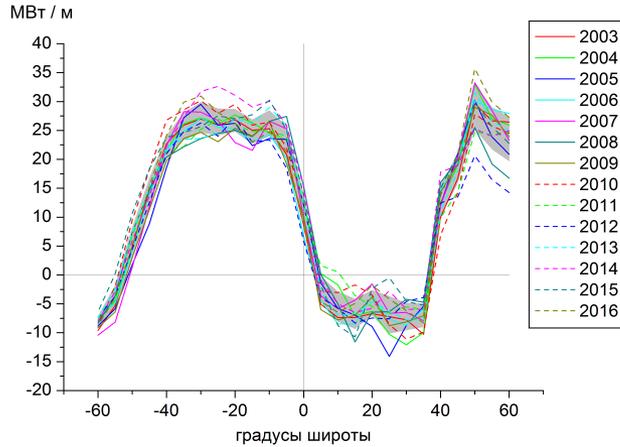


Мировой океан

МВт / м



Мировой океан



“On the whole ($P-E$) is positive in the Northern Hemisphere and negative in the Southern Hemisphere. To achieve balance, 1647×10^{13} kg/year of water vapor must hence be transported northward across the Equator. This corresponds to an annual transport of about 10^{22} cal of latent heat”

Palmen E., Newton C.W., *Atmospheric circulation systems: Their structural and physical interpretation*, NY: Academic Press, 1969.

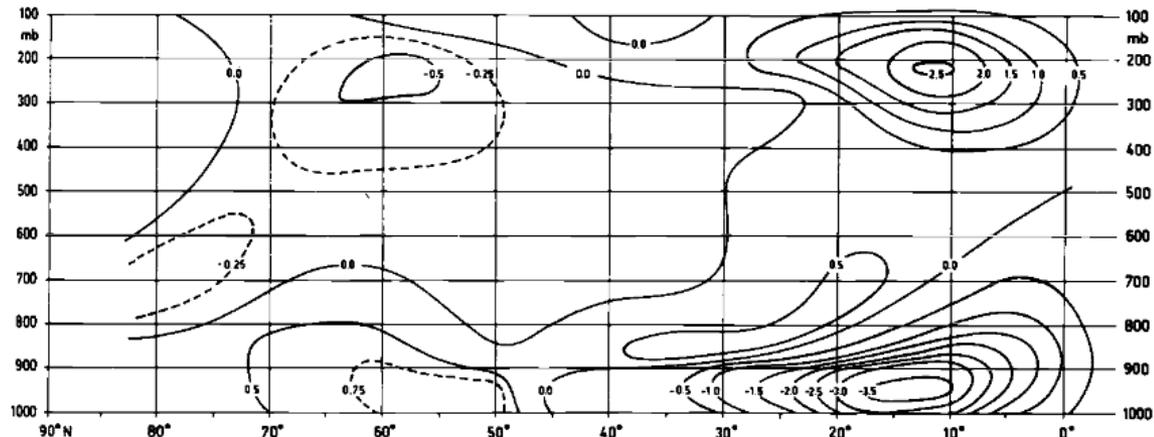
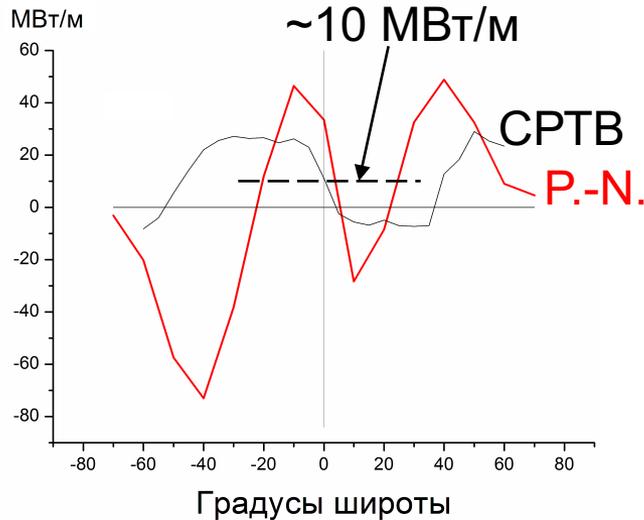
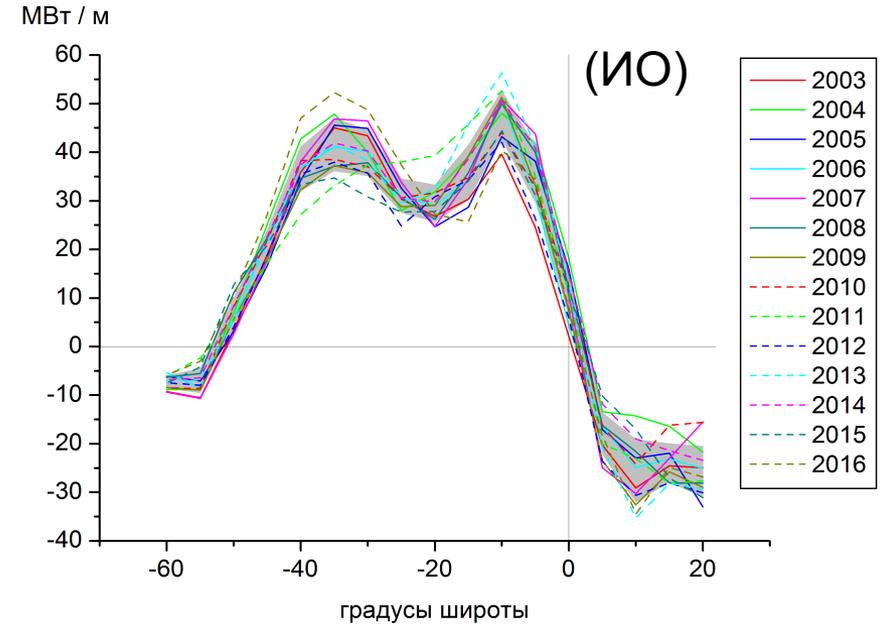
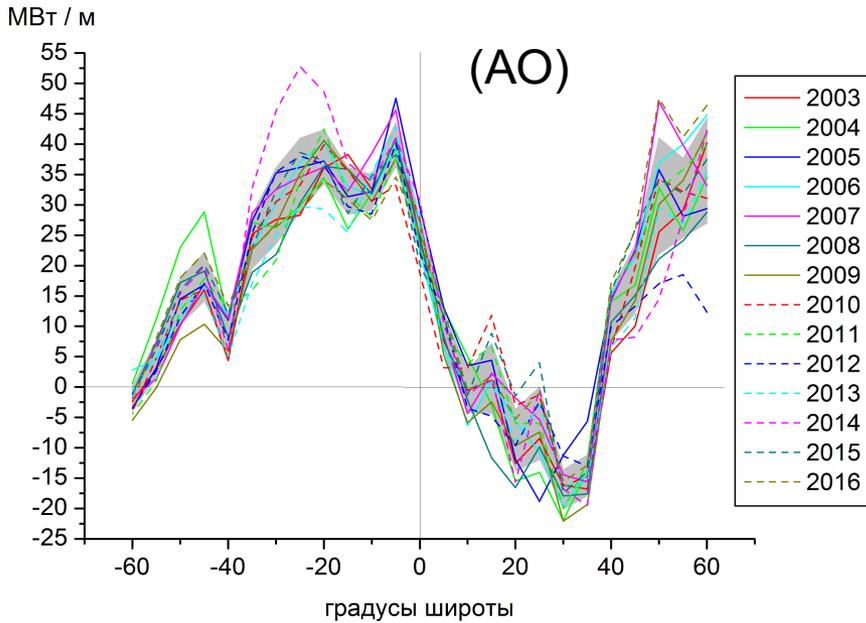
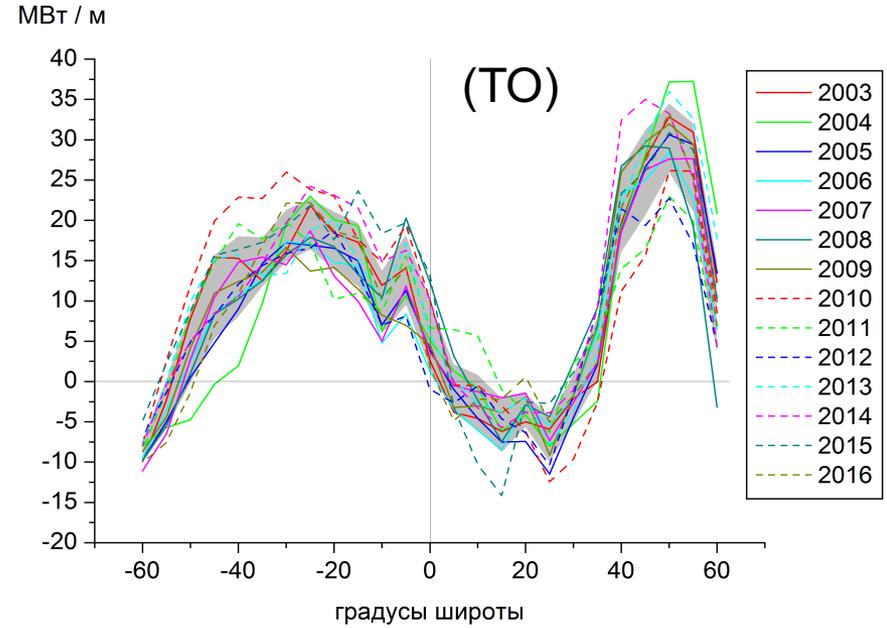
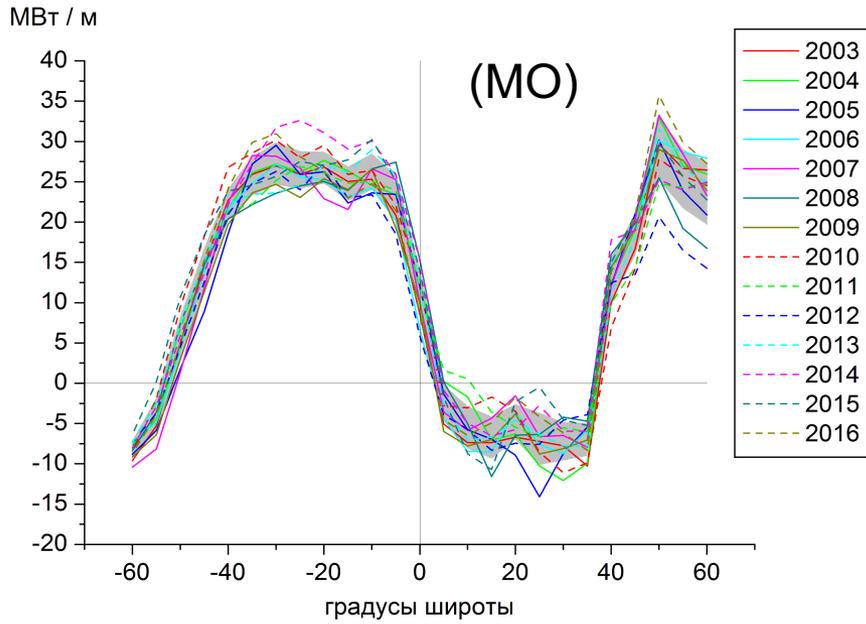
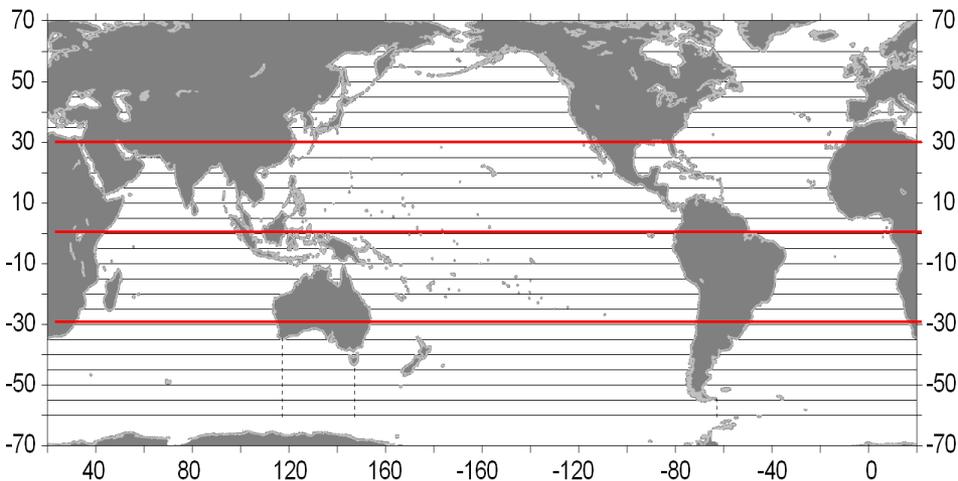


FIG. 1.3 Mean meridional wind components (m/sec, positive for south wind) in the Northern Hemisphere during the winter season, December-February. (After Palmén and Vuorela, 1963.)

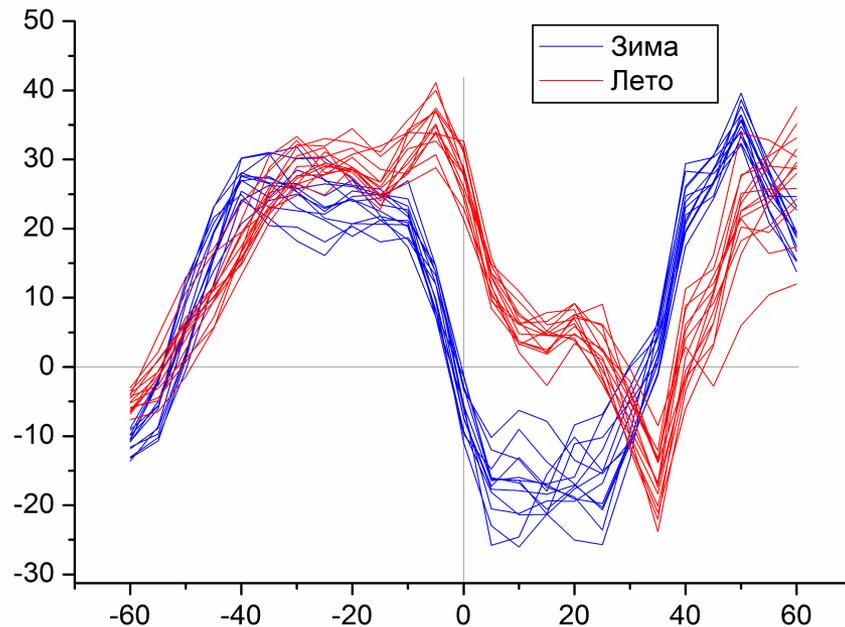
Тихий, Атлантический, Индийский океаны



Сезонный ход



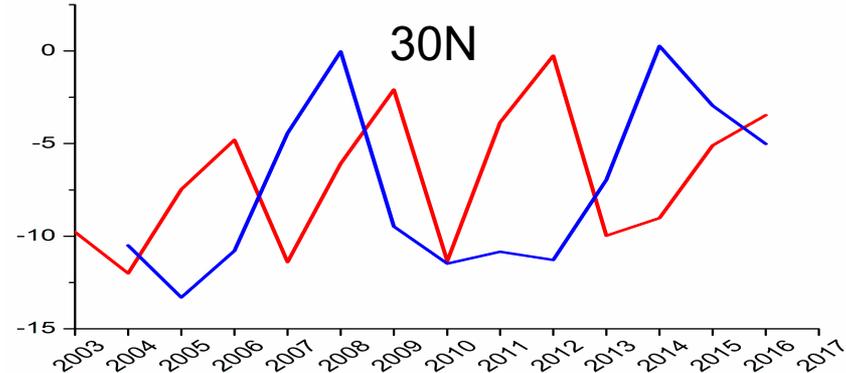
МВт/м



Градусы широты

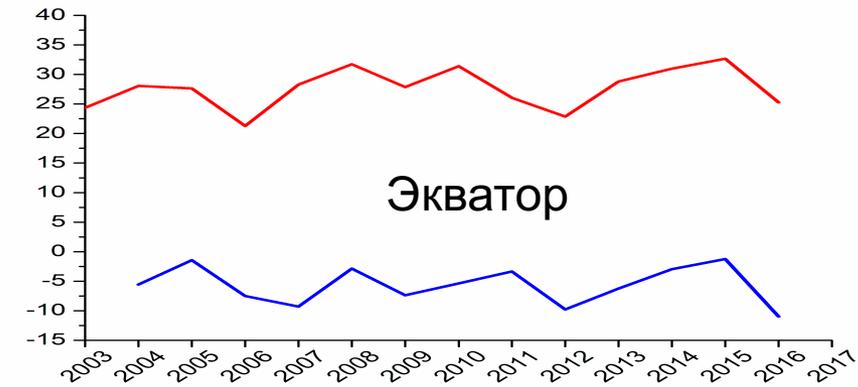
Зима=[Окт-Мар]; Лето=[Апр-Сен]

МВт/м



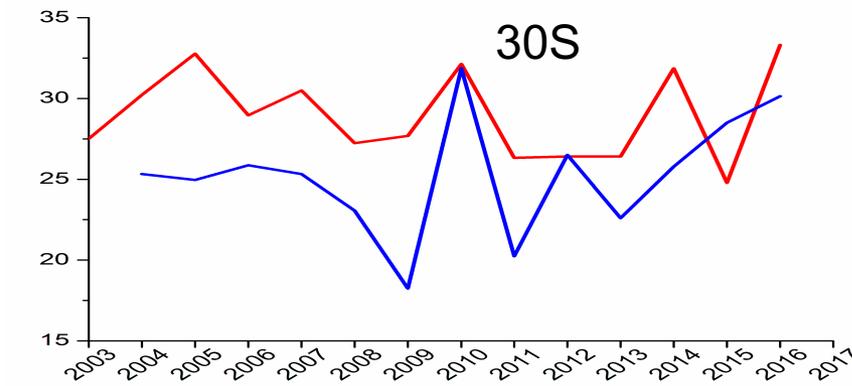
30N

МВт/м



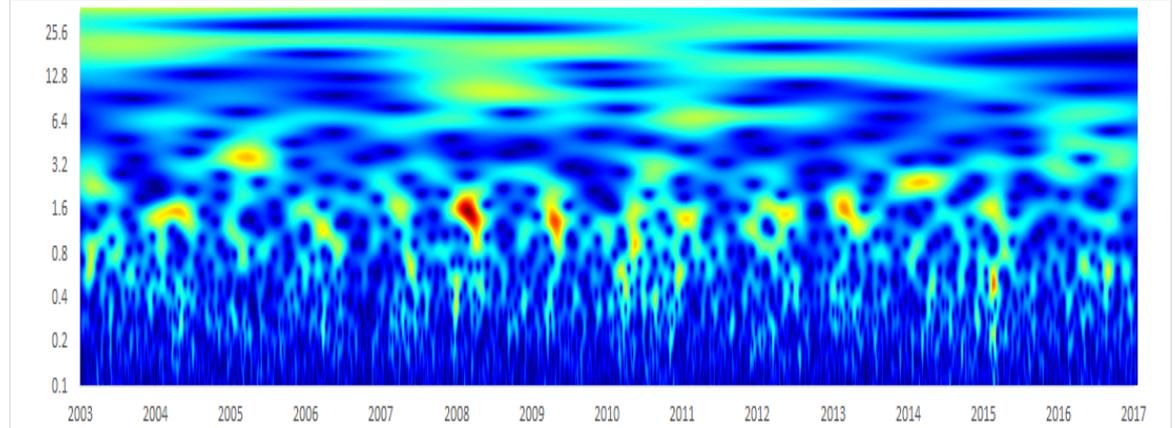
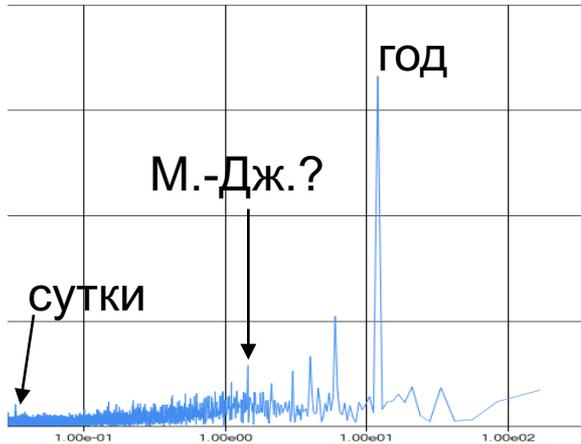
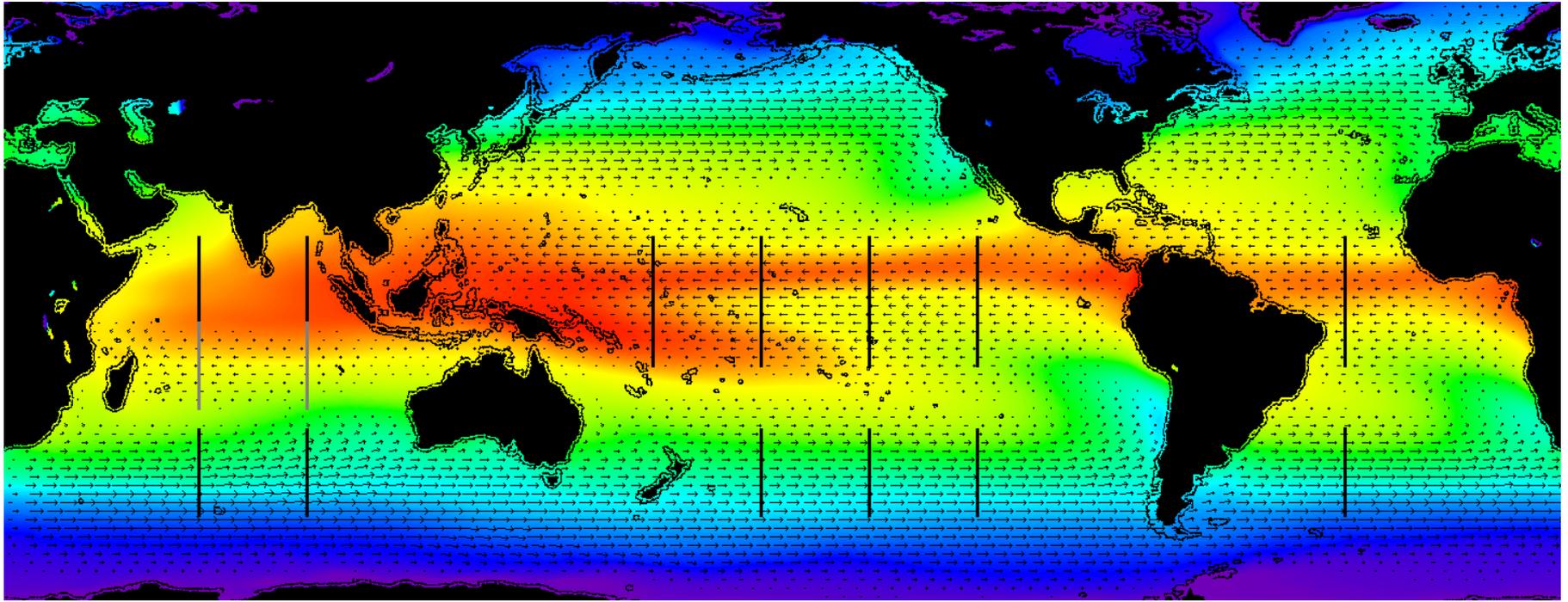
Экватор

МВт/м



30S

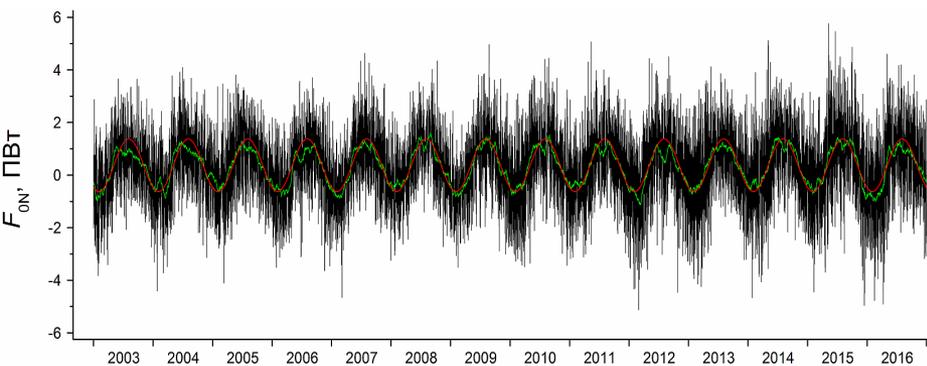
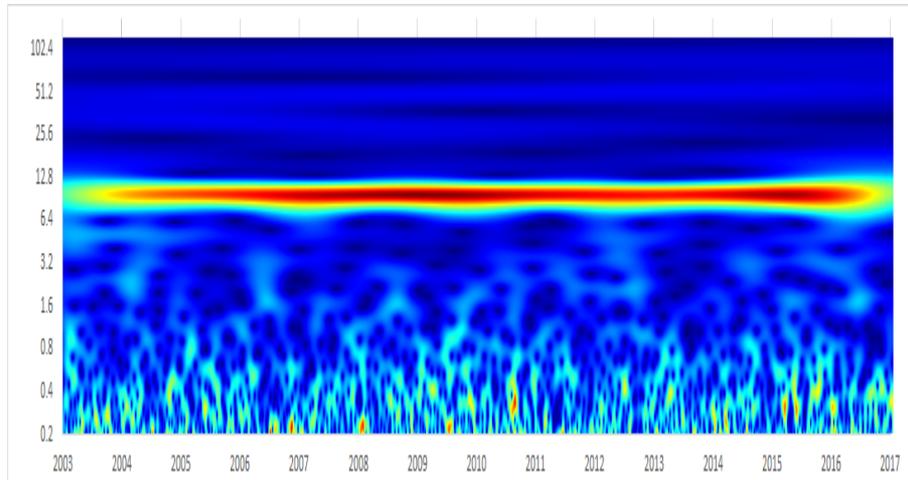
Зональный перенос



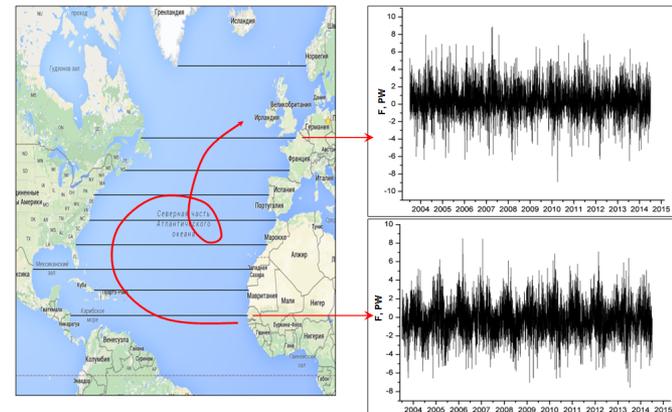
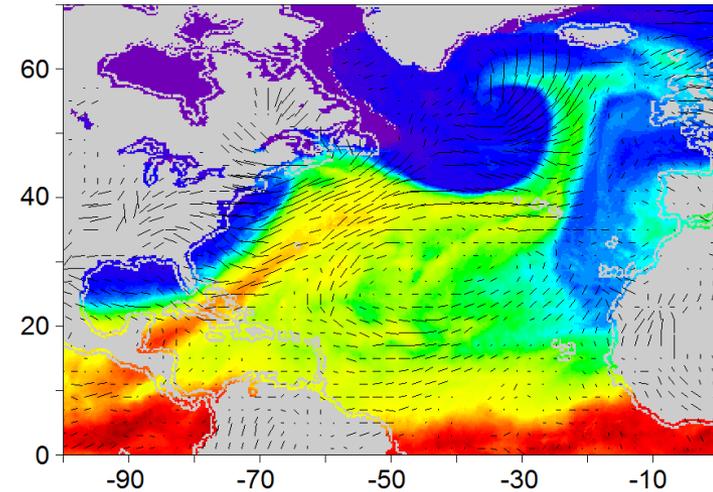
(Ермаков Д.М., Шарков Е.А., Чернушич А.П. ИКИ РАН, ноябрь 2017)

Актуальные задачи

Повышение пространственно-временного разрешения и детализация анализа



Выявление вклада «подсеточных» процессов



(Ермаков Д.М., Шарков Е.А., Чернушич А.П. ИКИ РАН, ноябрь 2017)

Геопортал спутникового радиотепловидения

← → ↻ fire.fryazino.net/tpw/



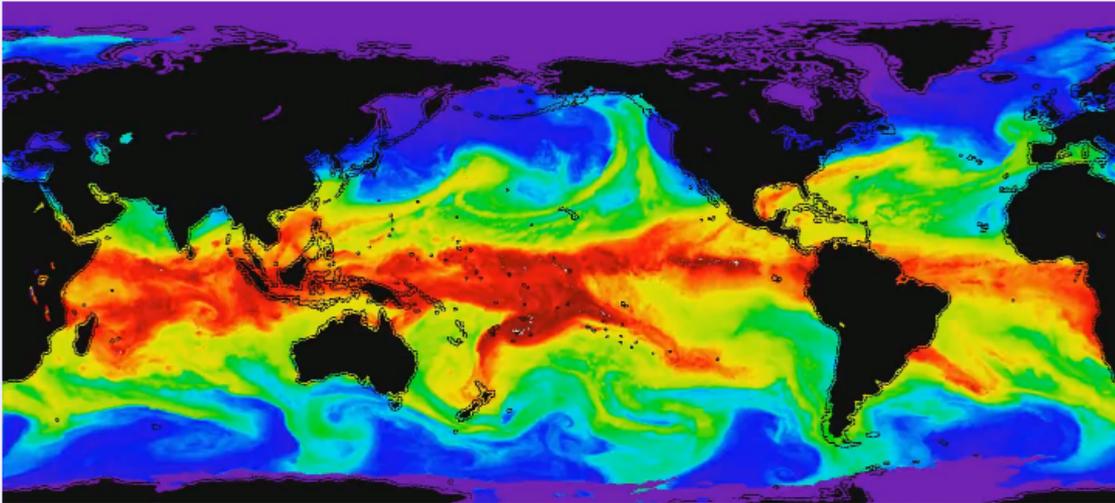
СПУТНИКОВОЕ РАДИОТЕПЛОВИДЕНИЕ: ДИНАМИКА ГЕОФИЗИЧЕСКИХ ПОЛЕЙ

Анимация Поля Икар Методика Публикации Программы Новости Контакты

2016 ▾ Параметер: TPW ▾

АНИМИРОВАННЫЕ ГЕОФИЗИЧЕСКИЕ ПОЛЯ

Динамика поля геофизического параметра атмосферы над акваториями Мирового океана: интегральное влагосодержание атмосферы (TPW), водозапас облаков (CLW) и скорость приповерхностного ветра (WND). Шаг по времени – 3 часа. Шаг сетки – 0,25°. Цветовая шкала значений приведена справа.



0:00 / 1:57

Качество отображения анимированных полей зависит от пропускной способности сетевого соединения. Для получения полей в исходном виде откройте вкладку "Поля"

<http://fire.fryazino.net/tpw/>